ORSTOM

L'institut français de recherche scientifque pour le développement en coopération

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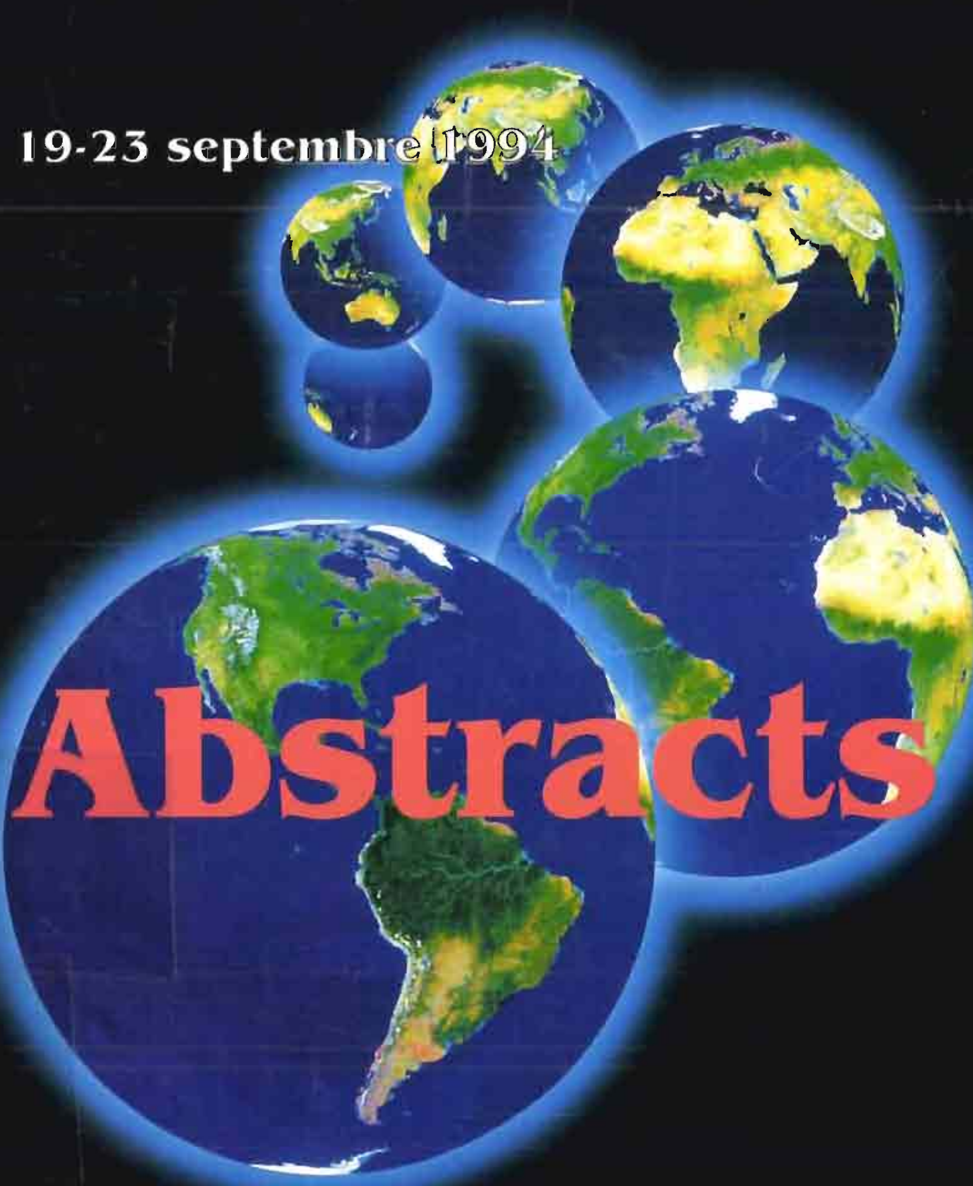
Les sciences hors d'Occident au XXème siècle

19-23 septembre 1994



Abstracts

ORSTOM 1944-1994

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UNESCO

20th Century Science beyond the Metropolis

19-23 September 1994

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Jointly organised by ORSTOM and UNESCO to celebrate
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We would like to thank all those at ORSTOM who willingly helped to accomplish the huge amount of work involved in organising this Conference ; a special word of thanks goes out to the many secretaries who agreed to play a part, often on the spur of the moment.

Conference Speeches

Inaugural Speech

Georges BALANDIER

A Special Speech by

Jonathan MANN

followed by a Round Table with

Jonathan MANN

Plenary Session Speeches

Lawrence BUSCH

Robert HALLEUX

Geoffrey OLDHAM

Albert SASSON

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Part one

History

Workshop

Colonial thinking and policy on forestry in the French Empire

Anne BERGERET*

Foresters trained at the prestigious Forestry School in Nancy, from 1925 on, were immersed in the predominant European view of man's relationship with the world around him, characterised, to a large extent, by man's domination of nature. They saw the conquered lands from the standpoint of European images of the world, European economic doctrine and colonial ideology; the French forests were their reference frame.

First of all, we must review the myth of a natural balance in the tropical forests, the supposition that this was «virgin» forest until the colonial conquests. Tropical forests had in fact undergone a succession of disturbances, followed by regeneration that restored them, to a greater or lesser extent, to their previous state. If some forest-dwelling populations changed their natural environment very little, this was because they thought of themselves as being *in* the forest, not apart from it. Their rituals of alliance or restitution were intended to ensure the renewal and perpetuation of resources. However, these forests and their inhabitants were not always spared by raids and wars and, as is well known, military expeditions are often highly destructive. The French conquest was no exception: it applied the same «scorched earth» policy, but used more powerful and destructive means. Furthermore, like the soldiers from whom they took over, the administrators saw forests and wooded areas as refuges for potential rebels.

Conquerors and colonisers were impregnated with the European image of the forest. For them, the tropical forest was really foreign, quite unlike their home environment. Their view of it fluctuated between that of a «green hell» of wild disorder, a tangle of vegetation full of ill-identified dangers, and that of dazzling profusion, unlimited wealth, the opulence of a golden age of forests long perceived as «virgin» since their native inhabitants, «savage» as wild beasts, were almost by definition incapable of mastering the forest. To the colonisers fell the task of domesticating the forest, putting it in rational order and civilising the primitive populations who lived there.

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In this respect, slash-and-burn farmers and nomadic herders alike were always seen as unproductive predators. The ideal benchmark was the French model, incarnation of civilization: the sedentary mixed farmer running a privately-owned holding which, as the Physiocrats had shown, was the bed-rock of the nation's prosperity.

With astonishing constancy, the French colonial foresters saw in the forest nothing but timber and, above all, precious woods ripe for exploitation. They worked, as they always had, in the service of the central power, supplying its demand for timber for its armies, navy, civil engineering works, railroads and the large-scale import-export trade with the home country. Through the policy of «reserves», they set about bringing order to the forest and protecting it by means of regulations that separated forest real estate from its inveterate enemies, the itinerant farmers and more or less nomadic herders.

Such was the prestige of the French School of Forestry that, along with the German schools, it had a powerful influence on American forestry, whether as practised in the USA or in the tropics. American forestry, in its turn, focused on timber production and the use of exogenous species, denigrating local knowledge and practices which were regarded as lacking rationality, if not frankly irrational. The many local tree species and their cultivation remained largely unknown, as did the biological complexity of the forest. Local populations and their needs remained, more often than not, outside the scope of their preoccupations, for their education included neither ecology nor the social sciences.

The essential issue for most foresters continued, for many years to come, to be the exclusive exercise of power, derived from their exclusive knowledge, over a territory «purged of all customary rights».

This paper is essentially based on written sources from the first half of the 20th century and a few recent writings by historians or geographers.

Workshop

A century of topographical and thematic mapping in Central Africa

Yves BOULVERT*

On the maps of the 17th and 18th centuries, the contours of Africa are fairly well represented, but the interior seems to overflow with mythical representations. Updating these maps in the mid-19th century, it was realized that nothing was known of the central regions, the last great blank space on the maps. Little by little, the blank was filled in by independent explorers and adventurers of different nationalities, from different backgrounds, guided by a wide range of differing motives. The first of them reached the region of today's Central African Republic from the Sudan, with the slaver caravans, the best example being W. Junker.

The discovery of the course of the Congo by the American H.M. Stanley (1877) awakened the imperialist ambitions of King Leopold II of Belgium for the whole basin of this immense river. With Brazza, the French tried to counter him and keep the Belgians from outstripping them on the Ubangi. The expansion continued northwards and, little by little, all the inroads to the African heartlands were reported in the European capitals and synoptic maps were drawn up. It took nearly twenty years to trace the course of the Ubangi with any accuracy. Besides the slave-trading sultans Senoussi and Rabah, the French were also competing with the English who, after Fachoda in 1899, shifted the frontier of the Nile-Congo interfluve; meanwhile the border with Cameroon fluctuated several times as conflict broke out between the French and Germans. These border regions were the most thoroughly surveyed, for political reasons. During this period, Central Africa being a focus of European territorial designs, more than 600 maps were drawn up.

By the turn of the century, with the occupation of the region being largely complete, one might have expected to see investment in Central Africa, considering its potential in terms of its rational exploitation. The government, unwilling to sustain the costs of colonization, abandonned vast areas of land (the biggest being 145,000 km2) to seventeen different concessionaire companies. In most cases, they coincided with hydrographical basins of the Ubangi tributaries and were granted without knowing the relative size of the areas involved. The first job the company agents had to do was to trace the boundaries of their concession and map it.

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After the first world war, Governor Lamblin built 4,200 kilometers of road in the space of five years. This was a turning point, especially seeing as the population clustered along these roads. They were used by administrators, missionaries and traders; now it was only hunters and mineral prospectors who ventured into the vast hinterland. Unpublished maps show that the mining companies, mainly looking for gold and diamonds, carried out considerable prospecting work. The only official scientific mission at the beginning of the century was that of Professor A. Chevalier in 1902-4.

Mapping errors dating from the early 20th Century (a 4,200ft Bongo mountain range, or the Bamingui rather than the Ouham shown as the source of the Chari) still survive in atlases, copied one from another down through the years. They ought to have been eliminated; the systematic airborne coverage of the 1950s enabled the *Institut géographique national* to draw up regular topographical maps at a scale of 1:200,000 with contour lines replacing the earlier figurative representations. This work was only completed in 1981. Similarly, at the end of the second world war, there was a great deal of French metropolitan investment on FIDES funding. 1:500,000 geological reconnaissance mapping was then undertaken, but was unfortunately curtailed shortly after independence in 1960.

The collection of thematic maps of Central Africa shows that efforts were made in many different fields such as climatology, entomology, gravimetry, magnetism and human geography. The medium-scale (1:200,000) pedological maps, drawn up by alternating systematic photo-interpretation with ground surveys, paved the way for a synopsis of Central Africa's natural environment, with 1:1,000,000 maps of its oro-hydrography, pedology, phytogeography and geomorphology, and climate maps at 1:5,000,000. In 1973, the American POGO satellite confirmed the existence of the world's largest magnetic anomaly over Central Africa; it had been identified on the ground by ORSTOM researchers in 1958. In 1988, a joint IGN-ORSTOM mission completed the gravimetric map using the most advanced techniques (helicopter transport, positioning by GPS satellite).

Astonishing progress in a country where, just a century ago, people of an iron age culture were prey to incessant raids by slave traders. Some neighbouring regions such as northern Zaire, southern Sudan and Ethiopia are far less advanced in their map coverage. Contrary to the impression given by the media, our knowledge of the Earth is still far from perfect. Much remains to be done, and satellites cannot solve all the problems, given the lack of receiving stations, the rarity of photographic images, the disturbance of images by cloud cover or bush fires, and the difficulty of interpreting the images theme by theme. Ground data, along with stereoscopy, are still indispensable, and this should be the work of Central Africans now that they have taken over the reins from the Europeans.

Workshop

The British colonial forestry policy in South India. An unscientific or inadapted policy ?

Marlène BUCHY*

The district of North Canara lies in the northern part of the State of Karnataka, bordering the Oman Sea on the edge of the Territory of Goa. Covering 10,291 km2 and divided administratively into eleven *taluks*, it can be divided into three geographical zones:
- *the coastal zone*, with a hot, humid climate,
- *the upland zone* of the Western Ghats, at altitudes ranging from 900 ft to 3000 ft and very humid towards the south,
- *the transitional zone*, towards the Karnataka Plateau and the district of Dharwar, with a drier climate.

Depending on relief and climate, several distinct rural communities have developed different pastoral and agricultural systems: on the plain there are rice fields bordered by coconut palms, in the heart of the wooded uplands there are spice gardens, while on the plateau there is extensive cattle grazing. Areas of forest-covered ferralitic soils are interspersed with areas of alluvium where crops are grown.

Besides building timber and firewood, these forests also produce an impressive number of minor forest products. Although the colonial markets had little use for most of these products, they fulfilled an important role in the daily lives of the local farming communities. The functioning of the production systems and, to some extent, their survival depended on free access to these natural resources.

The forests of the district were rich in hardwoods (*Tectona grandis, Terminalia sp.*), indispensable for British shipbuilding and, later, for developing the railways. A conflict of interest between the State and the local populations very soon arose.

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AGRONOMIC SCIENCES AND THE MANAGEMENT OF TROPICAL NATURE

This paper sets out the main characteristics of the British forestry policy. The strategy was essentially based on the introduction of a complex and authoritarian body of forest law, arbitrary subdivision of the forested land, exclusion of the local population, and forestry development plans that supposedly guaranteed balanced resource use.

The new administrative subdivision of the forest, backed up by an elaborate forest code, was mainly intended to facilitate modern forestry, the principles of which are set out in the *Working Plans*. It was also designed to control access to the forest and limit the size of private forest holdings to a strict minimum.

The colonial heritage weighs heavy on India's contemporary forest management. The general shape of forest policy has had major consequences at various levels: the forest landscape has considerably changed, pressure on resources has increased in some places, local agriculture has been much disrupted, relations between foresters and local communities have deteriorated and tensions have arisen.

An analysis of the political and scientific ideology of British colonial forestry, itself strongly influenced by continental European ideas, can partly help us to resolve the social and political crisis in the district of Uttara Kanada in our own day.

The research is essentially based on a reading of British colonial archives conserved in London and different Indian towns. The data mostly concern the forest in the district of North Canara (Uttara Kanada) in the Western Ghats, State of Karnataka, South India.

Workshop

The history, ideology and social impact of colonial and neo-colonial conservation policies in Sub-Saharan Africa (1659-1980

Richard GROVE*

The ecological dimensions of European imperialism have become the subject of a new and burgeoning historiography during the last twenty years or so. This has been in part a response to a new concern for histories of material culture and «people's history» or «history from below». However, it has also arisen out of a growing sense of global environmental crisis during the period and from a growing awareness of the impact of economic growth in the «North» on poverty and ecological change in the «South». Some of the new treatments have attempted a «global reach». Typically, most of these global treatments fail to convey any idea of the full complexity of the interaction between colonialism and the environment. Most regional treatments have framed colonial environmental policy merely in the frame of resistance to those policies (e.g. see Guha, 1990; Peluso, 1992). Studies such as that by Blaikie and Blaikie and Brookfield suffer from a severe lack of archival insights, and therefore fail to recognise the very long period over which colonial environmental interventions took place. Useful and much more empirical (if not revisionist !) correctives have recently appeared in the work of Beinart (1984, 1985), Grove (1990, 1993) and Showers (1992). These latter works have also underlined the fact that the idea of environmentalism itself arose in the old rather than the new world, specifically in the Cape and the islands of the southern African region (Grove, 1993). Sufficient work exists now to enable one to attempt some kind of synthesis on the environmental context of the history of colonialism in Africa, focusing for convenience on the structures of official responses to fears of environmental degradation and on state environmental interventions. In particular we focus here on responses to perceived threats from deforestation, soil erosion, desiccation (or desertification) and climatic change. Early attempts to synthesise some of the experiences of European environmental intervention are to be found in Hailey's "African Survey" and in E.B. Worthington's "Science in Africa and Science in the Development of Africa"; and in Jacks and Whyte's "The Rape of the Earth". To some extent these works responded to the increased environmental awareness promoted by New Deal conservationism. This theme of American influence is taken up by Beinart (1984) and Anderson (1984). Both papers

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reflected growing interest in the historiography of Africa in the process of ecological change and especially in the relations between capitalism and ecological change. (See Ford 1971, Kjeksjus, 1977, Vail 1977, 1983, and Iliffe 1977). In general, these essays tended to depict a Golden Age scenario. Subsequently a challenge to this kind of golden age thinking has been mounted by McCracken (McCracken, 1977). This paper pinpointed the difficulties of generalising about sub-Saharan Africa or even East-Central Africa as a whole. In fact ecological golden age thinking is being increasingly challenged, in North America, in Indonesia, in India and in Central America.

More latterly, attention has been drawn to a more analytical, regionalised approach to the nature of the European impact on the environment. In seeking to understand the dynamics of contests over land use, and the origins of some colonial and post-colonial phases of resistance and rebellion, careful investigation is needed of the motivations and ideologies of European land-use strategies in Africa, of their extra-African intellectual origins, and of the alternatives that developed to the broader directions of colonial policy. This may be considered a somewhat revisionist exercise. However, it is necessary and involves a greater concentration on the institutional history of land management organisations and lobbies, and on the social histories of communities of scientists. It is simply not sufficient or historically rigorous to see colonial conservation strategies merely as extensions of oppressive arms of colonial government, even if this was often the case. Rather, colonial conservationism emerges as a peculiarly contradictory development in the history of imperialism and, frequently, one that was highly innovative, investigatory and relatively responsive to local conditions, particularly in West Africa.

To some extent, sub-saharan Africa is an ideal location in which to study the evolution of colonial responses to the environment and changes in it. It is appropriate to begin our survey in the southern African region since events there strongly affected the history of conservation policy elsewhere in Africa. We see a continual interchange of ideas between communities of scientists based in the «periphery» of Africa, India, Mauritius, the Dutch East Indies, South East Asia and the United States and those based in the imperial centres in Paris, London, Berlin and Lisbon. Almost all these communities were the offspring of centralised imperial networks responding in modernistic or Baconian fashion to the classificatory and economic demands of the expanding frontier and imperial control. This is not to say that environmental ideas as such were centralised in origin. Indeed the opposite was very often the case. Moreover, until as late as 1900, this community of peripheral colonial scientists can be characterised as having been dominated at root by a combination of Scottish Enlightenment science and dissenting religion, itself heavily influenced by the Physiocrats of the French enlightenment. One needs to question, therefore, whether one is, at core, actually dealing with a «colonial» phenomenon or rather with a particular modernist and globalising social construction of nature, some of which ran counter to colonial profit-maximising assumptions. The modernism of colonial environmentalism probably needs to be associated with the study of other modernising tendencies perpetuated by colonial expertise and with the genesis of ideas about development, most of which, like those of conservation, had a colonial origin. However, it should be noted that much colonial conservationism stands in contrast to much of the current modernist sustainable development movement.

One main way to circumvent this problem is to make a conscious attempt to explore conservation ideology through a biographical approach, and by recognising that the construction of that ideology was often highly idiosyncratic and personal in nature. The views and contexts of individual colonial scientists and officials were generally disproportionately influential and generally far more so than those at the metropoles. In fact scientists in the colonial context were far more powerful than their counterparts at the imperial centre. In fact, in no sense can colonial government ideology be considered synonymous at all with colonial scientific ideology. Governments and scientific communities alike were often riven by faction and disagreement in matters of theory, ideology and practice.

Insofar as we can make a sharp distinction between forest, soil and water conservation, a major chronological element is involved in the African colonies. In genera,l State environmental protection until about 1925 was largely confined to forest conservation. After that soil conservation began to achieve a new pre-eminence, especially in some colonies, although in other colonies soil conservation never became a major policy issue. Meanwhile game conservation, while not as old as forest conservation, achieved its own particular development. In general it is probably true to say that in most colonies these three aspects of conservation policy remained remarkably separate and sometimes even contradictory, as well as spatially separate. In general, forest conservation in British and Francophone Africa was dominated by traditions of Indian and South-East Asian practice. In general, of course, it was far more exclusionist than soil conservation and may be said to have represented much greater claims over the landscape on the part of the colonial State, particularly in the equatorial forest belt of West Africa. Moreover the agendas of forest conservation were historically and in practice far more complex than those of soil conservation. They influenced State conservation practice and institution-building far outside Africa, not least in the United States where the early proponents of a state forest service were much attracted by precedents and propaganda from both southern Africa and India, although probably more by the former.

Workshop

The Nogent School and the emergence of French colonial agronomy as a profession

Mina KLEICHE*

The Ecole nationale supérieure d'agriculture coloniale (ENSAC) was founded in 1902, at the Colonial Garden in Nogent, set up three years earlier. The declared purpose was to train managers for the agricultural services in the French colonies. ENSAC's specialised agricultural teaching was intended to help establish «modern» agriculture in the new French colonial empire.

In organisational terms, the Nogent School was based on the model of the *Ecole coloniale*, which trained managers for the colonial administration; in terms of content, it was strongly influenced by the national agricultural colleges of mainland France.

From the outset, ENSAC had to compete fiercely with the colleges from which its inspiration came and, at another level, with the *Muséum national d'histoire naturelle*; gradually however, through a series of reforms, it became the essential stepping stone for any agriculturist wishing to make a career in the colonies.

Training technicians capable of managing and structuring modern farms, Nogent also established tropical agriculture as a new research field and produced a new group of specialist researchers: the tropical agricultural scientists, referred to for the first time as *«les ingénieurs d'agronomie tropicale»* in a Decree dated 3/8/1920.

The Nogent School changed names a number of times, from ENSAC to INAC *(Institut national d'agronomie coloniale)* in 1921, then INAFOM *(Institut national d'agronomie de la france d'Outre-Mer)* in 1934, ESAAT *(Ecole supérieure d'application d'agronomie tropicale)* in 1939, ESAT *(Ecole supérieure d'agronomie tropicale)* in 1963 and CNEARC *(Centre national d'études agronomiques des régions chaudes)* in 1981. From 1963 its task shifted from training French civil servants to training agricultural managers for the tropical countries. The successive name changes reflect a distancing from the original

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colonial purpose to a scientific purpose, with the creation of tropical agricultural science as an autonomous body of knowledge, a new discipline.

Who was behind the creation of ENSAC? Why set up a School at a time when there were already professorships and lectureships on colonial crops in the agricultural colleges, the universities and the Muséum? And why set it up in mainland France when its work was devoted to the colonies? In what way did the Nogent school differ from the other agricultural colleges in France and the colonies?

The Nogent School was founded at the same time as the colonial agricultural services were being formed, and it trained managers for these services. This leads us to examine the history of the colonial administration: how did the Ministry for the Colonies operate, in terms of its central administration in Paris and its local administrations? How did the agricultural research services function?

Who went to the Nogent School? Did they form a homogeneous group, did the type of recruit change over time? From what social background, from what previous education did those who chose this type of career come -and how did this change (if it did change) with the political and economic events of the time?

Did the teaching dispensed at Nogent really produce a new scientific discipline, i.e., a body of theoretical knowledge independent of all political and economic contingencies, operating according to its own internal logic?

To answer these questions, we try to put some perspective on the institutional history of the school, the social history of its students and the history of agricultural science in France.

To establish a typology of this group, we have followed individuals' careers through a somewhat sociological survey based on interviews and many written testimonies, students' files, correspondence with the school from old boys in the colonies and papers in the journal of the Colonial Garden (*L'Agriculture pratique des pays chauds* (1902-1932); *l'Agronomie coloniale* (1900-1939); *l'Agronomie tropicale* (1946-1961)). Legal texts (decrees, orders and administrative decisions of all kinds concerning the life of the school and the organization of government agricultural research services in the colonies) have helped us trace the evolution of the Nogent School since its founding. Lastly, setting the teaching at Nogent against the background of agricultural science teaching in mainland France (through an examination of teaching content at the three national agriculture colleges at Montpellier, Rennes and Grignon, and the *Institut national d'agronomie*) highlights the genuinely specific features of tropical agricultural science as a new field of teaching and research.

Workshop

European visions : Science, the tropics, and the war on Nature

Michael OSBORNE

The very concept of the tropics is inextricably linked to European notions of a colony. The tropics were and still are regarded as fertile and productive areas of the globe which teem with life. In the years before ORSTOM's founding, the very measure of value for a colony resided in the colony's degree of difference from France. In terms of products, French colonies were supposed to produce "exotic" products. For much of the nineteenth century an "exotic" product meant anything France could not produce itself. This might be high quality tobacco, vanilla beans, or sugar from cane. What most often counted for "exotic" linked with the tropics, or with the productions of the near-tropical regions which France tried to engineer into a modified tropical environment. In the early years of the present century, the colonies still offered up fruits and other exotic products for public nutrition. But they also offered another product which France had not produced in abundance, namely men fit for military service and labor. By the second decade of the twentieth century, the colonies were providing thousands of soldiers who fought in the Great War. Later, around the time of the founding of ORSTOM under Vichy, the colonies again provided soldiers for the armies of World War II.

For the French, the potential super productivity of the tropical and at times pre-tropical environment, was seen as something in need of rationalization and scientific management. In the nineteenth century, the economist and demographer Jules Duval, defined the essence of colonization as the "exploration, peopling and agricultural clearing of the globe". He saw the French as destined to colonize and bring order to tropical environment in virtue of their superior talent for science. Science was more than an ally. It was the key. The real strugglen , according to Duval, pitted European colonists "against a wild and untamed nature.. The fierce enemy"had not yet softened "the rules of regular production." Thus it is not surprising that a clear plurality of French scientific efforts in Africa and Asia were directed at creating social and physical environments where agriculture, paticularly export agriculture, could prosper. Nature, like colonial populations, became things to be mastered. Yet the colonized peoples were needed. As one of Duval's contemporaries put it, Africans and colonists would need to band together "to fight against and defeat (an) invisible enemy more formidable than man-climate."

AGRONOMIC SCIENCES AND THE MANAGEMENT OF TROPICAL NATURE

At the dawn of the present century, the political economy of Europe began to shift and require a new kind of colonial product. This was mainly a need for manpower in the form of troops to fight in the European armies, and, more recently, for laborers for the fields of France. The colonies and former colonies were still seen as productive of the "exotic" things Europe needed, and there was much scientific and quasi-scientific debate over the true value of the colonies, and how to rationalize this new sort of production. France responded to these new needs. It formed a special civilian health service to augment and finally replace the colonial medical officers which had come mainly from the navy and army. France was still at war with tropical nature, especially the exotic diseases of Africa and Asia which crippled productivity and threatened European activities in the colonies and in Europe. But now the scientific tools were perhaps more appropriate for the task, and the rhetoric about that war, as well as the essence of the struggle, began to shift.

This paper argues that much of France's overseas scientific and medical efforts in the nineteenth and twentieth centuries may be construed as a "war on nature." It also highlights the role of Science in the spread of French culture. Dr. Paul Bert, for example, the celebrated physiologist and governor of colonial Indochina, felt that Science was the key to securing the cooperation of colonized peoples. It was not religion, Bert argued, but Science and the French sense of justice which marked his nation's "true superiority in the eyes of the natives" Science (and medicine) then, were regarded as tools to refashion nature. Until about 1940, a "war on nature" metaphor succinctly describes the ideological basis of much French overseas scientific effort. After the Great War, but especially after World War II and the beginnings of the ORSC (and later ORSTOM), cooperative metaphors began to replace those which echoed the older theme of a war against nature. Simultaneously, French scientific agents in the tropics and elsewhere sought for "appropriate" crops and technologies, and French science became more sensitive to local physical and social environments.

Workshop

The Empire, colony, and lesser developed country as mirror: Reflections on agricultural research for eceonomic development in the colonial and post-colonial periphery (1930-1970)

Paolo PALLADINO*

Criticism of the «Green Revolution» since the late 1960s has focused largely on the relationship between scientific innovation to raise agricultural productivity and the equitable distribution of costs and benefits to agricultural producers in the lesser developed countries of Asia and Africa. The introduction of high-yielding rice, wheat and maize varieties, and the concomitant changes in agronomic practice (with all the implied direct and indirect dependence on North American and European technical capacity), seem to have reduced growers' economic independence, as well as increased the disparities between the wealthiest and poorest members of this group. This situation has been translated into a view of science for economic development as a vehicle of neo-colonialism, a view which has found much support among historians interested in the relationship between Science and imperialism. The latter have focused much attention on the emergence in the imperial outposts of Great Britain, France and the United States of distinctly imperial sciences. Imperial because tropical medicine and agriculture were characterised by a problem-oriented, vertically integrated approach that was both technocratic and encompassing a very limited definition of socio-economic problems that favoured the political agenda of the imperial powers. I argue that if this historical perspective were more than just superficially comparative, the contrast between Science for the colonial (or post-colonial) periphery and Science in the North American and European metropoles would have to be seriously reconsidered.

In this paper I first review the literature on the organisation of national institutions for agricultural research, and for crop improvement and agronomic research in particular, as they developed in France, the United States and the United Kingdom during the first half of this century. I suggest that although there were important differences between the experiences of these three countries (as might be expected given their very different social and political histories), the aims of their respective institutions for agricultural research were fundamentally the same, to establish agriculture as an integral part of a

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modern industrial society as well as a worldwide market for cheap food to feed the everrrestive industrial classes. Furthermore, this common aim was implemented in equally similar manners, that is, by adopting everywhere a problem-oriented, vertically integrated approach that was fundamentally technocratic in its redefinition of problems of the agricultural economy as problems of applied biology. Little regard was paid to the social and economic repercussions of this narrowed definition on the social organisation of rural life; in fact, these problems too were sometimes redefined as technical rather than political problems, and thus rendered amenable to management by agricultural economists and rural sociologists.

In the second part of this paper, I go on to suggest that this approach to the problems of metropolitan agriculture was exported to the colonial (and post-colonial) domain of France, the United States, and Great Britain. Of course, just as differences between the social and political histories of these three countries resulted in the evolution of somewhat different institutional organisations for agricultural research, so did peculiarities of this new context result in modification (but not qualitative transformation). In fact, it sometimes happened (as in Britain) that the modified model created in the colonial periphery was re-exported back to the post-imperial Metropolis without too much trouble. This essential similarity between the historical experience of French, American, and British agriculture on the one hand, and that of agriculture in the lesser developed countries of Africa under the guidance of French, British, and American technical advisors, calls, I think, for rethinking the meaning and implications of tropical science.

In conclusion, support for agricultural (or medical) science in the lesser developed countries was, and is, meant to establish the grounds for the emergence of a self-sustaining industrial society, fully integrated into a larger world economy. Despite the sometimes voiced rejection of a developmental model of economic growth, the aim is to actually replicate the path of development followed by Metropolitan agriculture, with all its costs and benefits (economic, social, and political). Thus, when North American and European scholars such as myself examine what has happened (and is still happening) in these lesser developed countries, we are looking in a mirror. It befits us to realise this more fully. In so doing, we will be able (if we so desire) to turn any lessons we might draw therefrom to some use at home. There is a profoundly ethical point here: not coming to terms with this reflection and its implicit meanings is to replicate the imperial relationship for we would then be simply telling the natives' story and continuing the orientalist narrative.

Workshop

Private planters paying for pure science? The Java sugar experiment stations (1885-1940)

Wim J. VAN DER SCHOOR*

Without a doubt, biology was one of the more successful colonial sciences in the nineteenth and twentieth centuries. Obviously, it had something to do with agriculture, but this observation is seldom substantiated in historical literature. «Colonial biology» seems to be a strange mix of «useful plants», more or less dangerous expeditions, magnificent rare orchids, birds of paradise, and national botanical gardens, and associated (and often disposed of) with specimen collecting, and «merely applied» research. Typically, agricultural experiment stations are sometimes referred to as «testing stations», implying that they simply aimed at routine testing of artificial fertilizers and so on. In many cases this will be true; in other cases it is not true.

In this paper, I would like to analyse the way in which the research programmes were determined, and point out the scientific character of colonial private agricultural experiment stations in the former Dutch East Indies (the present Indonesia). I am not going to create a gallery of «great scientists», nor do I intend to expose the «tools of exploitation». I will try to locate scientists, scientific research and research institutions in a particular, colonial context.

My hero is the Java Sugar Experiment Station. Large scale colonial sugar cane cultivation on Java wasnot only an important factor in shaping colonial society, economy, agriculture, ecology, etc, but has also been shaped by social, political, hydrological, technological and other forces and constraints. In the same way, scientific research was both shaping and shaped by the various particular conditions of colonial agricultural enterprise in the tropics. A comparison could be made (and has frequently been made by contemporaries indeed) with e.g., sugar cane cultivation and the Sugar Experiment Station of the Hawaiian Sugar Planters' Association.

When, from 1870 onwards, sugar cane cultivation passed from the Durch colonial State to private enterprises, scientific research also was organised in private experiment stations. The Java sugar experiment stations, established in

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1885 (Central Java), 1886 (west Java), and 1887 (East Java), served as a model in many respects for the agricultural experiment stations that mushroomed in the former Dutch East Indies between circa 1885 and 1920. The central Java station was rather short-lived and ceased to exist in 1893. The other two, however, were rather successful. In 1907 they merged into the large Sugar Experiment Station, since 1925 located at Pasoeroean, which at its zenith in the late 1920's employed a European staff of more than sixty, mostly scientists. It then consisted of a Technical Department, a Chemical Department (both mainly concerned with sugar fabrication), and a Cultivation Department. The large Cultivation Department consisted of a research group at Pasoeroean, and a decentralised extension service.

From their beginnings, the experiment stations aimed not only at trouble shooting or analysing fertilizers, but at developing sugar cane cultivation and manufacture «on a pure scientific foundation.» They reflected a deep-rooted belief in Science as the only means for agricultural progress. An important part of the more fundamental research was in biology, and both scientists and planters stressed the need for laboratory-based investigations. Some of the most important and longstanding practical aims were the control of the notorious «sereh» disease, which appeared from the 1880's onward and posed a serious treat to the Java sugar indsutry, and the production of high yield sugar cane varieties. The desire for the improvement of races and the control of plant diseases and pests occasioned research in plant physiology, pathology, genetics, cytology, systematics, entomology, etc

Of course, research aimed at improving quality and quantity in the first place, but it also served other ends. For example, while the entrepeneurs naturally stressed that a flourishing sugar industry would ultimately benefit the indigenous population, scientists carried out experiments on the alleged effects of sugar cane cultivation on native agriculture. Besides, scientists not only aimed at better races and so on, but also, more generally, at the laws of e.g.,heredity and the nature of physiological processes in the cane.

Scientific and professional ambitions, together with considerations on the role of (pure) Science for practice, had an important impact on the work and organisation of the experiment stations. Yearly, entrepreneurs and scientists had to reach consensus on the research programme. Besides, entrepreneurs and scientists sometimes had thoroughly different views on publication policies. In general, however, a simple dichotomy between «practical» planters and «theoretical» scientists would be misleading. Moreover, in the course of time control over experiment station affairs shifted from planters in the Indies to boards of directors in the Netherlands and their agents.

The expanding research and extension activities posed specific demands to the organisation of the experiment station and caused considerations on the relationship between pure and applied science. Experiment station directors like the botanist V.J. Koningsberger (1926-1934), who had been appointed to make the experiment station «more scientific», preferred research of a more fundamental, biological nature. One of the factors underlying this was a struggle between biologists at the Dutch universities and agronomists, sharpened by the institutionalisation of agronomy on a university level at Wageningen in the Netherlands in 1918. The situation was put to the test in the 1930's when the experiment station had to economise, and the more fundamental research was spared.

Workshop

The scientific positions of military medicine in Algeria: The example of C.L.A. Laveran

Yamina BETTAHAR*

Army medicine is a particularly fruitful field for measuring the usefulness and dissemination of European science outside the West. In Algeria, French army medicine became a fully-fledged tool at the service of colonial policy. Given the devastating health problems confronting the troops of the expeditionary corps of the French army of occupation, measures had to be found to prevent and cure widespread diseases and epidemics such as dysentery, malaria, plague and smallpox. Faced with these afflictions, the army doctors had to combine their military function with scholarly medical activity. The requirements of these two necessary functions played a major part in the discoveries made by army doctors.

For some doctors, a tour of duty in the Maghreb, in Algeria particularly, was a particularly fruitful time, both intellectually and institutionally; it helped some to develop their scientific vocation. The most outstanding example is C.L.A. Laveran, for several reasons.

Laveran came from a line of Alsatian army doctors. A doctor himself, inspector of armies and Director of the Val-de-Grace hospital in Paris, he was posted to the army hospital in Constantine, Algeria. During his service there from 1878 to 1883, confronted with a range of diseases and epidemics that were rife in eastern Algeria, he discovered the agent responsible for transmitting malaria. His period in Algeria and his discovery quite certainly determined his scientific vocation since, in 1897, he resigned from the army to join the Pasteur team in Paris and devote himself exclusively to his research and his *Pasteurian* scientific career until his death in 1922.

There are several reasons why Laveran is a telling focus for study:

• He was regarded by his peers as a man of independent mind, and a description of the man and his career show him to be one of the great forerunners of microbiology.

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Given the remarkable scope and quality of his scientific work, he provides a good illustration of that new generation of professional scientists.

• Our research has shown that, although his discovery earned him belated recognition from his peers and an international accolade (in the form of a Nobel prize for physiology and medicine in 1907), it was, at the time, a focus of major scientific, socio-political and ideological conflict.

The story of Laveran's discovery and later scientific success is a classic example of the controversies among scientists of his time.

The controversies and learned debates generated by this discovery outside the West are perhaps an indication that separate, antagonistic scientific currents were developing, reflecting different scientific approaches and practice, divergent «scientific styles» that found expression in scientific production, between clinical medicine and laboratory medicine, between scholarly medicine and army medicine. The conflicts perhaps foreshadowed those which took place during the 1930s and '40s between Claude Bernard and Laennec on the subject of the two strands of medical progress, the clinic and the laboratory.

We have followed two lines of reflection in our paper:

•We bring into perspective the scientific and socio-political background and the institutional structures set up by the colonial power in Algeria to foster the dissemination of science in European circles;

•We bring into perspective the strategies implemented by the different professional individuals and/or groups involved in the feud over (a) the value of military and scholarly medical practice and the relationship between them, and (b) the contribution of scholarly practice outside the West.

Sources

Archives
Algeria: Institut Pasteur; Bibliothèque nationale; Centre de recherches techniques sur les zones arides;
France: Archives nationales; Bibliothèque nationale; Institut Pasteur, Paris; Val-de-Grâce Hospital Museum.

Interviews

Authors: Yamina Bettahar, Roland Waast, Georges Canguilhem, Michel Foucault, Françoise Huguet, Haroun Jamous, Bruno Latour, A. Laveran, Anne Marcovich, Melia, Anne-Marie Moulin, Dr. Marie Phisalix, Claire Salomon-Bayet, Edmond and Etienne Sergent, and L. Parrot, Yvonne Turin, Michael Worboys.

Workshop

Between Science and Empire, between botany and agricultural science: Auguste Chevalier, colonial savant

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By the wide range of his work in tropical botany and phytogeography and the extent of the networks he wove at the interface between scientific and colonial circles, Auguste Chevalier (1873-1956) is certainly the central figure in the agronomical sciences in the French empire. From his very first mission, in the wake of the colonial troops in French Sudan in 1898-99, Chevalier was also concerned by the issue of the «development» of the newly-conquered regions. He was highly influential in forming agricultural and forestry policy in tropical Africa and Indochina.

Starting from Chevalier's work (more than 1200 publications), the paper highlights the main stages of his career, from Chevalier the explorer (prior to 1914) to Chevalier the metropolitan scientist (between the wars). In each case, we'll explore his scientific style and his relations with the different actors involved in colonisation.

The first period is that of his scientific botanical missions. He went out to French Sudan in 1898, almost unwillingly, since the trip interrupted work on his thesis. Over the next 15 years he travelled a distance of 50,000 kilometres around Africa. The paper describes how he became an explorer, the procedures he used to construct stable, general scientific facts from a multitude of local observations, using the knowledge of his African interlocutors and information provided by colonial officers and administrators. What were his relations with the different agents of colonisation? Although a scientific mercenary, fulfilling practical missions that varied according to the type of colony using his services, Chevalier drew from each expedition the material for papers published in the most prestigious metropolitan scientific journals and managed to direct the path of his scientific career. Geobotany was an important strand in his work.

In 1911, the *Laboratoire d'agronomie coloniale* and the *Mission permanente des cultures et jardins d'essais coloniaux* were set up. From then until 1919, Chevalier supervised overseas agricultural research and management, in

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competition with the Colonial Garden in Nogent, the umbrella institution for French imperial agronomy. As we have shown elsewhere, in this post Chevalier played a key role in setting up specialised agricultural research stations in West Africa and then in Indochina where, under Albert Sarraut, he directed the agricultural program.

After the war, with the network of colonial agronomists expanding, Chevalier did not manage to carve out an institutional niche for himself. Less inclined now to undertake long periods in the tropics, the explorer became a savant and devoted all his energy to setting up and running the *Revue de botanique appliquée et d'agriculture coloniale*. The laboratory, which benefitted from donations by private colonial entrepreneurs, acquired a stronger link with the *Muséum d'Histoire Naturelle* when a Chair in colonial agronomy was created there in 1928. It then became a focus for men, resources and scientific and technical information from the five continents, a crossroads through which passed administrators, colonists and leading figures from the colonial lobbies, trainees, researchers working on collections, colonial agriculturalists on leave, foreign scientists, etc. The paper shows how this centralisation took place and how the work was organised.

We close by following the different careers of Chevalier's students. This shows the wide scope of the fields tackled by the botanist (systematics and flora, anatomy, phytogeography and ecology, rural economics, ethnobotany, agricultural science etc.), but also the ambivalence of the heritage he left to post-colonial researchers in these fields.

Besides the many published sources, our work is based on a wealth of archive material: the *Centre des archives d'Outremer*, Aix-en-Provence; the archives of the General Government of French West Africa, now in the Senegal National Archives; and hitherto unexploited letters and manuscripts by Chevalier in the central library and ethnobiology-biogeography laboratory of the *Muséum National d'Histoire Naturelle*.

Workshop

Adversity and scientific styles: The life sciences in Latin America during the 20th Century

Dr. Marcos CUETO*

Many reports on the development of Science in the developing world have played on themes such as foreign dissemination, imperial expansionism and local acceptance. This paper proposes to highlight the distinguishing elements of the local dynamics of scientific development in Latin America. It will present an exposé of Latin American biomedical science laboratory practices in the first half of the 20th century. The main Latin American municipal institutes of physiology and bacteriology will be given special attention. One of the paper's aims is to identify laboratory practices which typified constraint-bound contexts in which resources were limited. These included infrequent use of sophisticated and costly equipment, a holistic and interdisciplinary approach to research topics, and a preference for fields in which there was little international competence. In some instances, Science flourished and had national and international repercussions notwithstanding these circumstances.

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Workshop

Plant virology in tropical Africa: English style, French style

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This paper describes the essential stages in the history of plant virology in tropical Africa. The respective contributions of British and French research are specified, with emphasis on the evolution of working methods, differences and similarities of approach and the question of trends over the coming period.

Plant virology in Africa is a hundred years old this year. It was in 1894 that the symptoms of African cassava mosaic, today regarded as the foremost virus disease in African crops, were first described. Sugar cane mosaic is another virus disease that attracted attention around the turn of the century. In the 1930s, other virus diseases were studied, such as cotton leaf roll and its whitefly vector in Sudan and Nigeria and the maize streak virus in Kenya. In fact, the early interest in virus diseases already reflected their serious economic effects. Observation, experiment and veritable research programmes were undertaken by agricultural scientists, breeders, pathologists and virologists. The aims of the research were many: to describe the symptoms and geographical distribution of the disease, its epidemiology, method of transmission and varietal resistance. The quality of the results obtained, despite the almost total lack of knowledge of causal agents at the time and the still rudimentary state of virological techniques, reflects a sustained effort in high-quality scientific work.

Until the 1950s the research teams were mainly British. H.H. Storey (1894-1969) began his scientific career in South Africa in the 1920s, moving on to Amani, Tanzania and then Muguga, Kenya. His work on the groundnut rosette virus, cassava mosaic and the transmission of maize streak are regarded as classics of virology and are widely quoted in reference books. The quality of Storey's work was also fully acknowledged by his contemporaries and in 1946 he became one of the first virologists to be elected to the Royal Society. From 1937 to 1949, A.F. Posnette, another Royal Society member,

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also began his career in the Colonial Agriculture Service, in what later became Ghana. His work on the etiology, transmission, ecology and control of cacao swollen shoot is the authority on this subject.

Until the 1950s, French-speaking Africa had no virologists and no pathologists working mainly on plant viruses. However, the remarkable work done by Bourisquet and Cours between 1930 and 1950, on African cassava mosaic virus in Madagascar, production losses and resistance mechanisms, deserves special mention, as does the work on breeding groundnuts for virus disease resistance carried out at the Bambey station in Senegal. Until the 1950s, however, virology research in French-speaking Africa was mainly the work of breeder-agronomists devoting only a part of their time to this field, and did not have an impact comparable to the achievements of the full-time pathologist-virologists in English-speaking Africa. It is also possible that the more confidential way in which results from French-speaking Africa were published may have restricted their dissemination. For example, G. Cours' findings remained little known since they were published in one 200-page book based on his thesis, whereas the English virologists' research was regularly printed in tropical studies journals before publication in the *Annals of Applied Biology*, one of the oldest and best-known international scientific journals.

During the 1960s, French and British tropical research adopted comparable systems for the study of tropical viruses, setting up substantial teams in specialist virology laboratories well-equipped with greenhouses, centrifuges, spectrophotometers etc. and with back-up from laboratories in the home country. In this way, British and French virology laboratories were set up in Ghana, Kenya and Côte d'Ivoire. The aims of the research were similar: to draw up as exhaustive an inventory of virus diseases as possible (this had become possible with the virology equipment newly available overseas), and carry out in-depth studies of some of the principal virus diseases. Contacts between French and British virology teams, very limited at first, increased rapidly in the late 1970s, particularly through the study of the African cassava mosaic virus. Information and equipment exchanges led to real collaboration in the 1980s, particularly under European STD projects.

The spirit of tropical virology research changed significantly during the 1980s with the closure of the Kenyan virology laboratory and the concomitant development of more fundamental research programmes, in Great Britain, on a few of the most important tropical viruses: the geminiviruses, groundnut rosette virus, etc. (this work being enabled by developments in molecular biology). France followed suit, some ten years later, with the closure of the Cte d'Ivoire laboratory and the creation of the *Laboratoire de phytovirologie des régions chaudes* in Montpellier, entirely devoted to studying groundnut stunt virus, maize streak virus, banana bunchy top and rice yellow mottle.

Towards the end of the 1980s, the first African virologists were trained. Both French and British structures now try, each in its own way, to facilitate their efforts by complementing field studies by African researchers with French laboratory work, developing joint programmes and working through informal networks. This is essential, because recent progress in molecular biology and genetic engineering is revolutionising virus disease control, and tropical Africa deserves to benefit from these advances.

Workshop

Scientific migration (South-North and North-South) and researchers' careers

Dominique MARTIN-ROVET*

It is usual, when a scientist spends a long period abroad at the start of his or her career, to write a thesis or a post-doc, to sing extravagant praise of the advantages of such a trip and the benefits of the internationalisation of science and scientists. Scientific migration is today regarded as professional, an integral part of a good career. However, without denying the advantages each individual may gain at the personal level, it is useful to analyse the economic, sociological, political and scientific factors at work in such a phenomenon. The influence of scientific discipline on the practice of scientific travel and on the education and career of researchers must not be allowed to mask another aspect that proves to be of prime importance - the level of scientific and technical development of the home country compared to that of the host country.

Over the past five years we interviewed about seven hundred French and foreign researchers who spent a long stay abroad at the start of their careers. All work in the experimental sciences, mainly physics, chemistry, engineering and the life sciences.

To look at the *industrialised countries* first: French scientists mainly went to the United States or to other European countries, i.e., towards the *centre* or another European country considered to be at the same level; in this case the motivation is internationalisation or else attraction to a *centre* for their discipline. Europeans, e.g. the English, take the same kind of approach. The Americans generally consider themselves to be at the *centre* and are not much inclined to study abroad; if they do spend a long period abroad it is at the senior level, as a sabbatical or as a guest researcher.

The case of scientists in the *developing countries* bears a particular stamp. Those in our sample came from the Maghreb, Mexico, Colombia, Brazil, Chile, and China. For them it was a question of acquiring a training they could not find at home. Here the avowed aim was to escape to the *center*, or to return home to put their knowledge at the service of development of their own people.

Obviously, there are many shades of variation between the two extremes. But there is a characteristic difference in the career patterns of Northern and Southern researchers once they return home.

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SCIENTISTS: FIGUREHEADS AND STYLES OF SCIENCE

By way of example we have made a comparison between the careers of two leading scientists of the same age (fifty-five) in the same very specific field - co-ordination chemistry. Antonio Campero is Mexican, a Professor and head of the chemistry department at the Autonomous Metropolitan University of Mexico-Iztapalapa. Malcolm Green is British, a Professor and chemistry department head at Oxford. Both spent long stays abroad, altogether in line with the pattern briefly described above.

Antonio Campero wrote his doctor's thesis in France and did a post-doc in California before returning home, where he had to help in the development of his country's energy industry, first as director of chemistry research in the brand new national nuclear energy commission, then directing chemistry research at the Mexican petroleum institute. Only much later was he able to return to academic research and become a university teacher. His scientific activity is reflected in some thirty publications, mostly in Latin-American journals, and he has held a series of posts of national responsibility.

Malcolm Green, having done his doctoral and post-doctoral work in a prestigious laboratory at home in the United Kingdom, took several six-month trips abroad, to Canada, France and the USA. On his return, he soon obtained a post at Oxford. He has had a typical though brilliant academic career, studded with rewards, and has produced more than three hundred publications in mainstream journals.

According to their own testimony, these two leading figures in the same discipline, both the same age and similarly prominent, owe their exceptional careers to their international mobility. However, they have followed very different careers, as is shown by a *bibliometric analysis* of their scientific output, an in-depth study of their *curricula vitae* and long *interviews* carried out in France and in their respective laboratories.

It emerges that decision-making mechanisms as regards career orientation vary but, for two scientists of equal worth in the same discipline, the state of development of the country of origin plays a decisive part. The freedom for a gifted research scientist to stay in academic research, on the royal road to academic success, is still generally a privilege of the industrialised countries; top-level scientists in the developing countries have a direct political and economic part to play. A further striking factor is the scientific and sociological impact of international mobility in reaching one's objectives: building up networks of professional contacts, acquiring scientific credibility in the scientific community of one's discipline, in the invisible college of one's specific research field and in the decision-making structures of Science and Technology policy. Today, more than ever, scientists have become internationalized and operate in a space that knows no frontiers. It is this space, where Science and Technology are manufactured, that must be constructed or occupied.

Workshop

Jean-Thadée Dybowski (1856-1928): Pioneer of modern tropical agronomy research and founder of tropical agronomy education

Bernard SIMON*

In this simple biography, we remember and pay hommage to a former student of the *Ecole de Nogent*, tropical agronomist, yet also amateur historian, a now overly neglected figure in French agronomy: Jean-Thadée Dybowski.

Jean-Thadée Dybowski, born in 1856 in Charonne, was the son of noble Polish emigrés who arrived in France in 1830. In 1879, after completing his studies at the *Ecole nationale d'agriculture de Grignon* and perfecting his grasp of botany at the *Muséum*, he became a botany tutor at Grignon, where he went on to be appointed senior lecturer in horticulture. In 1889, he published his guide to gardening.

Having come to the attention of the Minister of Agriculture, Eugène Tisserand, he was put in charge of scientific missions to explore the Algerian South (1889) and the Sahara (1890). These gave him the opportunity to display his abilities and, above all, his feeling for comparative agriculture. His reputation as an agronomist-explorer led to his being selected to lead a back-up mission supporting Crampel in Central Africa.

Dybowski stayed in the Congo from 1891 to 1892. On learning that Crampel had been murdered, he set off for the Chari basin, hunted down his killers and saw that justice was done. Back in Bangui, he nonetheless wanted his mission to have scientific content; he journeyed up the Kemo, making obeservations, collecting samples and setting up posts where he installed his «vegetable experimentation gardens». He then fell sick and was posted back to France, only to leave again to explore the Gabonese coast from 1894, moving on to Guinea in 1895/96.

Meanwhile, Tisserand had named him to the post of Professor of Tropical Crops at the *Institut agronomique*. It was a position created especially for him and one he held it until his death. In 1896, Tisserand also had him appointed to take over from Paul Bourde as Director of Agriculture and Commerce of the

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Regency of Tunis. This was where Dybowski believed himself to be fulfilling one of his dearest wishes: to create a proper school of colonial agriculture, through the existence of an already reputed *jardin d'essais*.

The settlers' hostility didn't manage to stop him from achieving his ambition, but he was so disgusted by their lack of understanding that he left Tunisia in 1898 and returned to teach at the *Institut agronomique*. He would only go back in May 1899, to attend the inauguration of what was no longer quite «his» school (for by then it was in fact the school and not the agriculture which was «colonial»!). Dybowski then set about achieving what he couldn't do in Tunisia, in the Metropolis. In fact, a government commission of which he was a member recommended that a *jardin d'essais* be set up in Paris, based on the model of Kew Gardens in London.

Three January days of 1899 saw the creation of the *«Jardin colonial de Nogent»* (The Nogent Colonial Gardens) and Dybowski was appointed its Director. He didn't stop there, though, and went on to have the college of his dreams set up in 1902: the *Ecole nationale supérieure d'agriculture coloniale* (the National College of Colonial Agriculture) enfranchised through the Museum's supervision.

Dybowski very quickly established the garden and college's reputation by bringing in the best teachers, publishing the first volume of his eventually unfinished *«traité pratique des cultures tropicales»* (practical treatise on tropical crops) and organising exhibitions of colonial agriculture.

Unfortunately, probably owing to his tyrannical nature, his overly latitudinarian management and because of internal rivalries, Dybowski, by now the ex-»pope» of colonial agriculture had to leave the management of the garden and school in 1909.

With his fighting spirit gone, he confined himself to his teaching at ENSAC and the INA, and continued producing published works. His ensuing virtual anonymity makes it harder to find out about his final years; after the Great War, Dybowski reestablished his links with Poland and horticulture at the Pulawy Institute of Agronomy and meanwhile kept up his activities in France (exotic gardens, intensive agriculture...).

When death came suddenly in 1928 in Mandres, he was already a largely forgotten man, except at ENSAC and among his colleagues at the *Académie d'agriculture*.

Too neglected nowadays, Dybowski was one of a small group of men who, at the turn of the century, understood the potential importance of developing tropical agriculture, as much for the Metropolis as for the colonies.

Furthermore, his education and experience led him to consider that such development could only succeed if accompanied and backed up by a specific training for the people in charge of its implementation and a modern and pragmatic agronomical research capable of satisfying its needs.

Main sources

Obituary articles by A. Chevalier, E. Prudhomme, L. Joly.
Personal writings of family and former students.
Turn of the century works on colonial expansion by F. Rouget, P. Gaffarel.
"The *Ecole coloniale d'agriculture de Tunis* and its former students", by G. Boué
Practical guide to tropical crops and hot country plantations, by E. Raoul and P. Sagot
Various DEA theses and memoires.
"The colonial *jardin d'essais*" by A. Milhe-Poutingnon.
The published works of J.T. Dybowski
The proceedings of the *Académie d'agriculture de France* .

Workshop

Scientific research and colonial policy. The creation of ORSTOM, from the Popular Front to the Liberation of France, via Vichy, 1937-1947

Christophe BONNEUIL*
Patrick PETITJEAN*

One cannot fail to be intrigued by the apparent continuity in the treatment of a certain number of institutions after the Liberation of France, including the CNRS and ORSTOM (name changes apart). The fact is all the more interesting in that ORSTOM was explicitly set up as a scientific instrument of colonial policy.

The aim of this paper is to examine the different aspects of this continuity, seek out its foundations and retrace the process leading from the creation of the *Comité de la France d'Outre-Mer* on September 25, 1937, to the founding *of the Office de la recherche scientifique coloniale* (ORSC, later to become ORSTOM), set up by law on October 11, 1943, and confirmed by decree on November 2, 1944. Popular Front teams headed by Jean Perrin had laid the groundwork for this colonial scientific organisation; the Vichy government set it up and the post-Liberation government expanded it.

Between the wars, the question of organising colonial science lay at the intersection between two trends: the general process of organising scientific research in France, and the desire to «rationalise» the management of the overseas territories. This was a particularly pressing need because a community of research scientists had emerged, working in or in relation to the colonies, in working conditions that often led them into conflict with the various administrative bodies.

In 1937, the «Colonies-Science» Association organised a Congress on Scientific Research in the Overseas Territories. Besides demonstrating the fact that colonial researchers constituted a growing professional body, the event provided a vehicle for their demands. The foremost demands of the colonial researchers, scattered as they were among different institutions with uncertain funding and forced to cope with different administrative mentalities, were: greater independence from colonial administrative bodies, guarantees for the durability of their ventures, and recognition in the scientific community and its institutions. The ORSC's first activities directly concerned the professional interests of this group: it gave them training that was not always provided by the higher education institutions, a civil servant status, the means to work and communicate, etc.

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COLONIAL AND POST-COLONIAL SCIENCE: INSTITUTIONS AND POLICIES.

Part one: From North...

The gradual institutionalisation and development of overseas scientific activities since the end of the 19th century had made colonial science a much more visible part of French scientific research as a whole, so that traditional academics began to show an interest in it and include it in their projects for organising science. Or, sometimes, they tried to take control of a branch that had largely developed independently of them.

The problems of guiding research (eg. deciding on the respective places of basic and applied research, or defining coordination methods and structures) were amplified in the case of colonial research by the inherent contradictions of colonial policy: the gap between rhetoric and resources, between global plans and the *de facto* fragmentation of powers, and the multiplicity of different interests and agents involved.

The Vichy government set up a number of specific institutions for colonial research: as well as the ORSC, there were agricultural research institutes specialising in different tropical crops. This constituted a break with the integrated national system initiated in 1937, which, from 1939 on, was centred on the CNRS (Centre national de recherche scientifique).

Was it that the tropics were epistemologically so specific? Or was it that French colonial science was made to serve economic objectives and administrative reasoning while the Vichy government, continuing the earlier «scientific mobilisation», was also steering the CNRS towards applied research at that time? Apart from the formal separation, how did the ORSC ultimately fit into the national research apparatus?

In the first place, a closer analysis of the actors involved is required (both their scientific styles and institutional strategies) and, more especially, of the ups and downs of the relations between the CNRS and the young ORSTOM, even though these events, in the end, had little impact on the institution's objectives. More decisive for ORSTOM's vocation were the conflicts of competence with the colonial agricultural research bodies, which defined the fluctuating fortunes of agronomy as a research branch.

New trends in colonial policy after the first world war that made it necessary for the Ministry for the Colonies to organise colonial science: development («mise en valeur» as it was called in those days), implying optimum management of the empire's natural and human resources to meet the needs of the home country. So the need for a «scientific policy» taking institutional form was more obvious for colonial science than for mainstream science in France. That colonial science was, in a sense, one step ahead was also reflected in certain pioneering measures taken by the young ORSTOM, heralding the emergence of the civil servant researcher and the postgraduate researcher.

Workshop

The missions of the French Ministry of State Education (1842-1914)

Jean-Christophe BOURQUIN*

As part of my thesis "The State and travelling scientists" (Paris I University, 1993), I studied 1205 individual State-supported scientific or literary trips between 1840 and 1914. They were only possible because a special financial reserve had been set aside for them. 1842 was the year that Villemain, the Minister for State Education, asked Members of Parliament to agree to a budget allocation of 12,000 to 112,000 francs for «scientific trips and missions».

The missions were «scientific and literary». As many zoological, botanical or geological explorations, as much paleontological or physical anthropology work, and as many astronomical or meteorological observations received support as did archival research, historical work, archeological digs, ethnographical work or literary «missions». At times, the missions also acted as surveys, ordered by the Minister, who despatched a trustworthy person to examine the working methods of German university libraries, the state of primary school education in Switzerland or the organisation of natural history museums in the larger countries of Europe. The investigations, mostly combining approaches both «scientific» (compiling collections) and «literary» (ethnographical descriptions, geographical surveys), also received State funding.

Overall, the period was dominated by «literary» missions. The legitimacy of scientific field work steadily declined throughout the last century, when experimental sciences emerged and became established as Science par excellence. On the literary side, though, there was a growing requirement for the work to be backed up by research on the ground, be it in the archives or in distant lands, as seen in the rising demand for erudition among historians and the obligatory trip to China for sinologists. Chronologically, though, the years 1871 to 1892 were dominated by missions exploring distant lands, in step with the pace of French colonial expansion. The end of the 19th and beginning of the 20th centuries saw a very clear return to literary missions, to mainly European destinations.

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COLONIAL AND POST-COLONIAL SCIENCE: INSTITUTIONS AND POLICIES.

Part one: From North...

The return to Europe obviously tied in with the scientific reorienting of the missions: Africa had neither archives nor libraries to explore. Each mission received a subsidy that varied, of course, according to the destination and goals. Good sense and descriptive statistical elements can help differentiate lower-cost European missions (library visits, missions described solely as «literary») from distant and more expensive missions (explorations, and also archeological digs with their heavy staffing requirements).

The missions were assigned to categories of individuals that varied according to the times. Before 1871, missions were primarily assigned to archivists and librarians and the staff of large cultural establishments. Then, until the end of the century, came the turn of the amateurs, mostly unknown explorers, and the staff of French schools abroad. Between 1902 and 1914, university academics came to the fore. The varying sociology of mission leaders should be looked at in the light of the above-described changes: scientific goals of the missions, their destinations and the sums received. It also tied in with the institutional framework determining whether to award or refuse a subsidy.

For almost the whole of the period we are studying, funding for trips and missions was administered at the Ministry of State Education by the Office of Historical Works. This elementary administrative unit was first attached to the Department of Arts and Sciences, which handled the large establishments, the Institute, public libraries, book purchases and so on; after 1852 it was transferred to the Minister's office and secretariat; in 1864, it returned to the Division of Sciences and the Arts until 1882, with brief spells under the general secretariat of the Ministry. In 1898, missions came under the authority of the Higher Education Services where they were to remain until their consecrated funding disappeared in 1936.

The change at the end of the century also explains why an increasing number of missions were given to university academics proposing literary and European goals. With the missions' administration being independent from the teaching divisions (or «departments»), subsidies could more easily be awarded to people outside the University. Indeed, one of the main features of the missions was that they had for a long time been assigned to non specialists as well. The relative balance between literary and scientific legitimacy was otherwise conveyed in the commission in charge of assessing mission requests and the distribution of funding from 1874.

The changes in the mission goals and destinations as well as in the categories of people leading them, are explained by changing definitions of legitimate mission goals and those with a rightful claim to a subsidy. Under the July Monarchy, amateurs could fully expect State support to go and make copies of inscriptions in Palestine or Sinai; in 1912, this kind of work was done by specialists, for the most part from the Ecole française d'athènes. The goal of the mission still remained legitimate, but amateur status did not.

Between 1871 and 1891, there was strong public and political pressure in favour of exploration in Africa or Indochina. The culmination of colonial conquest and, (a less often stressed factor) the many explorers dying in the course of their missions, weakened the social demand for that type of journey: and interest in them had ebbed by the end of the century.

So the missions of the Ministry of State Education therefore offer an excellent means of shedding light on the historical changes in scientific activity conducted abroad with State support. Within the framework of a conference on Sciences beyond the Metropolis, I can analyse the missions' decline (exploration and gathering natural history collections) related to the various political, institutional, scientific and social factors briefly touched on above.

Workshop

UNESCO and the politics of scientific internationalism

Aant ELZINGA*

This paper focuses on the early history of UNESCO to explore ideals and realities of scientific internationalism. It is found that in its genesis UNESCO was linked to an important discourse of social responsability from the inter-war years, in the face of rising fascism in the 1930s. The "Social Relations of Science" (SRS) movement, which also impacted on the International Council of Scientific Unions (ICSU) posited its ideals of universality and internationalism in opposition to the traditionalist concept of pure science, i.e the ideology of *science pour la science*, which in practice revealed itself to be impotent and manipulable by aggressive nationalist and great power chauvinist agendas that mobilised Science and its symbolic purity in the service of particularist politics.

Within the anti-traditionalist discourse on internationalism, however, there was an epistemological and ideological tension between a liberal pragmatist and a more radical Marxist program. Both of these, nevertheless, traded on some version of enlightenment rethoric. UNESCO, at its inception, accommodated both approaches, but was unable to prevent their splitting apart under the pressure of the Cold War. When unity was maintained it was at the cost of far-reaching technisation and scientism, with an instrumentalist concept of knowledge. Attempts to reverse this were made in the mid-1970's, whence there was an upsurge of Third World nations calling for a New World Order in Science, the media, and the flow of information and resources, in hopes of rectifying an imperialist bias. In the course of this there was a partial de-technisation of the discourse on Science and information.

The case of UNESCO will be used in this paper to explore some basic issues in the tradeoff between Science and politics.

Science is supposed to be international and universal. This commonly accepted ethos is nurtured internally by epistemological and material requirements embodied in scientific practices -the standardisation of instruments, calibra-

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tion of basic units, methods of measurement and consensus around preferred methodologies and concepts, as well as a division of labour across scientific groups, institutions and nations. This is especially the case today in megascience projects, and in research on the enhanced greenhouse effect and climate change.

Externally, the institutional motive for using Science as a vehicle for politics contributes to situations where the rhetoric of internationalism and the presentation of knowledge claims as independent of time and place can turn out to be a promotion of its diametrical opposite: nationalism and interests rooted in local and particularistic agendas. Science because it is not disembodied but very much a material force, becomes a continuation of politics by other means.

This does not mean that Science is reduced to brute politics, pure and simple. Rather it attests to both its material and symbolic value. The appeal to its purity is used to empower the actors that do so. Material and symbolic values are cashed in on political arenas, global as well as local. In other words the credibility cycle of political decision-making stands and falls with the (internal) epistemic credibility cycle of Science, based on recognition authority and peer review. The latter is a process that has become strongly formalised and institutionalised. This may be seen in the current operation of the Intergouvernmental Panel on Climate Change (IPCC) created in 1988 by UNEP and the WMO. IPCC seeks global consensus by combining anchorage in disciplinary depth, with geographical breadth, with scientific elites in the North guaranteeing the former and representation in the South the latter.

Thus, we find a repeat today of the some tensions and contradictions between non- and inter-governmental modes of internationalism in science that were very much at stake in the early formation of UNESCO. The confluence of scientism and a patronising species of neo-colonialism was superbly articulated by UNESCO's first Director -General, the maverick British biologist, Julian Huxley. The paper will therefore also touch upon his vision of global science, as well as more moderate views of the first three Science Directors, Joseph Needham, Pierre Auger and Victor Korda, who struggled to carry forward a more radical (leftist) interpretation of the Social Responsibility of Science through the Natural Science Department, 1946-1965.

From the historical experience of the gap between the virtuous ideal of and the geopolitical constraints to scientific internationalism in UNESCO there is much to be learned for the present theme of this conference. In this century, when it comes to Science, the Metropolis has expanded, rhetoric has changed, but the basic center-periphery relationship remains. Still, at the level of ideals of science the frustrated notions of a truer internationalism are still around, e.g., in the case of Antarctic science.

Workshop

The history of scientific programming at ORSTOM (1944-1994)

Marie-Lise SABRIÉ*

What are the main themes and perspectives propelling ORSTOM research programmes since 1944? How and why have they evolved over the last half century? These are the main questions raised in this paper. Input will come from nearly a year's research and reflection conducted within the context of the 50th Anniversary of ORSTOM, at the Institute's request and in close collaboration with its researchers, by the ClioMédia agency of historians with which I work. We were asked to compile and publish a *mini-dictionary compendium* whose one hundred or so articles would map out an account of fifty years of research at ORSTOM.

New scientific fields: from survey to enhancement (1944-1960)

Soon after the end of World War II, the researchers of the *Office de la recherche scientifique coloniale*[1] embarked on their first missions to the French colonies of Africa, Madagascar and the Pacific. Although some research had already been done there under the auspices of earlier established institutes of tropical science, vast areas of those territories remained scientifically unexplored.

The first fifteen years in the history of ORSTOM scientific programming were marked by intense surveying and prospecting in the field; in all disciplines, in physical, biological and human sciences. It was a «new world with no limits to the task», as Raoul Combes, the first ORSC director, put it in 1945, and the ORSC researchers had to *create the data*.

To add to that, there was another objective behind the exploration of new fields of scientific experience in the French tropical territories: i.e., to develop research programmes to enable the enhancement of those insufficiently developed lands, and accomplish a «mission to civilize» (R. Combes) indigenous populations too long denied the chance to progress.

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How far did the ORSC researchers respond to that double objective (surveying and enhancement of the colonies) during the first period of the Institute's history, and how did they go about it? This is the first question our paper will strive to answer.

The sciences and development aid (1960-1976)

In 1960, decolonization in Africa and Madagascar provoked profound institutional and geopolitical upheaval. While the actual nature of ORSTOM's activities remained fundamentally the same (with scientific programmes continuing under agreements with the new States), the goals changed because of a decree issued in August 1960. It demanded that basic research be undertaken for the development of tropical countries - a new vocation replacing the original objectives of colonial science: to enhance and «civilize» the colonies.

Aiding development was the premise of a policy for scientific and technical cooperation with Third World countries implemented in the course of the following decades and established at the beginning of the Eighties. It was reaffirmed in 1964 with the reorganization of the Institute: sixteen technical committees were instituted, corresponding to a similar number of scientific disciplines whose research programmes would thenceforth be strictly defined.

What «new» scientific programming did the objective of assisting development arouse after Independence? This is the second question our paper will strive to answer.

Scientific research for development in cooperation (1976-1994)

During the Seventies, ORSTOM's thirty year policy of assistance or substituting indegenous researchers in Africa aimed at becoming a policy of scientific and technical cooperation in the vein of that already in practise in Latin America, the Maghreb and Asia. There were three reasons for this. One, the scientific aid was called into question, accused of being too often limited to substitute research; second national research systems were emerging indeveloping countries and had to be taken into account. And third, there aws a political wish to develop French research in the Third World: notably expressed within the framework of the VIIth National Plan for French Research (1976) and the orientation and programming law for France's research and technological development (Muster Programme n°4, 1982).

Implementing the cooperation policy implied an in-depth reform of the Institute, whose organization and scientific programming principles hadn't change since the 1960 decree proclaimed at the dawning of independences. Undertaken in June 1984, the reform gave ORSTOM the principles of its present organization. Thenceforth, its mission was to promote and produce scientific and technical research that would make a lasting contribution to the economic, social and cultural progress of developing countries. Multidisciplinary scientific departments corresponding to major thematic divisions were instituted to replace the old technical committees and strictly disciplinary programming. They would serve as a defining framework for research programmes conceived and produced with partner country scientific institutes and researchers. A sign of the change was that, while retaining ORSTOM as its acronym, the office was rechristened «Institut français de recherche scientifique et technique pour le développement en coopération»(2).

What "new" scientific programming emerged during that period? What factors (from the evolution of scientific technology to the institutional reform of the Institute) contributed to that evolution? The third part of our paper will centre on these avenues of investigation.

Bibliographical references

This paper will be grounded on the documentary research we carried out with a view to producing the mini-dictionary compendium: namely a comprehensive analysis of *ORSTOM activity reports* from 1943 to 1992 (i.e., around twenty volumes) and a series of interviews with about twenty ORSTOM researchers.

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1 *Office de recherche scientifique coloniale* (ORSC): ORSTOM as it was formerly known. Literally translates as the Office of Colonial Scientific Research.

2 *Institut français de recherche scientifique et technique pour le développement en coopération*, literally translates as «French institute for Scientific and Technological Research for Development in Cooperation».

Workshop

International experimentation and control of the locust plague. Africa in the first half of the 20th Century

Antonio BUJ*

Some species of locust are endemic in Africa. These locust plagues, historical responsible for problems in alimentation, still have catastrophic results, as it has recently happened in this continent.

The first steps for the international control of the locust plague happened during the 2nd decade of this Century in the Agricultural International Institute, launched in Rome in 1905. Under this organisation a meeting between several countries was held to fight the insect in October 1920. The meeting had been rejected by the representatives of the French and Italian colonies in Africa. Nevertheless, the international Conferences, which marked the definite scientific development of the problem, didn't happened until the following decade. The first convention was held in Rome, 1931 ; the last one in Brussels, 1938. All these gatherings under the auspices of the European Metropolis dealt basically with the locust in Africa.

The fast that tplague grew enormously after 1928 in Africa explains this intense activity. In this continent, ruled by the European Metropolis at the time, the applied Enthomology began to take an active part from the beginning of this Century onwards in what has become known as «constructive imperialism» and *«mission civilisatrice»* or *«mise en valeur»* in the French colonies. Coincidental with the development of the African plague, an intense scientific literature began to be published. Especially important was the work by Boris P. Uvarov, *Locusts and grasshoppers* (London, 1928), the compulsory reference for all those who research on the topic. Highly remarkable were the works developed by Paul Vayssière, Assistant Director at the *«Station entomologique»* in Paris. Besides, Vayssière took part with Auguste Chevalier, another scientist who made interesting studies about the locust, in the creation of the *Académie des sciences coloniales* (1922), and in the *Association colonies-sciences* (1926). Chevalier was also one of the most important participants in the *Congrès de la recherche scientifique dans les territoires d'Outre-Mer* (1937).

This paper tries to analiyse the reason for theEuropean Metropolis becoming interested in the scientific and arganising aspects of the locust in Africa.

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Workshop

*The staging of Science and a metaphor for ordn:.
The Cairo Geographical Society (Egypt)
1875-1925*

Jean-Noël FERRIÉ*
Gilles BOETSCH**

A lively work by Edward Saïd (1978) prompted a certain number of authors to try and demonstrate how «Western» scholars of non-Western societies had both invented «indigenous societies» -pigeon-holing them in a stable and stigmatising category- and forced that image of themselves on them as a framework of disciplinary action through which to exert colonial power. This is a basically idealistic viewpoint -since it assumes that scientific categories can be an effective means of power- which most of the time draws support from a short reading of Foucauld. In the case of Egypt, this was shown by Timothy Mitchell (1988).

These views have quite often led people to considering geography and anthropology as «colonial sciences», i.e. sciences specifically used to control indigenous societies and include them in systems of knowledge which would also double up as power systems. As such, institutions like the Cairo Geographical Society -created by Khédive Tawfik-Pacha in the last quarter of the 19th Century- could give the impression of being completely devoted to a «disciplinary» project. The Cairo society, which was for the most part managed by Europeans to further a detailed and systematic knowledge of Egypt, displayed all the characteristics of Bacon's words, «knowledge is power».

This paper sets out to demonstrate that such an interpretation does hold water: knowledge cannot be assimilated with power over others. For all that, we are not pretending to say that the creators of the Geographical Society had no classificatory project in mind, much as that (on a broader scale) of the 19th Century scientific elites; one should, however, avoid confusing the project with its accomplishment, the building up of knowledge with the construction of models for action, the organisational reductionism inherent to laboratory activity with the current reductionism in the ongoing colonial debate. Without such distinctions, the history of building knowledge about

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others would run the risk of no longer being read as anything other than Western hegemony's mode of expansion par excellence, and the genealogical appreciation of knowledge (from which it stems) could well overtake the scrutiny of its relevance. One of the methodological shortcuts we criticise maintains that some «laboratory-devised» categories offer the structure of a system of action, universally applicable to all fields. Whereas, as we shall strive to show, laboratory-devised categories are only relevent to the laboratory public, i.e. scientists themselves and elites interested in the development of Science. In reality, an event like the 50th Anniversary of the Geographical Society, which corresponded with the staging of an international geographical congress, says less about Egypt's inferior world position during the inter-war years than its admission into transnational scientific networks.

Under such conditions, knowledge (the scientific production of the Geographical Society) is validated not by its admission into the local political context (colonisation, to put it briefly), but by its ability to enter a network of knowledge that is accepted as valid and built up independently of local contexts. The 50th Anniversary of the Cairo Geographical Society staged such a network rather than a situation of dependency. The question of the Egyptian Society's «organisation» should be thought of according to the *philosophie des lumières* and in relation to Western society itself. From this point of view, the Geographical Society was an institution whose role consisted of rationalising reality by inserting it in a systematic knowledge, in a purpose-built environment. Order of that kind, however, only exists *for want of real order*; it is a substitute rather than genuine programme, a metaphor for order rather than order being planned.

References

Mitchell, T. 1988 "Colonising Egypt". Cambridge University Press: Cambridge;
Saïd, E. 1978 "Orientalism". Pantheon: New York.

Workshop

The geographical societies: An instrument of scientific propangada in Latin America in the early 20th Century (1900-1914)

Leoncio LOPEZ-OCON*

In the early 20th century, a hundred years after independence in most Latin American countries, scientific societies proliferated in the region. There seem to have been two reasons for this: the cultural elites of several Latin American countries were trying to consolidate local initiatives to develop scientific knowledge and practice, and they were also trying to become part of international scientific communication networks. The resulting movement was torn between a nationalistic rhetoric and an internationalist practice.

The aim of the present paper is to show how this tension was reflected in the way the geographical societies operated - the geographical societies having been the backbone of the scientific society movement.

I shall analyse three strands of the propaganda work of several geographical societies that were active in Latin America between 1900 and 1914, eg. the mexican Society for Geography and Statistics, the Rio de Janeiro Geographical Society, the Geographical Society of Lima, the Argentine Geographical Institute, the Costa Rica Institute of Physical Geography and the Geographical Societies of La Paz and Sucre, Bolivia.

On the one hand, these associations were the main force in a drive to disseminate science in the social circles within which they operated. The aim here was to develop a territorialised ideology, and the work helped to elaborate a nationalistic rhetoric. The geographical societies fulfilled various tasks; for example, they promoted local exploration, the inventorying of their countries' natural resources, the creation of an indigenous scientific memory or the development of a taste for knowledge of the pre-Columbian past and its cultures.

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The second strand of their work was to disseminate scientific matter outside their home countries. Several joined forces with bodies involved in colonization and immigration, to run international campaigns highlighting the wealth of natural resources their countries possessed, and to convince public opinion that tropical America was habitable for Europeans.

Lastly, the members of these Societies regarded themselves as part of the international scientific community and defended its ethos; they were the voice of scientific progress in geography at an international level.

To carry out this threefold propaganda activity, there were very extensive communications networks, some more than countrywide, reaching across Latin America if not worldwide. For a more precise assessment of the impact of the propaganda activities of the Latin American geographical societies, we end our paper with an analysis of their relations with the Geographical Society in Paris between 1900 and 1914.

Workshop

ORSTOM in French West Africa: From its creation to the Independencies

Saliou MBAYE*

The genesis of scientific research in French West Africa

The beginnings of scientific research in the French colonies of Africa can be traced back to the second half of the 19th Century. It was originally initiated and conducted by isolated individuals: chiefly explorers, missionaries and settlers when they weren't scientists sent out from the Metropolis. Even though questions of a scientific order were being raised with some acuity, there was a much-deplored absence of any research centres in the African colonies.

Scientific research on a permanent basis only really began in the French overseas territories in 1890, the year that Doctor Calmette founded the microbiology laboratory in Saigon under the auspices of Louis Pasteur: it went on to become the first overseas branch of the *Institut Pasteur*.

The *Comité d'études historiques et scientifiques* (Committee of Historical and Scientific Studies) was established in French West Africa in 1912. From it emerged the IFAN in 1938.

Scientific units were then set up and they spread to various territories of West Africa. In particular, a number of experimental agricultural stations appeared between 1924 and 1926. Characterised by their dispersal and lack of coordination, these creations often had diverging motivations.

During the same period, dynamic research bodies made a name for themselves in a good many fields. This is especially true of the *Association scientifique internationale d'agronomie tropicale* (International Scientific Association of Tropical Agronomy) founded in 1906 and, above all, the *Congrès pour la recherche scientifique dans les colonies* (Scientific Research in the Colonies Congress). The latter assembled in 1931 and 1937 and repeatedly called for the setting up of a scientific research institute in the colonies.

And yet it took another six years before a law (published in 1943) saw the institution of the *Office de la recherche scientifique d'Outre-mer* (Overseas Scientific Research Office - ORSTOM).

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COLONIAL AND POST-COLONIAL SCIENCE: INSTITUTIONS AND POLICIES.

Part two: ...to South

ORSTOM - historical background

ORSTOM came into being as a result of a law passed on 11 October, 1943. It officially instated a Colonial Scientific Research Office which, through the decree of 28 May, 1949, became the Overseas Scientific Research Office (*Office de la recherche scientifique d'Outre-mer*) and then, with the law of 17 November, 1953, the *Office de la recherche scientifique et technique d'Outre-mer* (Overseas Scientific and Technical Research Office).

ORSTOM's activities

The Office launched and began developing its activities in various operation bases in French West Africa in 1945. These bases were mainly ORSTOM-owned centres installed in the regions being studied: Dakar, Mbour and Richard-Toll (Senegal), Ouagadougou (Upper Volta), Niamey (the Niger), Fort-Lamy (Chad). To add to that, there were also bases embedded in foreign structures. Such was the case of the *Centre d'océanographie* (Centre of Oceanography) in Thiaroye (Senegal) managed by ORSTOM, and the *Mission d'entomologie médicale* (Medical Entomology Mission) that it set up in Bobo-Dioulasso (Upper Volta).

And then there were bases installed in other countries than those geographically belonging to «dry» Africa: these sent out missions of specialists in various fields. The main examples were the centres of Adiopodoumé (the Côte d'Ivoire), Bangui (Ubangui-Chari) and Bondy (France).

The research the Office accomplished in French West Africa therefore benefitted from large-scale logistics; its specialists covered a wide range of fields concerning earth sciences, biological sciences, marine environmental sciences and finally social sciences.

ORSTOM and the other colonial research institutes

ORSTOM keeps up sustained cooperation with other bodies such as:

• *le Centre de recherches agronomiques de Bambey* (the Bambey Agronomical Research Centre);

• *le Centre de recherches agronomiques de Bingerville* (the Bingerville Agronomical Research Centre);

• *l'Institut de recherche pour les huiles et oléagineux* (the Institute of Research on Oils and Oil-producing Plants);

• *l'Institut français de recherche fruitière d'outre-mer* (the French Institute of Overseas Research on Fruit);

• *l'Institut de recherche sur le caoutchouc en Afrique* (the Institute of Rubber Research in Africa;

- *l'Institut français d'Afrique noire* (the French Institute of Black Africa);

- *le Comité de coordination des recherches agronomiques* (the Coordinating Committee of Agronomical Research).

At the time of the Independencies, ORSTOM contributes to the emergence of national scientific research in the countries of Africa.

Workshop

The fear of leprosy in Colombia: The uses of knowledge

Diana OBREGON*

Leprosy was an important subject of inquiry for Colombian physicians and bacteriologists in early 20th century. These scientists were usually «amateur» researchers, working with their own resources in laboratories made by themselves at a time where scientific research was not institutionalised in the country. In order to convince the government of the need to struggle against the disease, physicians unfolded a rhetoric where nationalist considerations as well as exaggeration played a principal role. Colombian physicians saw the disease as extremely contagious. The amplification of the severity of the disease led some of the physicians to suggest that the government should isolate lepers on an island, a proposal that was never implemented; the sick remained within lazarettos built since the 19th century. The physicians claimed that the example of Norway proved rigorous isolation as the only effective way to solve the problem of leprosy. However, they were not following Norway's example, but rather complying with the conclusions of the First International Leprosy Congress held in Berlin in 1897. According to those conclusions, leprosy was very dangerous, and segregation was seen as the best way to prevent the spread of the disease. This image of leprosy came from the imperialist expansion of Europe and the United States in late 19th century where racism played an important role. Leprosy was seen as a common disease among «poor» peoples, such as Chinese, Indian, Hawaiian.

Between 1903 and the 1930s, the Colombian government imposed regulations ordering the isolation of the sick. It also created special institutions for lepers, separated from the ordinary institutions of public health, such as the *Code for Lazarettos* (Codigo de Lazaretos), and the *Lazarettos'* National Board (Direccion Nacional de Lazaretos). The *Central Laboratory for Leprosy Research* (Laboratorio Central de Investigaciones de la Lepra) was created in 1934. In the Thirties, isolation was still the main procedure to manage the disease, but the medical rhetoric started to change. Leprosy was viewed as a curable disease, and prevention was seen as a more rational proceeding : Observing children at school, and controlling people who had been close to

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lepers. Compulsory isolation was rejected. The emphasis was put on prevention and research. This new approach was connected with liberal ideas that were dominant at that time in Colombia.

During the 1930s Federico Lleras Acosta, veterinarian, conducted most of the research on leprosy in Colombia. He tried to cultivate the bacillus, *Mycobacterium leprae*, in order to produce a vaccine. Several researchers at that time claimed to have grown the leprosy bacillus. Nonetheless, the bacillus has been highly resistant to attempts of cultivation *in vitro*, and producing the disease in laboratory animals has been impossible. Guillermo Munoz Rivas, a Lleras disciple and a son of a physician who studied leprosy, led leprosy research in Colombia between 1940s and 1970s. His experimental research on fleas (*Pulex irritans*), and his theory that fleas were important transmitters of leprosy got international recognition. How leprosy is transmitted is still uncertain, and the role of insects has not been totally accepted neither totally ruled out. What is important here is not the veracity or falsity of Muniz's theory, but its consequences: his ideas were highly popularised in the press during the 1940s and 1950s, and they played an important role at pointing out the poverty of Colombian peasants and their miserable life conditions. He also claimed that leprosy was less contagious than many other diseases, such as tuberculosis and syphillis, and argued that it was possible to treat leprosy patients in ordinary hospitals. Despite his arguments, the stigma of leprosy in Colombia is still strong.

Workshop

ORSTOM in action in Amazonia: The decephering and synthesis of a research system

Carlos SALDHANA MACHADO*

Some decades ago, French research bodies agreed to conduct extensive efforts on the intertropical world. Since then, several research institutes and laboratories have been taking action to implement this project, with a view to establishing a vast international cooperation network. This enables France to play an influential role both through her scientific research machinery and, as a contributing partner in the setting up and development of other national research machinery in the countries in question.

ORSTOM is the chief instrument of the cooperative research machinery of France. It is a world-wide body with permanent installations in the territories where it is active. ORSTOM covers both a considerable disciplinary field and practically every area of science involved in environmental studies. Working in collaboration with the national structures of partner countries, in Latin America it takes part in the dynamics of Amazonian scientific research. Partnership with Brazil began in 1979 when a pact signed between the CNPq (National Council of Scientific Research) and ORSTOM allowed French researchers to be posted to the INPA (National Institute of Amazonian Research) in Manaus. This agreement meant actors there could be associated in a totally different way with regard to their earlier practices; actions undertaken on the ground in Amazonia made protagonists far more sensitive *vis-à-vis* temporal and spatial problems.

From the Bruntland report of 1987, the «sustainable development» and «ecologically rational» dimension emerged to take on strategic importance for the hybrid communities of scientists working in the field of tropical ecology. Going on this statement, the extent to which this dimension contributes to a restructuring of ORSTOM's Amazonian research machinery must be underscored. The diversity and complexity of the movements of mobilised actors have led researchers and scientific managers to giving thought to its manner of intervention and to renegotiating its relationships with regional partners.

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COLONIAL AND POST-COLONIAL SCIENCE: INSTITUTIONS AND POLICIES.

Part two: ...to South

This paper is by no means setting itself up as an exhaustive analysis of the organisation and institutional policy of a regional programme involving ORSTOM. It above all intends to put forward some of the features of the way in which *Orstomian* researchers have acted in Brazilian Amazonia over the past few years. In other words, we can investigate how the researchers have tuned the suppleness and flexibility of their actions to the constraints of the bodies responsible for managing science and technology. Actually, the challenges involved in this type of research are seen to be proliferating more due to the emergence of the *Environment* field of science. This can help us understand the role of the networks and the multidisciplinary system in today's «delocalised» scientific activities. Besides that, we must analyse how much of an effect the variety of directions taken by the research has had in engendering a quite individual form of action, one that differs even from the old scientific cooperation in Africa in which some of the researchers currently working in Latin America were involved. With regard to this, can it be said that there has been a change in the scientific approach? On hearing researchers talk about the effort they have put into adapting to new circumstances, can it be said that there has been a movement towards innovative ways of tackling the problems they study? From this point of view, researchers' practices will be the key to the distinctive features of an ongoing empirical process.

The bulk of our approach stems from two sources of information: interviews with the various participating actors, past and present, in the ORSTOM-INPA cooperation pact, and an analysis of mission reports. A total of around twenty people were interviewed, and each gave their own personal account of the research subjects, theoretical tools, the methods used, the analysis models, experimental mechanisms, instruments, the science policy, the administrative decisions and finally, every constituent part of the body of heterogeneous practices now in place in Amazonia.

This region of Brazil has, in fact, been turned into a huge theatre of operations, peopled with active and farsighted players whose challenges are no longer defined by individuals holding a view to the future course of history. All we want to do is to highlight the way in which the researchers have understood this ever-evolving Amazonia rather than the representations (our conceived ideas of the world or a given object) that give us the perfect picture of reality. We now know better than ever before, that reality is, in fact, taking hold in all its immensity.

Workshop

The honeymoon ends: Some reflections on state and Science in modern India

Dr. Satpal SANGWAN*

Progress of Science, as they say, rests on human, «thirst to explore the unknown». A scientist wrestles with this «intellectual curiosity» with the help of national as well as other organs of society. Sources of such support have been different intervals of human history, depending upon the motivation and capacity of the supporting agency. Broadly speaking, state had a marginal role in shaping the direction of science until the modern nation-State was attracted to its magical appeal around mid-18th century. Riding on the popular slogan of «utilitarianism» it sought to direct scientific enquiry towards assessing and increasing the productive resources.

In India the ball was set in motion by the East India Company towards the last quarter of the 18th century. Beginning with the appointment of professional naturalists and surveyors for accumulating information on the material resources of the country, its ranks increased over the years as newly identified areas called for the involvement of other specialists like astronomers, engineers, chemists, and physicists. Under the arrangement, the spot-light was on soft environmental sciences like geology, meteorology, botany, and zoology. Though «no less than applied research» this type of scientific research remained part of government machinery for a fairly long time. A decisive change came around the turn of the 19th century when a few motivated «native» scientists realised the importance of basic science, i.e. science for the sake of knowledge. Next came the demand for corporate and planned scientific and industrial research. The colonial State responded by making concessions in piece-meal which met the tactical approval of the scientific community. Nonetheless, enough spade work had been accomplished by the time a national independent Indian government replaced British colonial rule in 1947. Taking pledge to put India on the faster track of «modernisation», the sovereign State offered a bonanza of research laboratories much to the satisfaction of the scientific community. Recent changes on the economic front have inspired the State to distance itself from scientific research leaving the scientific community at a crossroads.

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COLONIAL AND POST-COLONIAL SCIENCE: INSTITUTIONS AND POLICIES.

Part two: ...to South

This essay recounts the events leading to the union and seperation of state and science in India during colonial and post-colonial times. Taking the position that the honeymoon, though it began on a promising note, was never free from squabbles, I make a socio-psychological enquiry of the fragile union.

Workshop

Anatomy and pathology of research at a University institute

Yolanda TEXERA-ARNAL*

Taking as its example the Anatomy-Pathology Institute of the Faculty of Medicine of the Central University of Venezuela, the article discusses the setting up and evolution of a university research institute. It attempts to track the difficulties and contradictions which emerge when models of institutions are taken from a set of different realities and transplanted into, for example, Venezuelan society of the Fifties and, more particularly, the university which founded the institute at a time when conditions were not ripe for the launch of ongoing and progressive research activity. The institute project developers had failed to grasp the facts and, as a result, the institute took on a strict statutory supplier role, to provide services and assistance to the existing University Hospital of Caracas. When conditions both in the country and at the university improved, there was no significant change to the symbiotic hospital-institute link as far as its scientific research role was concerned. Thus, the future of the institute as a cradle of scientific research remained compromised.

The article looks at the backdrop of the conception and setting up of university research institutes, with particular reference to the Anatomy-Pathology Institute. The university's internal historical factors are considered, to wit: it had resisted the introduction of substantial reforms to such a point that, in order to modernise the university, the State was forced to set up semi-autonomous institutes. Then there were external factors, notably the influence of institutional models and perceived notions about the nature of scientific research by Venezuelan doctors who had trained abroad, and non-nationals, who wanted to see them adopted locally. Together, they brokered the idea of creating university institutes, which they assumed would be devoted to scientific research.

The organisational form of the institute, which was fragmented, is studied in detail. The small units, dependent on financing bodies for research activity, were essentially geared to satisfying individual requests. That was compoun

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ded by the politics and practices of university professors as a body, with all that is implied by the sacrosanct freedom of the chairs and of research. All conspired to make an unmanageable type of institute when it came to mustering multi-disciplinary teams to tackle priority research problems, which either chose to respond or not to respond to the "Internal demands of science". Other elements of this organisational orientation inclued the ways in which institute staff were trained, which consisted mainly of specialisation in particular fields, and the make-up of the staff - mainly doctors trained for medical practice. The upshot was that the centre found itself in a situation which was hardly conducive to the whole-hearted pursuit of research, and whatever happened, such activities were limited by the material contribution afforded by the hospital. Thus, it was locked into a double-bind situation. On the one hand, it was bound by the weight and recognition given to its assistance and service to the Faculty of Medicine, and on the other, by the lack of importance ascribed to research tasks within the context of a faculty and university which were traditionally vocational in orientation.

This analysis shows that when new institutions are set up in countries whose contexts do not favour progressive and continuous research, there needs to be clarity of purpose to form a protective shield around their research activities, and they must be equipped with appropriate management and organisation to guarantee survival. As far as the international community is concerned, this means nurturing a network of agencies and institutions with potential interest in the fruit of their work. In that case, the provision of services should be viewed as subsidiary to the main activity of scientific research, come what may. Moreover, links with foreign institutions should serve as the means of earning recognition for the work carried out, with its attendant assets - something vital when conditions on the ground in the host country are poor. Domestically, this means above all else, a clear and decisive leadership and a high-level scientific staff whose entire allegiance is to the institution so that it will progressively constitute a basis to train the next generation. Special care must be taken to safeguard these requisites when there are deeply entrenched vocational attitudes, as in the case under examination.

Workshop

The invention of endemic diseases and the formation of the Egyptian medical corps

Sylvia CHIFFOLEAU*

The transfer of intellectual and technical knowledge to Egypt from the West, during the 19th century, led to the emergence of new categories of social agent. Among these were the doctors of medicine, a deeply committed group who were destined to play an exemplary role in their country's development.

The aim of this paper is to consider how the medical model was transferred to Egypt, and above all how it was appropriated by those at whom it was directed. In other words, how this new knowledge was mobilised and re-evaluated so as to serve the liberation of a dominated profession and a dominated country.

19th century medicine: hunting down epidemics

A specific feature of Egypt's scientific history is that the principles of modern medicine were not directly introduced by a colonising power, as was the case in most Arab countries, but were deliberately imported on the country's own initiative. Starting in 1827, at the request of the Viceroy Muhammad Alī, a French doctor first set up a hospital and medical school in Cairo. Then, he established a nationwide national health service designed to combat the country's main diseases: smallpox, «anaemia», eye ailments, etc.

This early medical rationale was soon threatened by a competing rationale, of a defensive rather than offensive type, whose aim was to halt the progress of epidemics and prevent them from reaching Europe. For on the one hand, plague, which had disappeared in Europe, was still so obstinately persistent in Egypt that this country was regarded as its source. Second, with the outbreak of cholera, reactivating ancestral terrors in Europe, attention also focused on Egypt since this country was a crossroads for the pilgrim traffic that brought cholera back from Mecca.

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So the Western powers imposed on Egypt a powerful epidemic control apparatus, a veritable foreign enclave which grew in size, especially after the British occupation of 1882, stifling the national health service and subjecting it to its own surveillance needs.

The invention of endemic diseases

The medical school, meanwhile, progressed far more smoothly. In the late 19th and early 20th centuries, it was able to produce an Egyptian medical elite that set about combating the medical rationale imposed by the foreigners. To do this, it used the tools of modern medicine itself, turning them around and using them against the dominant model. After the founding of the Egyptian Medical Association (EMA) in 1917, this medical elite sought to initiate original Egyptian research so as to identify the country's real health problems, undermine the legitimacy of the rationale proposed by the Europeans and replace it with a genuine public health programme.

By mobilising the entire profession, especially provincial doctors in daily contact with the pattern of illness in Egypt, the EMA's core group of doctors succeeded in outlining a proper pathological profile of the country. This showed the extent of tuberculosis, an incredibly high rate of infant mortality due to gastro-intestinal illness and, above all, endemic parasite diseases - primarily bilharzia and ankylostomiasis, diseases which, though not fatal like the epidemics, are considerably disabling.

Once these health priorities had been scientifically demonstrated, the Institute for Research into Endemic Diseases was set up. This was Egypt's first official research structure. At the medical school, the first department offering a higher diploma was opened: the Hygiene and Tropical Medicine Department. When Egypt became formally independent in 1922, it became possible to develop a health care system that adhered to the same priorities, with the creation of sanatoria, post-natal health centres and mobile clinics for treating bilharzia and ankylostomiasis.

One outcome of these efforts to tackle endemic diseases was the International Conference on Hygiene and Tropical Medicine, held in Cairo in 1928 - the first scientific event of this importance to be held in the country, with Egyptian doctors acclaimed by their Western colleagues.

Interest in endemic diseases was ephemeral, however. The programme that had been defined to combat this pathology, an essentially preventive strategy, ran up against the interests of the liberal model on which the medical profession was built. However, in the national liberation movement of the 1900 to 1930s, this issue greatly helped to establish the autonomy of Egypt's medical corps through the national institutions that had been founded, and to ensure international recognition.

Workshop

The logic and the discovery of Chagas

François DELAPORTE*

The argument has been the same since the Forties: Chagas discovered a new morbid entity because research on vector-transmitted diseases was fashionable. At the turn of the century, tropical medicine was in full expansion. The explanation as to how yellow fever and filariasis are propagated had come right on the heels of Ross' work on paludism (malaria). The discoveries of Forde, Dutton and Castellani had been confirmed by Bruce, Nabarro and Kleine. Historians underline the degree to which Chagas was familiar with these scourges. They particularly emphasise the fact that he did much to prepare Brazilian medicine through his paludism prevention campaigns. He therefore couldn't help but pin down the domestic bug causing the scourge that now bears his name.

This reconstitution is historically incorrect. Twenty or so years elapsed before the pioneering work of Manson, Laveran, Finlay, Evans and Bruce bore fruit. It wouldn't be untrue to say that the dominant line of the time was the (classic) one according to which a pathogenic parasite presupposes a vector and a final host. But it would be wrong to believe that pinpointing one of the links is enough for all the others to fall into place so naturally. Rather than putting forward a paradigm of tropical medicine, the obstacles encountered in the elucidation of the genetic cycles of pathogenic (or otherwise) parasites should be underlined instead.

As far as American trypanosomiasis is concerned, it so happens that the first line of research that Chagas followed was foreign to the medical field. This is a very important point: at the time, research on flagellates was one of the aspects of knowledge about trypanosomes which mobilised parasitologists' interest. The magnitude of a field of exploration which sometimes wove links with pathology, must be stressed. On the one hand, flagellates can be the etiological agents of diseases in domestic animals: on the other, wild animals harbouring flagellates can serve as a reservoir of parasites causing disease in humans.

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For all that, it was natural history that focused attention on the trypanosome when it was still unkown to pathologists. Valentin discovered the first blood flagellate in the blood of a trout in 1841. The following year, Gruby, studying the frog flagellate, gave it the name, trypanosome. In 1878, Lewis discovered the rat trypanosome. From there, these parasites went on to enter the fields of animal and then human pathology. In 1880, Evans brought to light the parasite causing sickness in horses; in 1894, Bruce discovered Nagana trypanosome and showed how it was transmitted by the tsetse fly. These diseases constituted an obstacle to colonial expansion: the harvests, work, transport and armies were largely reliant on domestic animals.

Furthermore, these discoveries in animal pathology were the starting point for research that laid etiological blame for sleeping sickness on trypnosomes. In 1902, Ford and Dutton found some parasites in a patient's blood. In 1903, Castellani discovered the T. gambiense in a patient. These efforts were confirmed by Brumpt in Brazzaville (Congo) and by Bruce and Nabarro in Uganda. The history of sleeping sickness would clearly be unintelligible without an awareness of its links with the clinical and epidemiological studies of the Surra or Nagana and then, with their own historical contingencies.

A history of sleeping sickness should certainly turn on this chain of successions and framework of relations. In this respect, we shall see that Chagas' work stands apart from English work on sleeping sickness, in that he found his unexpected point of departure in an observation of no apparent practical interest, and it led him to his discovery of the disease that now bears his name.

Workshop

The system of epidemiological control in the USSR and its role in controlling infectious diseases

Elena IZMAÏLOVA*

The Russian control of infectious diseases owes more to destruction of the agents of propagation rather than to therapy. Before the October Revolution Russia had no central organisation for controlling infectious disease. However, the Zemstovos, or town councils, made uncoordinated attempts to deal with the problem. The civil war and the following years saw a decline in the epidemic environment which jeopardised Stalin's plan of industrialisation and collectivisation. In 1923, the «Republic Sanitary Organs Law» called for the creation of an extensive and centralised network of anti-epidemic organisations. By the middle 1920s, a system of sanitary and epidemiological control stations emerged.

Plague and malaria were widespread. Elimination of these two diseases was a complicated task. From 1922, the «Microbe» Institute of Saratov assumed leadership in the fight against plague. It carried on research on the agents of infection and developed integrated measures to eliminate the threat of epidemics. The Institute, and a new network of anti-plague stations, helped bring about a four-fold decrease in the incidence of plague between 1924 and 1927. After 1928 only a few localised cases of plague were reported. From 1933 to 1941, the authorities conducted extermination campaigns against rodents in the Caucasus Mountains and around the Caspian Sea, and soon cases of human plague disappeared. Beginning in 1950, the stations adopted the additional tasks of the prevention of tularemia, cholera, and brucellosis.

Malaria was the most common infectious disease and occurred over eighty percent of the area of the Russian Empire. The Institute of Malaria and Parasitic Diseases was founded in Moscow in 1920, and seven similar institutes arose in the 1920s. A network of anti-malaria stations expanded from just eight stations in 1921 to 1,236 in 1940. Campaigns against mosquito larvae were conducted, and the Soviets created therapeutic agents similar to quinine.

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By the early 1930s all means were at hand to eliminate malaria. But disease incidence rose due to famines in the Ukraine and Central Russia which occurred during collectivisation. The massive migrations to Central Asia which resulted placed new populations in the region of greatest malaria risk. In 1953 workers at the Moscow Institute of Malaria developed an integrated plan to combat the disease which included the insecticide treatment of reservoirs, careful accounting of and rapid response to new appearances of the disease, and preventive therapy for recovered patients. By the 1960s malaria epidemics had been «eliminated» from the entire territory of the USSR. Only rare cases of plague and malaria have been reported since the 1950s and 1960s, respectively.

Workshop

Vector extermination versus vaccination: The Rockfeller Foundation and yellow fever in Brazil, 1923-1939

Ilana LÖWY*

When the Health Division of the Rockefeller Foundation first began working in Latin America, its activities initially adhered to the 1915 «Gorgas doctrine» which centred on the eradication of a certain number of tropical diseases like ancylostomiasis or yellow fever. Apart from its immediate effects, this eradication would, in the minds of the Foundation's directors, provide telling proof of the superiority of North American public health methods (the only ones that were effective as far as RF specialists were concerned) and facilitate their spread in Latin America. In 1923, the RF settled an agreement with the Brazilian government making it responsible for wiping out yellow fever in a number of northern districts of Brazil. Between 1923 and 1928, the RF based its activities in Brazil on the «key focus theory», according to which eliminating yellow fever in the towns would automatically bring about its disappearance from small villages and rural areas. Despite its near radical elimination in the main towns of the north of the country (particularly the coastal ports), some pockets of yellow fever still remained.

The final blow to the «key focus theory» came when a major epidemic broke out in Rio de Janeiro in the spring of 1928, and was only brought under control in summer, 1929. It showed without a shadow of a doubt that eliminating the disease in the Atlantic coast towns (Rio de Janeiro had been spared since Oswaldo Cruz's great health campaign of 1903-1906) hadn't succeeded in putting an end to the persistance of small peripheral pockets powerful enough to recontaminate the towns. Following the 1928-29 epidemic, and the failure of the Brazilian health authorities to quickly get to grips with it, the RF managed to gain exclusive responsibility in the fight against yellow fever, firstly in all of northern Brazil (1929) and then, in the aftermath Getulio Vargas' coup d'état (1932) throughout the whole of the country. Under the full leadership and control of the RF, the battle against yellow fever was largely financed by the Brazilian government.

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Between 1929 and 1939, the Brazilian branch of the International Health Division led a systematic campaign to wipe out yellow fever in Brazil. During this period, Foundation specialists who had worked in the country (and had, in many cases, spent a good part of their professional lives in Latin America) developed numerous and intricate joint efforts involving RF management, Brazilian doctors (including the renowned tropical medicine specialists of the Oswaldo Cruz Institute in Rio de Janeiro), the country's public authorities, Brazilian general practitioners and finally, the local population. They introduced a certain number of innovations, such as viscerectomy (the systematic study of sections taken from the livers of people who had died of suspect «fevers», in order to detect the histological signs of yellow fever and thus signal recently occurring cases) and the diffusion of the «mouse test» (a test that can indicate the presence of yellow fever antibodies and thereby reveal the former sources of infection). They described "sylvan yellow fever", a new epidemiological form transmitted by other vectors than the *Aedes aegypti* mosquito, the only one known of at the time. They set up a unit to exterminate the *Aedes* mosquitoes which were responsible for spreading the disease in populated areas. Finally, from 1937 on, RF specialists introduced the yellow fever vaccine in Brazil, organised mass vaccination campaigns and established local vaccine production.

In 1940, the Brazilian government took over a share of the responsibility in the fight against yellow fever from the RF - with the exception of vaccine production and distribution. The RF management later presented the Brazilian case as an exemplary success story in its health policy, since it had combined the eradication of a dangerous contagious disease with the successful transfer of knowledge from North American specialists to a local team. Two contradicting versions were put forward to explain the unquestionable success of the RF programme. In the official story of the «victory over yellow fever in Brazil», the RF Health Division managers (working at its New York headquarters) accentuated the role of laboratory discoveries (virus culture, study of anti-yellow fever antibodies, "mouse test") and their results - the discovery of the sylvan form of the disease and then the development of the vaccine. According to RF chiefs, the detection of «sylvan yellow fever» proved that the disease couldn't possibly be wiped out completely: the vaccine had come just in time to promote the only effective action in the face of an endemic disease - individual protection.

Fred Soper, the RF branch manager in Brazil (and the man who «discovered» sylvan yellow fever) saw things in quite a different light. In a long letter addressed to the RF management in 1941, he contested the official version broadcast by the Foundation. For him, it was above all else the efficiency of the local *Aedes aegypti* mosquito extermination unit that had enabled the control of yellow fever in Brazil. Rather than the virus culture, the antibody studies, the description of the "sylvan" form of transmission and even the production of an effective vaccine, the biggest breakthrough of this battle came when the initial strategy which strove to restrict the numbers of *Aedes* mosquitoes, was replaced by a second strategy aiming at their total annihilation in whole areas of Brazil (the «zero index» policy). When yellow fever could no longer propogate in urban and semi-urban areas, continued isolated cases of "sylvan yellow fever" ceased being a public health threat, even before the vaccine had been developed. This contradiction - between the RF head office's (much hyped) stance giving pride of place to in vitro research, and the viewpoint (concealed within the RF) of on-the-ground specialists spotlighting the efficiency of the vector extermination organisation, the systematic introduction of simple health measures and the importance of minor technical innovations - reflects the antagonism existing between two approaches in the fight against tropical diseases.

Workshop

One colony's contribution to the emergence of tropical medicine: French Indochina, 1860-1939

Laurence MONNAIS*

If the colonial period is presently regarded as having been a factor for progress in a number of sectors, very little is known its about its contribution to progress in the field of health is the case of the former French Indochina.

And yet the imperialist experience played a very significant part in the emergence of a new, scientific medical specialisation: hygiene and public health. Indeed, looking at the history of french public health measures in Indochina is one way to discover more about the origins of tropical medicine.

Building up a health system in a Far Eastern country depended on a combination of two factors: colonization, and the scientific progress that was occurring so rapidly in the 19th Century. These twin factors heralded the period of the new ideology of hygiene. Assisted by French colonial ambitions (the famous «political, economic and humanitarian» objectives) which, from the beginning, considered him a faithful and efficient servant, the practitioner was free to indulge his taste for experiment. To further French imperialist objectives as rapidly as possible, colonial doctors were allowed to apply the recent European scientific discoveries, symbolised by what was later to be called the Pasteurian revolution. Once the country had been «pacified», experimental medicine could be promoted. The colonial administration of the Third Republic offered the medical corps research structures, legitimated its ventures and, around the turn of the century, developed a veritable health *policy*.

The implementation of this policy was chaotic. It could not be otherwise: the first measures introduced were assimilationist and made no attempt at adaptation to a tropical environment. But the reticence of many administrators in the face of the expenses involved, the reticence of some doctors who did not want to make their careers in the colonies, and the mistrust of local people, paradoxically opened the door to a more rational adaptation of Pasteurian methods. Personalised health care and prevention joined forces to combat the

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plagues of Indochina (eg. devastating epidemics, a flagrant lack of hygienic education among the population). Doctors, nurses and midwives, french and indochinese alike, became hygienists; Sino-Vietnamese medicine was even officially solicited to back up «tropical medicine» practices that were not yet up to scratch.

This colonial medicine, which matured as mass, preventive, educational medicine, looks like tangible proof (even if, all in all, its effectiveness was limited) that Indochina was a vast laboratory, scene of many discoveries and much progress. This colonized environment gave France the means not only to apply discoveries made at home but also to acquire a better understanding of the tropical and Asian environment.

Tropical medicine was born of colonial medicine and this parenthood proves that the modernization of the french homeland was partly a result of the colonization process. In Indochina tropical medicine abandoned its allegiance to imperialism; in France it transformed itself by acquiring the status of a specialization; then invested with a more disinterested mission.it «reconquered» the tropical environment. This marked the start of the great period of «humanitarian» medicine that spread with the emergence of what came to be called the Third World.

The earliest french public health operations in Indochina, obeying purely imperialist objectives that did it more harm than good, ultimately produced only mediocre results. But tropical medicine was able to draw fruitful conclusions from the administrative failure, break free of coercive colonial tendencies, take proper account of the country's environmental and behavioral particularities and retain only its central purpose, that of maintaining the health of the population, popularizing basic notions of hygiene and applying appropriate preventive measures.

Workshop

The unstable paradigm of tropical medicine

Anne-Marie MOULIN*

The development of tropical medicine from the end of the 19th century to the present day has been beset by numerous upheavals, and its scientific and political connotations remain ambiguous, its paradigm still unstable. The very term «tropical medicine», with all its historical weight, calls for a whole commentary.

Scientific ambiguity. Tropical medicine was first organised around afflictions transmitted by vectors that could be identified in the tropical microcosm, the chief example still being malaria. It set out to reconstruct a cycle, associating developments and complex transformations in nature. In a certain number of countries, including France, tropical medicine pronounced itself *Pasteurian*, whereas the *Pasteurian* agenda had specifically been to simplify and reduce the many «environmental» hygiene concerns to tracking down the pathological bacterial agent for isolation, culture and attenuation (vaccine). Pledging allegiance to medicine on the grounds of strategy and prestige, research in tropical medicine actually developed along another scientific plane which needs to be identified, where the preoccupations of naturalists met those of stockbreeders and farmers.

Closer to the concerns of veterinarians and naturalists, tropical medicine is basically not very «medical». Human parasites represent a tiny and, when all is said and done, a rather abnormal sample of the swarms of parasites found teeming in all the species of the earth. A parasite like the toxoplasma, whose seriousness is well-known in AIDS sufferers, is so ubiquitous that it thrives in humans, cetaceans and birds alike. The recent discovery that previously obscure animal parasites (Microsporidia, Cryptosporidia) are pathogenic to man, has revived our sense of being surrounded by an immense unkown.

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I shall trace the unstable dynamics of this tropical medicine paradigm through the historic efforts of Charles Nicolle (1902-1936), who sought to modify the research profile of the Institut Pasteur in Paris from his base in Tunis, and replace the *Pasteurian* working model with a richer paradigm; from this, I shall also strive to draw some conclusions with regard to the current position of tropical medicine within the health sciences as a whole.

Workshop

The interplay of paradigms in tropical sSoil sciences

Yvon CHATELIN

Tropical soil science constitutes just one narrow field in the group of earth sciences which are, in turn, only a small part of Science as a whole. We introduce a further restriction here by opting to study the soil science practised by French scientists in the intertropical world. Although this is a limited field of science, we nonetheless want to show that its interplay of competition and conflicts between various paradigms is comparable to those generally described by science historians on a much larger scale, or on scientific matters with greater epistemological, if not philosophical reach than in the case of soil science.

Birth of a discipline and a dominant paradigm

The distinctive feature of tropical soil science is that it claims a precise historical point of departure, marked by the 1807 definition of «laterites» by a certain Buchanan in India. Despite its extraordinary success, Buchanan's publication wasn't enough to found a new discipline. True soil science, as a world recognised and practised science, was created in Russia in the 1860's by V.V. Dokuchaev.

In one fell swoop, Dokuchaev, a geologist by training, though primarily inspired by biological sciences and their notions of laws and taxonomy, conceived a grandiose conceptual framework based on the «zonal laws», with a place for every single soil in the world. So it can be said that tropical soils were classified before they were even seriously described.

Dokuchaev had created a paradigm of rare power, and it rapidly established itself. It had all the virtues of the ideal paradigm. It was globalising (capable of representing the whole field of reality) and exclusive (offering a «natural» classification with nothing that could logically be said against it). It did not rule out sector-based research. Quite the contrary. Its aim was simply to assimilate it and relocate the results.

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FROM THE NATURAL SCIENCES TO THE ENVIRONMENTAL SCIENCES

A paradigm in a state of crisis

The paradigm in fact bore within it the seeds of its own destruction. In particular, the situation in the African intertropical field rapidly became confused. French, Belgian, Portuguese and South African pedologists confronted with palpably different natural environments with varied scientific traditions, developed their own classification schemes. The problems of coordination between classifications became intrusive and difficult to solve, despite the efforts of inter-African committees (CCTA/CSA, J. D'HOORE 1954). Discussions within a single school became a permanent feature.

Sector-based thematic studies were developed and made autonomous at the same time. The researchers engaged in these studies soon maintained that the classification systems (and their correlative dominance of cartography work) were obstructing the advance of knowledge. Personal rivalries modelled themselves on the scientific debate.

The supporters of soil classification put up a resistance, chiefly arguing the need for a system to enable both acquired scientific knowledge and the agricultural results yielded by any given type of soil, to be transposed from region to more or less far-off region. The «classification, mapping, development» paradigm can nonetheless be considered condemned by the end of the Sixties, as a dominating force, at least.

New paradigms that are fighting or ignoring one another

The subsequent period was characterised by an increase in the number of outstanding scientific approaches, thematics, teams and personalities. Does this mean that a new paradigm was setting itself up in the flowering of discoveries and new data? In our opinion, it was more a matter of a series of paradigms (or micro-paradigms) trying to get themselves established. Each micro-paradigm put forward an ontology and a language, which ought to be enough to define a paradigm in contrast to what only constitutes a scientific theme, approach or even school. We shall distinguish four of the main ones.: the first is the *«soil defined as an element of the ecosystem»* paradigm; the second is that of *«soil defined as a biogeodynamic system»*; the third lies on the fringes of pedology and geology and is described as the paradigm of *«soil considered as a geochemical residue»*; and finally, the fourth paradigm is rooted in a structuralist approach to soils and landscapes. J.F. Richard introduced it thus: *«soil as a geon body»*, the geon being the elementary structure of the natural environment.

FROM THE NATURAL SCIENCES TO THE ENVIRONMENTAL SCIENCES

General discussion

To begin with, one must ask oneself whether what we have just described might not correspond to a logical, somewhat inescapable development, which has ensured the passage from what could be called «natural sciences» (corresponding, in pedology, to the classification paradigm) to what will henceforth be called «environmental sciences», for example.

Let's also notice the short lifespan of the paradigms (or micro-paradigms). In soil science, some fifteen years are enough for a leading paradigm to take root, develop and collapse. As for the paradigms that come into conflict in the aftermath, each has its own clientele and zones of influence, but it is impossible to say under which form each of them could endure, change shape or disappear.

We thus come to wonder about the necessity and contingency of scientific consensus. One view of the history of science that certainly must be pointed out, allows us to imagine that the paradigms and the general consensus they achieve have an increasingly short lifespan, partly due to new social forms of scientific work.

And we must also ask ourselves whether the dialectics of the consensus and rupture aren't established following different methods in varied areas of science. Considering natural environmental sciences and agricultural sciences (oriented towards the exploitation of natural environments), L. Busch and Y. Chatelin (unpublished) suggest differentiating those of a fundamentally discursive nature from those that are mainly instrumental. Soil science would fall into the former category because it implements many conceptual theoretical structures: process of genesis, laws of spatial distribution, complex chronological reconstitutions. Consensus is difficult to obtain in such a domain, and the paradigms tend to fragment. Even in their current developments, predominantly instrumental sciences would be far closer to the experimental sciences, as previously defined in the past. Here, consensus is imposed through the approval of a successful and reproducible experiment (today, for example, the in vitro creation of a new living organism in the field of genetic engineering).

It remains for us to ask ourselves whether the rapid fragmentation of paradigms (above all in discursive sciences), and scientific competition and conflicts are as necessary (or acceptable) for the scientific communities in developing countries, as for those of Western countries.

Workshop

Tropical field ecology and conservation initiatives on the Osa Peninsula (Costa Rica)

Catherine A. CHRISTEN*

This paper explores the establishment and eleven year operation of the Rincon field station on Costa Rica's Osa Peninsula. It aims to consider both the role of Rincon station in the general context of the development of tropical ecology and conservation biology, and cultural and political concerns, including sovereignty issues, surrounding foreign scientists efforts to utilize and protect field research sites in tropical developing nations. Rincon field station's history is a case study in attempts to reconcile the considerations of ecologists and conservationists with initiatives of agrarian reform and business development within one tropical developing nation.

Rincon station was established in 1962 by the then newly founded Tropical Science Center (TSC), a consortium of San Jose-based but United States-trained tropical forestry and conservation consultants. The rustic field station was built on the property of the timber company Osa Productos Forestales (OPF) at the behest of OPF manager Alvin Wright. Having arrived on the Osa in late 1961, soon after OPF was incorporated, tropical forester Wright intended to establish a sustainable long-term forestry industry based upon harvesting the Peninsula's extensive and fast-growing tropical wet hardwood forests on a forty-year rotation cycle. Wright was frustrated in his development ambition by opposition from untitled farmers and leftist politicians who challenged the company's land title and promoted allocation of the company's land to agrarian reform. He was also thwarted by the lack of permits to allow construction of a plywood plant and modern dock necessary to a profitable operation.

In the meantime, with Wright and the settlers at a standoff, for eleven years Rincon station's primary forest location gave researchers and graduate students access to sites for long-term research and training in tropical biology, with emphasis on population and evolutionary ecology. Most of this training was carried out under the auspices of the Organization for Tropical Studies (OTS), a United States-Costa Rican educational consortium, with the majority of trainees coming from North America.

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By the early 1970s, grave threats to the integrity of the Osa forests' ecosystems were being posed by invasions of untitled farmers and by radical changes in the timber company's own development plans. In response, many of the scientists and students associated with Rincon station assumed roles as advocates for establishment of a private reserve or national park to protect some part of the Osa Peninsula. Debate and negotiation among the conservationists gradually led to a central focus on protection of the remarkably diverse ecosystems of a watershed area they designated the «Corcovado basin,» in the Osa's northwestern sector. This goal was consistent with prevailing ecological ideas regarding habitat, island biogeography, etc.

By the time new OPF management forced Rincon field station to shut down in 1973, activist scientists were joined with Costa Rican government functionaries and representatives of national and international conservation organizations in a campaign to create a national park or scientific reserve in the Corcovado basin. Although this goal was not accomplished until the more favorable political climate of 1974-1975, the ability of the conservationist community to act quickly at that time was predicated on their already having reached this ecologically-based concensus, as well as having conducted the equivalent of today's «rapid ecological assessments» and having determined certain political imperatives, including the necessity for the project to be a predominantly Costa Rican initiative, subsuming, at least for public consumption, the tremendous amount of foreign input that actually went into the Osa conservation effort.

The paper is based almost exclusively on primary documents, including extensive correspondence and reports of OPF employees, scientists associated with Rincon station, other conservationists, and functionaries of the Costa Rican National Park Service. To discuss the role of the Rincon station in a wider ecological context it looks at general literature on tropical ecology. It also relies on the minutes of Legislative Assembly hearings conducted to investigate land use practices of OPF and provide a forum for leftist politicians. Newspaper clippings, government reports, oral history interviews and field visits all supplement the main material.

Workshop

Biogeography: A single model or a common history

Jean-Marc DROUIN*

Biogeography is the science of the distribution of living things around the globe; by definition, then, it cannot be restricted to the Western world. This statement of the obvious nonetheless raises problems: what exactly is the relationship of biogeography to the non-Western world?

At the turn of the 18th-19th centuries, botanical and zoological geography were launched in the wake of European expansion. An article by Janet Browne (1992) has illustrated this point for Britain in the 19th Century. By its origins and its subsequent development, therefore, biogeography may seem to be a significant example of colonial science.

Moreover, the strongest sign of colonial control of a region is not so much a knowledge of its fauna and flora as their transformation. As recently shown by Michael Osborne (1982), Christophe Bonnéuil (1993) and Mina Kleiche (1993), the preoccupations of the administration in the French colonial empire lay primarily on the transformation side. Alfred Crosby (1986) has shown how exporting a part of the fauna and flora of the Old World to other continents made it possible for European populations to settle there permanently. But there was just as important a flow in the other direction, or even from one colony to another. All these transfers of species from one region to another provided biogeography with something like a series of experiments.

Biogeography was only able to develop thanks to the continual flow of people between Europe and the other continents, which wove an informal network of collections, observations and comparisons all around the world. This network was really not open to non-Western participation, but it lent itself to the idea of universal knowledge that can be shared by all and so break free of the bounds of its particular place of origin.

This question of universality is differently posed by different currents within biogeography. From its origins to today, there have been two main strands in biogeography research, one being the study of relations between living things

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and their environments, the other setting out to define the distribution range of different species, genera, families etc. (cf. Alexandre de Humboldt, 1805, Augustin-Pyramus de Candolle, 1820).

The first strand, which broke away around 1900, more or less merges with ecology. Its development over the years has been dominated by the construction, identification and study of ecological units, each constituting a different level of integration: plant community, biocenose, ecosystem, landscape, etc. Alongside this, the ecology of populations has been much influenced by the theory of equilibrium in island populations, developed by MacArthur and Wilson (1963). According to this theory, one can determine the number of species present from the size of the island and its distance from the continent. This is considered to apply equally to an off-shore island, a lake, a clearing or a copse. Insularity is thus seen as a universal phenomenon. From the epistemological standpoint, it is an attempt to go beyond purely empirical, naturalistic description and make ecological biogeography a predictive science like physics, capable of producing models. In this respect, the fact that this theory was developed from data on the Pacific islands and has been just as usefully applied in Scandinavia shows that it has a universality comparable to that of the laws of physics.

In any case, such a model cannot explain why such and such a species is found in one part of the world and not in another. This is a different research field, now called historical biogeography, and is a different kind of science - narrative and explanatory rather than model-building and predictive. It seems a more archaic field, closer to natural history, but it involves as much theoretical debate as the ecological strand and is connected with some extremely fertile research areas. We know how important the problem of the geographical distribution of species was for the arguments of Darwin and Wallace and, later, for Wegener. Today, adherents of cladistics like Gareth Nelson try to support their theses with Léon Croizat's panbiogeography (Croizat, 1964) and his theory of vicariance. Croizat criticises the concept of a North-South spread of fauna and flora. Nelson (1978) takes up this criticism on his own behalf and gives it, by analogy, a political significance. Ought one to see a connection between Croizat's position and the fact that he works in Venezuela, a country of the South? What about the position of Jan Cristian Smuts (1950) on the flora of South Africa? Nonetheless, historical biogeography certainly makes flora and fauna inventories of every country in the world crucially important for any reconstitution of the common history of living things.

The search for the ideal of a single, predictive, repeatable model is rather like looking for the pattern on a piece of wallpaper; historical biogeography, on the other hand, is more like putting a jigsaw puzzle together. But both strands of biogeography are at the same time Western and universal, either because the law identified in one place proves applicable everywhere, or because parts of the story being reconstructed are to be found in many different places.

Workshop

Five centuries of conflict over water in the Ecuadorian Andes: The founding of networks and water-sharing in Urcuqui

Thierry RUF*

Beginning with a precise description of the hydro-agricultural infrastructures of the village of Urcuqui in the northern Ecuadorian Andes, research on the current working order of irrigation shows that water resource-sharing rules are sometimes very old, and are often called into question by some of those involved in water management. The water lawsuits enable us to understand the various stages in the process of mountain-side development in liaison with the socio-economic organisation and land policy.

The digging of canal networks and transforming of landscapes can be seen as being due to conservationist forces that control access to already mobilised resources, and works-generating innovatory forces, often acting in a private capacity or sometimes in association with other social groups. Economically consolidated from the 18th Century on, the haciendas replaced the crisis ridden Indian communities in determining to whom the as yet untapped hydraulic resources belonged. If they disturbed the working of the older networks, however, they could face prosecution.

Since the first Indian canals were dug in the 16th Century, native chiefs (the caciques) were progressively stripped of their hydraulic power with the transferral of water rights to mixed race and Spanish landowners. Often a subject of conflict, those rights could also change hands due to interbreeding between Indian society and the Spanish settlers.

The peasants rallied repeatedly throughout the history of the village and, in the 20th Century, finally managed to regain control over the cacique's big canal, and established a new distribution system run on cooperative lines rather than under the rule of the caciques.

The water tower rules adopted in 1945 have been more or less openly transgressed. Today, the village network isn't enough to meet the current needs of the intensive agriculture that a new generation of peasants are keen to develop.

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Main argument

Confrontation between the Spanish colonial system and Indian autochtonous society in Ecuador was first conveyed as the authorities -the caciques and the new inhabitants- clashed over natural resources, land and water. To begin with, the Indians fell in line with Spanish political and legal order and, with the support of missionaries, founded the first big irrigation networks. After a few decades, the confrontation turned to their disadvantage due to the political and economic strategies of those gaining from the redistribution of landownership: i.e. the Spanish, though also some mixed-race people, heirs to the Indian caciques.

Five centuries of hydraulic history have seen systematic conflict between: the hacienda production systems, based on sugar cane irrigated on the hot, subtropical level; extensive livestock farming on the cooler natural prairies; and the peasant community production systems, based on cotton irrigated on the hot subtropical level, Indian rain corn on the temperate level and potatoes on the cold level.

Data source

The information comes from current knowledge about all of this region's irrigation networks, and from the systematic analysis of the water lawsuits -85 for the area around Urcuqui alone- from the 16th Century to the present day.

Workshop

From natural history to history of nature. Reconstructing the environmental history of colonial India

Satpal SANGWAN*

Setting out his agenda for writing the environmental history of the Americas Donald Worster has come out with a three-tier model involving (i) understanding of nature itself, (ii) contextualisation of the modes of resource use, and (iii) the representation of mental or intellectual metaphores. Worster's model has found expression in the writings of environmental historians of India, albeit only in a truncated form. A close scrutiny of Indian scholarship will confirm a definite bias towards the «misadventure» of the capitalist mode of resource use, an «alleged genocide of virgin environment» by the colonials. One explanation for this imbalance could be that serious work on the theme has come from the pen of economic historians well-versed with the pitfalls of political economy. Another possible reason could be that scholarship has been conditioned by «concern for environmental quality». The whole agenda appears to be emotional rather than scientific. Even the finest ecologists seem to have been carried away by its political appeal.

There are, however, some serious flaws and some lapses. In the first instance, the new land was never virgin, not even in the Americas. A few environmental historians have realised this as they locate the depth of environmental degradation and the complexity of human ecology which pre-dates the colonial expansion (W. Cronon, T. Silver, Romila Thapar and M. Gadgil). There is a growing understanding that the pre-colonial and post-colonial States were no less responsible for altering the face of earth. Richard Grove informs us, for a change, that resource management model on the colonial peripheries including India was much more scientific and sustainable, thanks mainly to the naturalists-turned-foresters. Employment flexibility is the core of his axial model of conservation programmes on the periphery involving Mauritius, Ceylon, India, Cape Town and St. Helena.

Secondly, it is not only the human immigrants with their sophisticated technologies who have affected the «new land environment». We need to take into account the imbalance created by incoming species. Alfred Crosby looks

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at American landscape from this standpoint in *Ecological Imperialism*. Generally speaking the debate on plant transfer within British colonial possessions has run into a political debate involving ethical and patent related issues (Lucile Brockway). This has invited others to insist on its humanitarian dimension (R. Desmond, R. Grove). There is a need to extend Crosby's thesis to the easter landscape.

There are a few vital sectors yet to be adopted by environmental historians. Theory of ecology, as it came to be known among and practised by colonial naturalists in India is one vital part which has not been dealt with. «Misadventure» of thecolonial resource management model notwithstanding, I believe reference to such thinking is going to dominate the debate concerning the environmental history of India. An important dimension which one can not fail to notice is almost a parallel ecological thinking among the naturalists travelling over the Indian landscape (J.F. Royle, W. Jacquemont, J.D. Hooker). To get into this debate one needs to readdress the discipline called natural history as it graduated from a simple data gathering activity to taxonomic explanations and thence to an understanding of the «functional interrelation between all the individual phenomena of the earth's surface». Unless we do that colonial science will continue to be looked down upon as a *patchy shadow* of metropolitan thinking.

Taking stock of the current level of research on the environmental history of India the paper is addressed to the «peripheral» roots of an ideology which is commonly known to be represented by A. von Humboldt, Henry David Thoreau, and Father Schouw. In short it contextualises the ecological ideas propounded by men cut-off from the mainstream.

A word about my sources. The main argument of the paper is built around the real professionals who came to serve the colonial state in different capacities viz., medical service, surveys, scientific institutions, museums, and botanic gardens. I strongly feel that social historians of «colonial» science have not addressed the writing, reports (on medical topography, for instance), correspondence, diaries etc of these professionals from an ecological perspective. The paper makes use of both conventional (published material) and non-conventional (personal correspondence) sources.

Workshop

The development of ideas concerning the «South» in 20th Century anthropology

Maurice BLOCH*

The academic subjects designated by the word «anthropology» and by the associated terms «social anthropology», «cultural anthropology», «ethnology» and «ethnography» do not have strict definitions and for this reason, among others, the same word is often used to designate quite different intellectual traditions and fields of study. Such diversity makes talking about anthropological topics difficult and occasions very serious misunderstandings. Also, the subjects I have listed have had a great importance in moulding the «North's» understanding of the «South» and even the «South's» own understanding of itself.

As constituted in the wake of Darwin's *Origin of Species* (1859), anthropology assumed the study of the history of mankind through four «fields»: physical anthropology, prehistory, the history of human languages, and cultural and social anthropology. But the «four fields» structure of anthropological research, based as it was on an evolutionary model, fell victim to attacks from religiously motivated diffusionists around the turn of the century. These diffusionists saw the Holy Land as the font of absolutely all matters regarding humans, and they sought to explain the rich cultural diversity of humankind by means of events and structures mentioned in the Bible. As a result, the four fields separated except, most notably, in North America. The ethnology of Francophone countries (cultural and social anthropology in England), now cut loose from the evolutionary paradigm, continued with investigations of preliterate peoples and amassed a great deal of information about the peoples of the «South».

My paper will focus on the diverse constructions of anthropological discourse about the peoples of the «South». The main fact to emerge from these histories is their heterogeneity and their arbitrariness. From the early 1970s, a new tendency began to manifest itself: the internationalisation of anthropology. There was a good deal of misunderstanding as everyone thought that the others were using words in the same sense as they understood them while they were not.

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Remnants of the old regime persist, however. While the link of anthropology and colonial administration is now gone, this linkage placed the study of previously colonised peoples at the heart of anthropology and the discipline at least pays attention to the ordinary people of the «South». The colonial «bent» of anthropology survives in another guise as well. The colonial concerns have changed their discourse and are now talked of in terms of «development» and the same kind of link between anthropology and development which once existed between colonial administration and anthropology now takes on this new form. Thus, countries such as Scandinavia, whose anthropology\ethnology was until recently turned in on themselves, is now greatly concerned with the «South» because of the leading role of these countries in development.

What does all this mean for the future? In the «North» a history which has no long term legitimising trajectory has been created but it is the only one which brings into the academy a concern for the general understanding of mankind as seen through the ordinary people of the «South», their daily life, their understandings and cultural achievements as seen from below.

For the «South» the situation is different. Scholars from the south should be aware of the nature of anthropology's history, largely so that they do not feel obligated to be bound by it. The knowledge of this history shows well that in its Northem academic form the subject has little justification. They need to create in their terms a new division of the social sciences which will ultimately not resemble that of the Northern academies. Their concerns and the socio-economic conditions in which their universities exist will be different and these will dictate the forms taken by these new social sciences. However, they would be well advised to retain from other anthropologies a focus on listening to the ordinary people of their countries and interpreting what it means to see the world in their terms.

Workshop

The colonial Empire of ethnological expertise and the contemporary challenges of applied anthropology: The example of Frenchspeaking Africa

Jean-Pierre CHAUVEAU*

The imperial enterprise configured the interfaces between knowledge and administrative action at the same time.Broadly speaking, today's debates are nourished by the same configuration.

However (and it is above all this aspect of the question we wish to emphasize), the history of colonial ethnology cannot be reduced to a confrontation between the rationales of knowledge and action. The history of applied colonial ethnology shows that this issue was a relatively minor one, or rather that it was an issue that arose in connection with other challenges that structured the confrontations between actors and institutions in this sphere. The history of applied colonial ethnology can shed some light on the true issues in applied anthropology today. It can certainly help us to get beyond a mere abstract invocation of epistemological and deontological principles, to a proper consideration of the unstated (conscious or unconscious) assumptions of the actors involved: those of the anthropologists with their demand that the intervention machinery be placed in the service of development and those of the decision-makers and politicians with their ambiguous relationship to anthropology.

We shall present the findings of a survey on the relationship between colonial ethnology and administrative action, starting from the following two propositions:

Applied anthropology has not followed the path it is commonly believed to have followed

What is involved is not a new claim of scientific rigour justifying closer integration of the anthropological approach into development studies and projects, but the revival of an old argument that was once influential, and was recognised by the colonial development operators themselves before losing credit among both anthropologists and administrators.We shall concentrate on two points:

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Ethnology at first held an important place among the preoccupations of colonial «developers», but then suffered a decline. This decline prodides an interesting starting point for our investigation insofar as anthropologists today are inclined to think they have to win a place in the development machinery, fighting against a «natural» attitude of mistrust on the part of development operators. We now know that this has not always been the case.

The «division» between administrative and scientific reasoning, on which contemporary debate over the content of applied ethnology has been based, is a product of history. The colonial nature of the ethnologist and his terrain does not alter this. The administrator-ethnologists, or most of them at any rate, held an ethnological viewpoint that is altogether acceptable by today's criteria. Furthermore, it was a viewpoint that had some influence on other administrators and colonial experts. So it can be shown that, if indeed there was connivance between the establishment of colonial order and the construction of colonial ethnology, this collaboration in no way prevented administrative reasoning from employing scientific criteria.

This explains why the practical vocation of ethnology in those days should have aroused debates altogether comparable with contemporary debates over ethnological expertise. But it must be stressed that these debates, focusing on extremely practical issues to do with the practice of the science, were not debates between ethnologists on one hand and administrators on the other, but among administrators.

The history of anthropology, with its constant themes and its changes, is to be explained not in terms of epistemology but by a sociological and historical analysis of the conditions under which applied ethnology (and today anthropology) emerged and was practised.

The history of the division between scientific reasoning and administrative (or development) reasoning is only one aspect (and, in the last analysis, a secondary aspect) of the changing pattern of confrontation among agents and institutions over the issues involved in applied ethnology. To describe these changes, we take account of the configuration of the different *institutional fields* (administrative, political and scientific), the main *groups of actors* concerned (colonial administrators, academics, tropical research officers), the different *areas of skill and know-how* which these agents recognised as legitimate and usable (administrative doctrines, ethnological methods, investigation methods, systems of sanction and reward in career structures). The combination of these different registers will provide us with a better understanding of the social and symbolic positions of the different agents and their strategic behaviour (particularly in terms of mobility within one register or from one register to another).

Identifying the different periods in the history of ethnology as applied to the problems of colonial development will enable us to define the nature of the issues involved in ethnological expertise and how they have changed. With this in mind, we shall compare the colonial situation with today's.

As a *provisional conclusion*, it seems to us that the specific ambiguity of contemporary debate over anthropological competence lies not so much in what is said about the relationship between knowledge and action (all of which is hardly new), as in unstated assumptions concerning the political aspect of development operations. By «political dimension» we mean not only, and not even mainly, the political ideologies which actors or institutions associate with development operations. Rather, following Bailey and his style of political anthropology, we see the political dimension of development operations as the expression of ordinary competition between groups of actors over mobilisable resources. Viewed from this angle, it is useful to know how and under what conditions applied anthropology is at one and the same time a means of competition and the result of historical debates and compromises.

Workshop

The sociology of development and the

Jean COPANS*

Upon examining the founding paradigms of dominant themes in France (1950-1960), one notices that these paradigms evolved along two distinct lines, both contemporary and successive: the first being theoretical criticism that was both Marxist and "*dépendantiste*" (1960-1975); and the second, a more methodological and anthropological critique (1975-1990). The double disintegration of these themes -- in the international economy, on the one hand, and in the anthropo-sociology of organisations on the other (to put it in schematic terms) -- left intact the problematics of an historical sociology, as well as the conceptual elaboration applicable to development. A quick overview could confirm that the characteristics of this set of themes are for the most part rooted in the history of the French social sciences and French colonial fields, a history which acts as a revealing prism of "other" historicities. This re-evaluation was provoked more by the empirical broadening of the world of development (and the social and political situation from 1970 to 1980) than by theoretical reflection itself. The fact remains that the immediate history of development needs to find again, or rather to reconstruct, its roots from the past half century in order to save this political anthropology of the organisation of development from the same fate as the founding paradigm.

Workshop

History in tropical Africa: Research centres, people, ideas

Dmitri OURSOU*

The aim of this paper is to reflect on the formation of a modern science of history in Africa, how it began, the stages it has gone through and the role of outside influences. Tropical Africa is the last part of the world to have written its own history; henceforth, the history of humankind is at last truly general and universal. This is a very significant fact. It is also worth noting that history was the first social science to become established in this part of the world.

Historiography, although one of the scientific disciplines that emerged in Africa with ORSTOM's help, received less attention than some, as France was primarily interested in developing the continent's natural resources. However, the French State assisted both the history research bodies and the education of historians.

This paper is based on the wealth of specialist literature available in Russian, French and English, on archive material and on direct field experience, since the author has spent several years teaching at the *Ecole Normale Supérieure* in Bamako.

After a brief introduction on the above lines, the author analyses the stages in the emergence of African historiography:

• Traditional, oral history, whose representation of the past did not correspond to the critical methods and principles of Western historiography. Here, knowledge of the past served to forge collective conscience: it was a collective, conventional history;

• Pre-scientific history, a transitory phase whose evolution shows three simultaneous phenomena: institutionalisation, professionalisation and Africanisation. Then came conceptualization, i.e. the passage from an accumulation of facts to the stage of rational explanation of those facts;

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• Modern, critical, scientific history with its threefold combination of research centres, people and ideas. The research centres and the people form the material infrastructure and the ideas (mental substance) form the theoretical superstructure.

The author also addresses other issues, particularly the prime role of school history as a powerful tool in national education strategy for forging a national identity.

In the third part, the author attempts to analyse the ideas of the romantic period of African historiography, in the 1950s and 60s. Like other historiographies born under colonial domination (Irish, Czech, Indian etc.), African historiography reflected its authors' political commitment, i.e., anticolonialism, exaggerated patriotism, a heroic version of the nation's past and negation of the colonial power's positive contribution. These historians saw the notion of history as an essential «lever» in constructing a strong and prosperous nation.

With the 1970s and 80s, history writing became more objective and quality improved. Different methodological schools developed. Erudite works began to produce a positive effect on the literary output of Africa's scholars.

The author closes with the conclusion that, today, there is but one universal history with some specific regional features and different theoretical schools. The West-on-West contrast will not die out overnight, but the main trend is towards integration. The only region that is still, for the time being, beyond the beneficial influence of the West is eastern Europe. This is why cooperation must be increased between the West and the new States born from the ashes of the last world empire.

Workshop

Anthropology and power. From imperial science to the empire science

Martin VERLET

Our discussion emphasises the relations woven between anthropology and politics, which is to say, the way political powers use anthropology as an instrument; the birth of political anthropology; and the empire anthropology seems at present to impose on the other social sciences, with the possible exception of economics. More precisely, we are interested in the triple knot of the relationships, often shifting and ambiguous, between anthropology and 1) Southern societies; 2) the other social sciences; and 3) governments and politics.

We will begin with an examination of a series of paradoxes or aporias. First issue: As a scientific practice, anthropology chose to place priority on non-Western fields of study. It headed South. Despite this choice at its foundation of what is exotic and elsewhere, it hardly flourished as a scientific practice in Southern societies (with the notable exception of Latin America). It remained peripheral and suspect most of the time. In a fundamental way, its gaze was void of expression. Second issue: As a scientific discipline, anthropology first of all formed separately from the other social sciences. It initially chose to keep its distance, in particular from history and sociology. Yet by making its ambitions universal, it established itself, in competition with economics, as a primary reference. Historians, political analysts, psychoanalysts, and proponents of institutional economics today follow its winding course, whereas its borders with sociology are increasingly hazy. Anthropology was born of criticism of political relations in the West, as is clearly testified to by Maine's approach. Yet with time, anthropology has compromised itself in its relations with established powers. It has become political, in every sense of the word.

It is perhaps worthwhile to elaborate on these three points of examination.

Science for an Empire

What we would have to call the "Malinowskian Revolution" marks a major turning point. With Malinowski the Trobriand Islands and the London School of Economics, anthropology emerged as a scientific discipline; it set itself apart in the field of knowledge; it became professional in the space of two decades. Yet there would be a price to pay for this transformation. Malinowski chose to exchange the new science for an Empire. By placing the anthropologist at the service of the colonial Empire, he also opened up certain fields to him. By making the anthropologist an expert, an engineer of "the scientific administration," Malinowski paradoxically cleared the way for what would later become political anthropology.

The Empire of anthropology

Anthropology reached out to disciplines on a variety of trajectories: linguistics, history, psychoanalysis. It became a primordial reference for the other social sciences. Yet in the process of carving out for itself an Empire in the field of the social sciences, anthropology became submissive and transformed itself into an instrument used by others.

The anthropologist in the shadow of power

Establishing a territory, physical as much as intellectual, is an integral part of what the anthropologist does. The imperative need for access and extended presence in the field constantly pit the anthropologist against the powers that be. Thus he is vulnerable and threatened. Glances are exchanged between the one (the anthropologist) and the others (the societies he observes and whose gestures and words he deciphers) through the lens of institutional constraints. The anthropologist is first and foremost an intruder; he arouses suspicion. And his claims on the power of DSience further confuse his ambiguous relations with multiple powers.

Workshop

The role of museums, Science and the public in Brazil

Maria Margaret LOPES*

The 1980s brought to Brazil a commitment to enhance the importance of museums in the context of the natural and exact sciences, technology, and in the history of Science. This can be seen through the increased support for the restoration and conservation of some old exhibitions. This support can also be seen in the creation of new science centre like the *Museu de Agronomia e Ciências Afins* - MAST, in Rio de Janeiro, and in the *Estaçâo Ciência* in Sâo Paulo, or more recently in the *Casa da Ciência e Tecnologia* in Curitiba, Paranâ, in the South of Brazil. It is also evident other local and rather small museums in several cities spread in the hinterland.

Museums related to the natural sciences have been in existence in Brazil since 1818 when the so-called «Royal Museum», now known as the National Museum, opened in Rio de Janeiro. It was inspired by the *Muséum national d'histoire naturelle de Paris.* Just like museums all over the world, the most important Brazilian museums -created in the second half of 19th century- began to lose their functions as institutions fundamental to the development of research in natural history from the first decade of this century. Other laboratories and centre of research were created, and museums were left in a marginal position. Thus, while some of them went through long years of lethargy and even closed, new local museums continued to appear throughout this century in a rather sporadic way.

The 1920s and 1930s inaugurated another phase in the development of Brazilian museums. These years were marked by the creation of the National Historical Museum, other historical museums, specialised museums linked to universities, and by the beginning of the perception of the importance of the educational role of museums to cooperate with formal education. One could find in this period the origins of so-called "museumisation" of official history that persists in our museums until today. Supported by a positivist world-view, it sought to distinguish one object from hundreds of similar ones based on the historical conceptions of great personalities and "facts". We can also

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find in this period the roots of the process of museum scholarisation, still present in our museums. By scholarisation, we mean that the museums have reduced their goals as cultural communicators, and have assumed merely a complementary role to the school, following mainly the methods of formal school education.

In the 50s and 60s there was a renewed interest on the role of museums, especially Science and Technology museums following a strong influence from the United States. They were thought of as mechanisms of fundamental importance to «bridge the distance» between the general public and the rapid development of Science and Technology, assuming the responsibility towards the homogenisation and universalisation of Western culture by means of scientific popularisation thanks to their dynamic and interactive methods.

Furthermore, since the 1970's, while some areas of museology in Brazil have participated in the debates of Latin American museology, discussing the roles of such institutions in our cultural realities, science and natural history museums kept themselves apart from the perspectives of museological renewal which have better integrated some museums within the communities that harbour them.

In short, in the case of Brazilian museums, their history is one of lost meanings and changes of functions. What has prevailed as solutions to overcome this situation are rather conservative measures.

Science museums account for approximately 15 % of all museological institutions in Brazil. We have outlined, mostly from a qualitative point of view, a first general picture of their situation. Such a diagnosis, the first one of its kind, has allowed us to characterise the various kinds of museums, the collections they possess, the conditions under which they work, the publics they receive, and the social roles they have been playing.

In Brazil, as in other countries, museums of «different epochs», and those that musealie the conception of science of «different epochs», still stand side by side. The research we have been undertaking on the situation of science museums in our country demonstrates signs of significant changes. Museums have hosted national, regional, and university meetings and forums, and been the site of important experiments. This has associated museums in a critical way with our social and environmental crises and produced museographical expressions which have incorporated multi-disciplinary methodologies and historical approaches.

This process has raised some fundamental questions and the answers to these questions might depend on the reflection about the practices themselves.

Some of these reflections are concerned with the continuity of the devastation of our heritage, even within the context of official discourse of preservationist policies which in practice act against the civil rights of Brazilian society. Other issues relate to the relationship of museum versus school, exhibition as the axis of communication between the museum and the general public, and last, but not least, the role those museums reserve for their publics. Our contribution considers cognitive aspects of the relationship between Science and its public, a factor rarely taken into account in philosophical, epistemological, political and historical studies of Science.

In our societies increasingly shaped by Science and Technology, a citizen must have not only an understanding of science, but also a critical perspective of his education in order to fulfill his citizenship.

If we recall that decisions affecting science production and its dissemination -clearly associated issues- are made by a small number of people and oriented by centralised policies, the so-called diffusion of scientific ideas that museums transmit in order to cover a wider social spectrum, seems a contradiction in itself.

According to the role that one intends to share with a participating public, museums could present alternative and demythologised views of past scientific practices.

It is not the mission of museums to solve all cultural, educational, social, environmental, and development crises generated by the present model of the construction of knowledge. But maybe museums ought to transmit other ways of understanding the world. In the case of Brazil, this would mean, for instance, providing other cultural references to girls and boys, alternatives to the harsh life of the streets.

Workshop

Popularisation of Science in Kerala, India

Madangarly P. PARAMESWARAN*

The Kerala Sastra Sahitya Parishad (KSSP), literally meaning the Kerala Science Literature Association, is a people's science movement (PSM)in the tiny south western state of Kerala, India. The KSSP slogan is "People Science Movement". The KSSP is a people's movement in the sense that it recognizes the fact that Indian society is broadly divided into two groups- a large majority which is impoverished, and a small minority gaining wealth at the expense of the majority. The movement takes a partisan position along with the majority and against the minority whenever interests are in conflict. It is a science movement because it understands that science and technology-information is today a powerful weapon in the hands of the rich minority enabling them to appropriate more than a proportionate share of social production, and that the majority should be armed with this weapon in their fight against impoverishment. It is also a social movement in as much as its scope widens continuously, its actors diversify and expand continuously and its ideology gets refined continuously. Finally is also a Gyan-Vigyan movement: Gyan means wisdom, Vigyan means knowledge. It recognizes the danger of using knowledge without wisdom.

Initiated as a small group of about 40 science writers in the Malayalam language in 1962, during the past three decades the KSSP has grown into a large organization of more than sixty thousand members distributed in about two thousand branches. There is no societal activity which is, today, outside its scope -health, education, environment, developement, gender issues, art, culture- everything comes under its purview. Its members and activists come, literally, from all walks of life. Except a handful, we are all volunteers.

The KSSP is, primarily, a communication movement. It makes use of all communication media- slides, posters, video-audio cassettes etc. on the one side and massive lecture campaigns, inter personal dialogues, live theatre etc. on the other side. Its communication efforts fall under three categories : (i) Informative, (ii) Ideative and (iii) Provocative. It exposed and opposed abuse of knowledge against the interests of the majority, it proposed and counter-posed alternatives - in almost all spheres of life : in education, in health, in

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energy planning, in land and water management, in industrialization... It has been championing people's right to know, and has been strengthening peoples capacity to know.

The KSSP is a nongovernmental organization receiving no financial support from anybody for its day today functioning. Nor does it require any. It sustains itself on book publication. It is the largest science publisher in Malayalam language, The books are marketted by its activists moving from house to house, from school to school.

The KSSP helped the initiation of similar people's science movements all over India. Today there exist more than thirty such organizations spread out in every state of India. Some are small, some are large. Together they have formed an All India People's Science Network (AIPSN) which has, currently a combined membership of over two hundred thousand. AIPSN today is a nationwide movement which cannot be totally ignored.

Again, it was the KSSP that initiated the mass literacy campaigns that have spread allover India, Though all the mass campaigns for literacy undertaken anywhere in the world previously were associated with some or other revolutionary social upheaval and that eventhough no such upheaval is taking place in India, the KSSP hypothesised, that a mass movement for literacy can be consciously engendered in the country and that such a movement may in turn trigger social upheavals in other spheres. In 1988 it took up the task of making the Ernakulam district of Kerala fully literate. It did achieve this making nearly 150,000 persons literate with the help of about 20,000 volunteers. Later the entire state of Kerala was made fully literate (95%). Today in India nearly 50 million illiterates from about 250 districts have become or are becoming literate with the help of about 5 million volunteers. The PSM of India is the backbone of this programme and the KSSP is playing a leading role in this too.

The call of the epoch is democracy. Whithout democracy humanity may not be able to see through the 21 st century, In the real sense of the term there had never been any democracy in the world anywhere. It is not just freedom of expression, freedom to elect rulers, freedom to make proflt.. Each and every citizen has to creatively participate in running the affairs of the society. This is possible only if small becomes not only beautiful but also powerful.

Yesterday's technologies have made small relatively weak. Tomorrow's technologies have to reverse this. Today the KSSP is involved in a massive experiment to strengthen the capabilities of small communities, to build up a strong base of decentralised democracy. It is an exercise in economic development, but will have its repurcussions in the political sphere too.

The three decade long history of the KSSP, thus, is the history of the experiences of a movement which leams continuously, which is not handicapped by a mechanical understanding of the past, the present or the future.

Workshop

Crisis and avoidance: Development studies and Science policy for Development

Antonio BOTELHO*

Over the past two decades the discourse of post-colonial Science and Technology policy went through several shocks. The global economic crises of the seventies were followed in the eighties by a rapid globalisation of the international economy and by an ambiguous redefinition of power blocks with the end of the Cold War. More important for Science and Technology policy thinking, was the seemingly inexorable advancement of a neo-liberal ideology that challenged the epistemological and moral assumptions of post-war developmentalist ideology.

The modernistic premisses of post colonial North-South scientific and technological relations were deeply shaken. Further, international organizations and national foreign assistance institutions for Science and Technology failed to deliver the promised golden eggs of progress to large segments of the developing world.

Paradoxically, while the broader field of development studies, at least its political economy and economics components, vigorously challenged the ideological attacks on its conceptual foundations, and came out of the battle rejuvenated and with a fresh vision more in tune with the political constraints and socio-economic realities of the 1990s, the discourse of science policy for Development has remained trapped in an outdated modernistic framework, imprisioned between a technocratic worldview and a revived and mainly platonic image of local Science and Technology.

In light of the above, this paper aims to provide a synthesis of the epistemological evolution of development studies discourse and contrasts it to the discourse trajectory of its sub-field of Science and Technology policy for Development. It briefly reviews the neo-liberal challenge to development studies and its reply, stressing those components which can help us formulate a post-modernist synthesis of Science and Technology policy. Next, it examines a sample of policy documents emanating from both international organizations

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and national science development institutions in the North in order to identify cognitive blockage points as well as possible building blocks for a new framework for guiding the dynamics of Science and Technology in North-South relations. Finally, it suggests that a post-modernist international Science and Technology policy discourse should be sensitive both to the increased global interpenetration of national economies and research networks and to local power relations and strategic objectives, social and political. More importantly, local and international post-colonial for bureaucratic organizations Science and Technology policy must be made more aware and actively responsive to diverse emergent new forms and relations of Science and Technology development rather than pursuit of an elusive mimetic reproduction of developed nation organizations and relations.

Workshop

Is modern Science an ethnoscience? Rethinking an epistemology for North/South science studies

Sandra HARDING*

«Ethnoscience» is an odd word to use to describe modern sciences, to understate the point, but using it can direct our attention to Eurocentric aspects of Western/Northern epistemologies and other theories of scientific knowledge. Recent «post-colonial science studies», ones that develop further what we could refer to as «the Needham question», provide a refreshing and more objective perspective on the specifically Northern cultural features of modern sciences. They enable us to see how the universal Science vs. local ethnosciences dichotomy is part of a conceptual complex that enables the systematic construction of limits to critical though-in other words, of systematic Eurocentric ignorance. The challenge, as I see it, is to understand how Northern Science is in some respect universal Science and also perhaps even because it is culturally local.

The universal science view contains important insights, but it also incorporates assumptions that are probably false and, at any rate, not supported by evidence. For example, it assumes that no other Sciences could generate the laws of gravity or antibiotics ; that modern science does not also work for producing human and natural disasters; that what has worked best to advance the North will also work best to advance other societies; that modern sciences are the best ones to discover all of the laws of nature; that the kinds of projects for which modern sciences have worked best in the past are the ones at which any possible sciences past, present and future should want to succeed. The important insights of the conventional view are more reasonably explained in ways that give up these assumptions and locate modern sciences on the more accurate historical maps produced by the post-colonial science accounts.

Why have the sciences of the North flourished ? The conventional answers to this question discuss the internal logic of modern science. However, a different kind of cause, overlooked in most standard Northern histories, philosophies and sociologies of science (including most of the last thirty years of post-kuhnian science studies) is that modern sciences focused on describing and explaining just those aspects of nature's regularities that have permitted the privileged groups in the North to multiply and thrive, especially through

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the prospering of their military, imperial and otherwise expansionist projects. This is not so rare or radical a claim as it may first appear; recently, this kind of perception has begun to appear just below the fully conscious surface of even popular histories in the North. For example, many museum exhibits and books associated with the 1992 quincentennial commemoration of the Columbian encounter drew attention, intentionally or not, to the numerous ways that European expansion in the Americas advanced European navigational sciences, geography, cartography, botany, agricultural sciences, etc. In effect, the world became a laboratory for European sciences during the «Voyages of Discovery».

Such projects have constituted modern science including its cognitive, technical core in culturally distinctive ways. But so, too have less dramatic historical events and processes; sciences have been constituted within the very same historical forces and cultural meanings of them that have generated the other institutions of societies. In this respect, natural sciences are fundamentally social they are social sciences and their results of research will continue to be shaped «behing the back of science» by those cultural assumptions that scientists and the rest of us fail critically to evaluate: cultural beliefs constituting scientific projects function as scientific evidence.

Such accounts suggest how sciences constituted through other kinds of cultural projects could detect a different array of nature's regularities and their underlying causes. Such sciences could be those of societies of the South, and they could be those of less greedy and militaristic future societies of the North.

The sciences of the North have been largely «naive ethnosciences» insofar as they failed to detect their distinctively local character. They could, instead, be «principled ethnosciences», critically evaluating through democracy-maximizing processes just which cultural values and interests to use as resources to develop sciences, social studies of science, and public understandings of science, and which to reject. The desirable values and interests could come from traditional Northern cultural identities such as truly generating sciences that served to block «might makes right» in the realm of knowledge production and, also, from emerging senses people have of belonging to a world community that values democratic social forms.

Should it not be the case that, in general, those who bear the consequences of decisions have a proportionate share in making them ? A widespread (though not universal, of course) yearning in the North as well as the South to bring modern sciences under democratic control supports just such a policy. Insofar as science and technology decisions made in the North have powerful effects on lives in the South and on the lives of groups in the North with less social power women, workers, the poor, racial and ethnic minorities- such elite decision-making blocks a positive relation between science and democracy. To begin to understand the ways in which modern science can move from being only a naive ethnoscience to becoming a principled one is a crucial step in advancing both the growth of knowledge and of democratic social forms.

Workshop

The Third world: French ethnocentricity and its impact on post-colonial science analysis

Edwige Liliane LEFEBVRE*

This paper analyses the concept «Third World» (Tiers-Monde) which originated in the 1950s during the French colonial wars. The term came to designate the non-industrialized nations. The embedding of the concept «Third World» in French religion and politics gave a specific texture and direction not only to French/former colonial relations but also to French/South relations. Since the nineteenth century, French political thought had been dominated by two great divisions. The first was anti-clericalism, inherited from the French Revolution and reinforced at the beginning of this century by a bitter divorce between Church and State. The second, partly caused by anti-clericalism, was the Left-Right ideological schism catalyzed by Marxist theory. The Third World was the agent of reconciliation between these conflicting forces. The uniqueness of the concept «Third World» lay in the fact that it permitted the articulation of a Franco-French dialogue between traditional political and social forces.

Allthough the expression «Third World» is now used internationally, it originated in a metaphor deeply rooted in French history. This quotation from Alfred Sauvy expresses his vision of the new proletariat : «After all, this Third World, ignored, despised, exploited like the Third Estate [Tiers-Etat], also wants to be something.» Sauvy intended the word Tiers-Nonde to refer to the Tiers-Etat, a specific social entity within the ancien régime at the time of the French Revolution. The Third Estate, the most numerous group in French society, including all the french population except the nobility and the clergy, suffered from prejudice and exploitation. They were denied access to certain professions, heavily taxed, and restrained in their freedom of movement by the two other groups.

In 1952, Sauvy saw the Third World as the Third Estate, preyed upon by two other powers : the Western and the Eastern blocs. The underdeveloped nations contained most of the world's population, but in the 1950s only a few countries in the Third World were independent. The rest of the Third World, living under colonial rule, had no right to citizenship or to suffrage ;

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they were subject to expulsion fron their lands, deportation, hard labor, and low pay. The association of ideas that led Sauvy to invent the term «Third World» was based on two sets of slogans which had engaged Western public opinion in the 1950s : the free, occidental, capitalist world as opposed to the Socialist or Communist world (the Cold War began in 1947 and peaked during the Korean War in 1952). The Third World, in contrast to the two other worlds, was viewed as underdeveloped : a world of material poverty, of misery, and of culture less nodern than industrial civilization or Communism.

During the ~ lgerian War, laïc and Christian anticolonialists recognized the Algerians as exploited, repressed, and suffering from injustice. After Algeria gained its independence in 1962 this myth of the exploited, downtrodden proletariat would be transferred to the Third World by anticolonialists. In the French vocabulary the expression «Tiers-Monde» came to designate the new world proletariat. Many anticolonialists without denying Algeria's national aspirations, believed that the FLN had assumed the historical revolutionary role of the Third Estate. The Third World was demanding its rights.

The articulation of the Third World concept would be reflected in the development of a political movement, Tiers-Mondisme, which would shape French politics for the next three decades. Tiers-Mondisme (literally, Third-Worldism), was a political-consciousness-turned-movement which promoted solutions (political, economic, technical, scientific, sociological etc..) to eradicate Third World problems taken from the ideological reservoir of what would be called the New Left (Christian and Laïc).

In the 1960s and 1970s the theories that the Tiers-Mondistes promoted to analyze the Third World's problems constituted three school of thoughts. The first maintained that the representation of underdevelopment as a «delay in evolution of development of Third World countries» came from a bias in the West's theory of the history of societies, and that, in fact, underdevelopment was a product of capitalistic expansion at the global level, the domination of the center over the periphery. The second upheld that the reason given for the vicious circle of poverty was radically false : primitive societies were not poor ; only when humanity produced more goods and when capitalism arose, did riches and poverty appear. The third affirmed that Third World countries would not becoue wealthy through free world trade or financial
exchanges.

The stategies advocated to inplemented these theories varied. Heavy industrialization was advocated for some countries of the Third World, such as Algeria The result was that Algeria was forced to import a large amount of food ; its foreign debt rose, and industrialization stagnated. After this downfall the Tiers-Mondistes questioned the transfer of technology which was in their opinion ruining the Third World financially and threatening a dramtic cultural upheaval(1). In the early 1970s the Tiers-Mondistes turned their hopes toward a «green revolution» due to new rational methods of intensive agriculture and the performance of new seeds, which were supposed to solve the problems of Brazil, Mexico, Iran, and India This also proved illusory. After the apparent failure of the «green revolution» generated by Western technology, •any Tiers-Mondistes aligned their strategy to the development of the Third World's agriculture with the indigenous reforms of China, Cuba, and India, which appeared to be the solution to their situation : to feed the population, to create jobs that did not require extensive investment as did heavy industry, to stabilize the agricultural population, and to grow a surplus There, also, deceptions occurred.

In the late 1960s a new economic order was advocated, after the 1974 oil crisis this concept received an official endorsment from the UN, and became the chief topic of international debate.(2) The concept seemed neutral at the time, neither liberal nor Marxist, but by the end of the 1970s it was still impossible to narrow and clarify its neaning, and many Tiers-Mondistes thought that the concept was too vague and too political to be functional.(3)

The Asian revolutions in China, Cambodia, and especially Vietnam, fed the Tiers-Mondistes' new hopes because of the disproportionate power of the belligerants and their own anti-imperialism. The Tiers-Mondistes pursued their quest for absolutes in the Third World, searching for solutions they had not found for French domestic problems. However, as the 1960s ended, the situation in the revolutionary regimes of the Third World was revealing deep political and social indigenous problems that the Christian and laïc Tiers-Mondistes had not foreseen, since they had projected their own Franco-French dialogue on the Third World, and had exempted the new countries from criticism, in a more complex attitude than just the guilt embedded in Tiers-Mondisme

The central idea for the Tiers-Mondistes was that in order to bring about a democratic society, economic and social needs first had to be met. By that time, in an evolutionary process, the Tiers-Mondiste involvement with Third World politics led domestically to the alignment of the secular Socialists with the New Left—ainly Christians from the MRP, PSA, and PSU, and dissidents from the parties like the PCF and the old SFIO This new situation propelled the Third World onto the battlefield between Left and Right in France The Right saw those who proposed other solutions to the Third World's problems, solutions which by promoting development would change the balance of power not only in the Third World but also worldwide, as acting from political motives. For the Tiers-Mondistes, to fight against the program of the Right was to accentuate the division between the Left and the Right. Through their diagnoses of Third World problems and their proposed remedies, professionals working on the Third World became more and more politically involved To the Left's position that the Third World's economic needs should be met first, the Right opposed by the 1980s a respect of democratic rules as the basis for cooperation In Paris the Franco-French dialogue was still articulated around the Third World, but it was now between leftist and righ-tist belligerants which resulted in greater ambiguities and detrimental effects on France/Third World relations

(1) Georges Corm, «L'utopie du développement clés en mains,» Esprit (January 1980) : 110-119.
(2) Philippe Laurent, «Les tiers-mondistes contesté,» Les Etudes (February 1984) :179.
(3) Philippe Laurent, «Vers un nouvel ordre économique international : Dix ans de recherche,» Les Etudes (Juin 1983) : 755-768.

Workshop

Christian confessions and styles of Science in Nineteenth-century Bengal: Their impact on the emergence of the social sciences

Kapil RAJ*

In talking about the relationship between the West and the rest of the world, it is common to talk of Western science as a homogeneous, undifferentiated whole, which was, or rather, *not*, adequately transmitted to the erstwhile colonised part of the globe. In this paper I would like to illustrate some of the difficulties of looking at science as a monolithic block by bringing to analysis the different conceptions and practices that the term covered in British India of the nineteenth century.

Turning first to the East India Company in Britain, the first thing one sees is the rising influence in its affairs of the Clapham Sect. As far as India was concerned, these evangelicals saw education as a means of reinforcing traditional Western religious (i.e., Christian) codes of behaviour to rid the Hindus of the moral depravity which according to the evangelicals, was the cause of degeneracy.

The few English in India who had a penchant for intellectual pursuits in the little leisure time their lucrative commercial activities left them, were, in the fashion of the «Great School», the Oxonian aristocracy of the eighteenth century to which they generally belonged, obsessed with classical thought. Indeed, their education had been dominated by the study of Greek and Latin. Upon arriving in India, a handful of them became infatuated with Oriental thought. Sanskrit, in their eyes, was to Indian vernaculars what Greek was to contemporary European languages. The greatest attestation to their faith in Orientalism came in 1800 when, in an effort to stem the spread among British employees of the doctrines of the French Revolution, the East India Company set up a college at Fort William, Calcutta. In this establishment, young, newly arrived British covenanted officers, in addition to learning European classics and history, also underwent instruction in the culture and languages of their Asiatic subjects, disciplines never before taught in Europe at any level. However, Western natural and experimental philosophy, although part of the College's curriculum, actually received little attention. This domain was nominally in the charge of a Scotsman.

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This is indeed unsurprising as it was mainly the Scots who manned the highly successful operational scientific and technological aspects of British activity in India. This had to do with the general mapping of the newly conquered lands as well as with the logistics of maintaining power. In keeping with the traditions of scientific training in Britain, this part of the colonial machine was manned predominantly by Doctors of Medicine and of Divinity from Scottish and Dutch universities, whose curricula ideally prepared their graduates to occupy senior technical positions in Britain's ever-expanding colonial services.

On the other hand, the number of university graduaes in science from the *English* universities, namely Oxford and Cambridge, was declining, and had been declining all through the 18th century. Many scientists were either self-educated, or trained in private academies. In all events, science was still very closely linked to religion. Indeed, the standard bearers of popular science education in England were the dissenting academies, especially the Unitarians and Baptists. Of these last, some were to flee persecution in England and seek refuge in India and establish themselves near Calcutta. Under William Carey, a Baptist fugitive turned indigo factory owner and small-time tradesman, the Baptists with their populist notions, were to write and publish a number of science textbooks for the indigenous population. This same Carey, because of his penchant for popular cultures, was to become the Bengali professor at the College of Fort William.

Given their locally antagonistic positions, it is highly improbable that these traditions could have met in Great Britain. As a number of old students from the "melting pot" that was the College of Fort William found jobs as professors in the ever increasing number of British universities, an unexpected spillover of this unique meeting of traditions occurred and became the genesis later in the century of a specific British tradition in sociology and social anthropology. This story, although taken from the nineteenth century, is pertinent in that it shows how different scientific traditions might even today give rise to the establishment of new disciplines.

Workshop

Agronomia Afranceada: The French contribution to Mexican agronomy, 1880-1940

Joseph COTTER*
Michael OSBORNE**

This paper examines French contributions to the development of Mexican agronomy. The mechanisms through which French agronomy was transmitted to Mexico are described, and the impact of this exchange on the evolution of the discipline in Mexico is evaluated Lastly, the wane of French influence in the face of other models of agronomy is discussed.

Before the Mexican Revolution (1910-1920), Mexico's elites were quite francophillic and Comtean positivism was in vogue. These circumstances had much influence on the development of educational institutions and the sciences, including agronomy. In Mexico, France was seen as the world's premier nation in the agricultural sciences. Mexican agronomists were trained with French texts and they relied heavily on the works of their French colleagues when preparing technical publications. However, by the end of the period they began to turn to other nations for scientific inspiration.

The Mexican Revolution did away with the old Porfirian regime and its positivist ideology. As elites turned away from things French, Mexico's agronomists looked to other nations, especially the United States and the Soviet Union, for scientific models. The rise of *indiqenismo* also influenced the development of Mexican agronomy. From 1920 to 1940 the French model of agronomy slowly gave way to other paradigms, but at least two French agronomists who immigrated to Mexico before the Revolution made important contributions to the discourses of the period.

By 1940, faced with an agricultural crisis and a long track record of failed research and extension programs, Mexico's agronomists searched for a foreign model that would transform the discipline into an experimental one. The outbreak of World War II made many foreign sources of scientific assistance, such as France or the Soviet Union, unavailable, and Mexico turned to the

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United States to tranform the discipline of agronomy. This led to the Green Revolution, and institutionalized a profoundly North American model of agronomy in Mexico.

These developments are discussed in the light of the findings of my doctoral disseration, which is based on research conducted at the *Archivo General de la Nacion*, the *Hemeroteca Nacional*, and the libraries of the *Banco de México* and the *Colegio de México* in Mexico City ; at the *Archivo de Ramon Fernandez* y *Fernandez* and the library of the *Colegio de Michoacan* in Zamora, Michoacan, Mexico ; and at other archives in Mexico ; at the Rockefeller Foundation Archives in Tarrytown, New York ; and at the National Archives in Washington, D.C. ; as well as on recent research I have conducted at the Bancroft Library and will conduct in Mexico City this June. The materials reviewed include Mexican agricultural journals, government publications on agriculture, letters and monographs by Mexican agronomists, newspapers, and other documents.

Workshop

French and American influences on the biomedical sciences of Latin America during the early XXth century

Marcos CUETO*

Generally speaking, the XXth century has been held to be a period of transition between the influence of the French and the influence of the North Americans on Latin American science and medicine. This perception presupposes the decline of French science, the absolute hegemony of North American science and the passiveness of the Latin Americans of the period. This paper postulates that this process was one of coexistence between the two influences. The French influence was entrenched at the end of the XIXth century, in particular as regards the creation of a body of State-remunerated health officials; the emphasis placed on anatomy and clinical practice in the reorganisation of medical teaching and practice; and in the acceptance of so-called «Hospital medicine». The North American influence, which was introduced into the region at the turn of the XXth century through the Rockefeller Foundation, held the French influence partly responsible for the backwardness of medical science. The competition between the influences allowed them to exist alongside one another for a good part of the XXth century, and this enabled the Latin Americans to have their own options and initiatives. This paper will describe the acceptance, primary features and coexistence of the two rivals, focusing special attention on the part played by the Rockefeller Foundation.

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Workshop

Who is developing whom? American agriculture in the Soviet Union, 1928-1932: Reflections on American Science abroad

Deborah FITZGERALD*

This paper will explore the ways in which American technical assistance programs in agriculture have functioned as exploratory trials for ideas and practices that are not yet accepted in America. That is, agricultural scientists employed in foreign fields, students, institutional structures, climatic advantages, seeds and livestock, farm laborers, and so forth, as experiment stations for projects that, for one reason or another, the scientists were not able to try out at their home base in America. In some cases, these scientists went abroad to take advantage of the extended growing season of the tropics, greatly accelerating the pace of plant research. In other cases, they simply needed bigger experimental fields. And in yet other cases they wished to enlarge their credibility by practicing in a «hostile» environment. Finally, since most scientists subscribed to the view that the knowledge they produced was «objective» and not reflective of or embedded in broader cultural values, they often felt that data obtained in another culture was indistinguishable from data obtained at the home site. Thus, an experimental excursion to another country was to some a flat-footed fact-gathering mission. As I have suggested elsewhere, this assumption was problematic, yet formed a cornerstone of pre-Cold War exercises in technical assistance.

As an illustration of these ideas, I would offer the story of some American agricultural economists and engineers who were hired by the Soviet government to advise the Soviets in their collectivization efforts during the first Five-Year Plan (1927-32). In general, the Americans' primary job was to help the Soviets shift from basically subsistence production to industrial production of wheat, and to help them organize and manage farms of unprecedented size. More specifically, some Americans helped the Soviets assemble, maintain and repair the tens of thousands of tractors, combines, and other agricultural machinery the Soviets had bought from American manufacturers. Other Americans helped plot out where the 20,000 acre fields ought to be, how many field workers and implements would be required to put in the crop, how these «inputs» would be distributed and moved between the hundreds of field units, each unit bigger than any farm the Americans had ever seen.

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While these American agriculturalists each made a handsome salary in their advisory capacities, just as development advisors do today, I wish to suggest that the more significant gain for the Americans was the experience they gained in large-scale farming. In America at this time, agricultural leaders and urban critics alike were engaged in a vigorous discussion regarding the proper organization of agriculture which, due to the post-war collapse of markets and domestic economic depression, was in bad shape. The most prominent idea in business circles was that agriculture was long overdue for modernization, and should resemble factory operations rather than some pastoral ideal. If Henry Ford could mass-produce cars, the logic went, then farmers should mass-produce food. This idea proved quite captivating to economists, agronomists, bankers, engineers, and many farmers, and led to a number of substantial experiments in «factory farming».

When agricultural economist M. L. Wilson was invited to spend half a year in the Soviet Union in 1929, he viewed this as an opportunity to expand his experiments on growing wheat on a large scale. For the previous two or three years, he had been campaigning to convince Montana farmers to triple the size of their farms and invest in the new agricultural machinery. He had even convinced John D. Rockefeller to provide a million dollars so he could experiment with mechanized farming. But Wilson was limited nonetheless by the size of the farms, the cost of and availability of machinery, and the general smallness of the experimental scale. Thus, given the chance to figure out the management of 200, 000 acre farms, and to turn these farms into mechanized wheat factories, he jumped at the chance.

In this paper, then, I will consider this peculiar congruence of needs and opportunities: the Soviet's need for technical advice, and Wilson's need for experimental verification of his ideas. After considering Wilson's story, I will return to the issues that opened this abstract, and discuss how these historical experiences shaped the expectations of technical experts abroad as well as the emerging critique of development.

Workshop

Instrument of development. Translating the MIT and Stanford models of the technical university to India and South Korea

Robert KARGON*
Stuart LESLIE*

U.S. President Truman's Four Point program of 1949 promised a «bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.» Truman's foreign policy advisors saw science and technology as essential tools for promoting democracy and economic growth in the Third World, and so for furthering American interests abroad. The Four Point program and its successors pumped some $80 billion in foreign aid into countries outside of Europe. But the direct transfer of American technology and know-how rarely led to the expected political or economic transformations.

Frustrated by the failure of these early programs to contribute to self-sustaining industrialization, policy planners in both the US and in developing nations began taking a closer look at translating American theories into practices that would be more appropriate in a Third World context. Most development experts agreed that independent institutions of scientific and technical education were an indispensable component for economic «take-off.» And, given America's industrial predominance in the postwar world, they understandably looked to American universities as models, especially MIT and Stanford, which had earned international reputations not only for the quality of their research and teaching, but for their contributions to the economic growth of their respective regions.

This paper compares attempts to translate the MIT model into India in the 1960s with attempts to translate the Stanford model to South Korea in the 1970s. In 1958 the Government of India asked for American assistance in creating an MIT-type institute of technology for the industrial city of Kanpur. With backing from the US Agency for International Development (USAID), MIT led a consortium of American universities, the Kanpur Indo-America Program, in introducing an Amerecan curriculum and American teaching methods through a joint American-Indian faculty. The focus was on an integrated course of scientific and technical instruction at the undergraduate level, with close cooperation with local industry. Rather than creating new

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industries, Kanpur was expected to strengthen existing ones, and so concentrated on civil, mechanical, and more traditional fields of electrical engineering. When it pursued a high technology strategy, as in its aeronautical engineering or its proposed electronics research park, it largely failed. After ten years, the Government of India took over IIT/Kanpur. It remains to this day a model for technical education in India.

South Korea, concerned in the 1960s about a scientific «brain drain» and convinced that its future competitiveness in high technology would require a local supply of technical manpower, turned to Stanford University and the technological park of Silicon Valley as a model for regional economic development. At the request of the South Korean government, a USAID appointed a team headed by Stanford electrical engineer and provost Frederick Terman, the acknowledged «father of Silicon Valley,» to plan the Korea Advanced Institute of Science and Technology (KAIST) as a graduate-only institution intended to be an integral part of a new Science Center in Seoul . KAIST's purpose was to help Korea keep pace with Japan and the US in high technology industry, not to strengthen older industries such as stell or shipbuilding. The Korean willingness to centralize R & D, and to coordinate it with industrial policy, offers an intriguing contrast to the Indian experience.

Workshop

Frictional adjustments and cooperative research: An examination of biotechnology related research agreements

Pascal BYÉ*

While the number and varying forms of research agreements seem to be evidence of new industrial strategies coming into play in the area of utilising fundamental biotechnological knowledge, analyses specific to the matter continue highlighting economic variables and strategic interpretations more to do with technology than actual research. Big companies might enter into such agreements as an inexpensive means of improving their competitiveness, and with a view to profiting from the ensuing free transfer of new knowledge. As such, they would set about negotiating a genuine middle course between securing these immediate benefits and the potential risks linked to the protection and privatisation of research results. Public partners, meanwhile, would seek to strike a balance between the benefits to be gained from new means of funding and the drawbacks entailed by some privatisation of their activity.

This rational and commercial conception of the actors' behaviour, however, underestimates the importance of two factors that appear particularly during the early stages of the agreement's realisation: the non-commercial world within which the partnership lies, and the gradual modification of the agreement's content and organisation. Both elements spotlight the role played by public policies: i.e. precipitating and safeguarding the healthy progress of the agreements.

While they may bring to light the role certain fundamental variables play in the history of these agreements, a good number of authors then come to underestimate the fact that the chief aim of the partners is to progressively build up a capacity to mutually absorb their respective knowledge. When all's said and done, this happens more spontaneously in the agreement than «ex post» readings of understandings made formal in contracts might lead one to believe. The realities of the day-to-day operation of the contract and its actual results, would lie concealed beneath the contract's legal and administrative wrapping, the most visible product of a pact between partners. When the

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research begins - and this is particularly important in areas where the creation of knowledge and new scientific subjects prevails over devising processes or marketable products - the agreement would cover many more non-defined modes of apprenticeship than clear-cut precisions as to how the results obtained will be shared.

This «cultural» contract - if one considers the first stages of the agreement to be like acquiring a common culture - becomes economical through practice. The «frictional adjustment» terms are put forward to illustrate the repeated steps agreement partners, banking on the organisations responsible for the transfer, take in their attempts to progressively translate their empirical researcher approaches into norm-governed contracts.

So this paper has a double objective. Firstly, going on rational readings of the agreements, it sets out to assess the particular meaning of certain basic variables, e.g. investment returns or barriers to entry. It also reconsiders the far too economical interpretations of cooperative research agreements, so as to highlight the importance of the informal factors needed to progressively establish a truly common culture between the actors party to the agreement. Finally, emphasising the role played by the organisations in this singular transfer of knowledge, it sets out to illustrate the «frictional adjustment» approach which starts with a non-formalised process of apprenticeship and leads to the conclusion of pacts, then contracts.

Workshop

Scientific knowledge and technical systems in agriculture: A study of biotechnologies

Maria FONTE*
Ladislao RUBIO*

The progressive way in which the knowledge mustered up for agriculture and food production has been changing, is expressed in the permanence and continuity of the composition of the existing knowledge base. The contribution scientific knowledge makes to agricultural techniques is, in fact, made concrete through the mediation of a series of social relations between individuals, groups, organisations or institutions. In this context, the market operates via selection and/or learning procedures which show themselves in a heterogeneous range of organisational situations at the level of microeconomic units.

This allows us to analyse technical systems in agriculture and food-production, such as systems of interaction and the social and economic «networks of relations» which compete to determine a common orientation in agricultural zones, or for a particular produce, towards an adapted or adaptable technology. The common technological orientation is rendered by a certain homogeneity in the cultural reference, the average technology used, the type of competence required in the production process, its origin, evolution or transformation. The foundation of this common orientation is rendered by an average level defined at the level of the territory (the zone) or market (the product).

One important aspect of food-production biotechnologies is an ability to compile generic scientific knowledge which is codified and capable of «long-distance» transfer. However, this ability is limited to the point where the new technique is adopted conforming to socio-economic contexts which differ greatly depending on the zone and product.

The analysis of certain local technical systems in the Italian Mezzorgiorno will enable us to illustrate how the adaptation, repetition and resistance processes, influence or modify those of renewing agricultural techniques and, in particular, the possibilities for applying biotechnologies to agriculture.

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Workshop

Plant biotechnologies and TurkISH agriculture: Some reflections on the characteristics of adoption

Ayse GÖZEN*

The paper will draw attention to the conditions of diffusion of plant biotechnologies in Turkey, indicating that they are very much related to the characteristics of the existing organiSation of agricultural research and the long-term evolution of social relations around it.

With ITS very weak science base, agriculture in Turkey highly relies on technologies adopted from the West. The State initiated breeding activities have been largely the inland development of foreign seeds of higher yields especially in field crops. The inefficiency of local research was more pronounced with the formal importation of hybrid seeds starting in the late 1960s. Very few of the foreign and domestic seed companies which started operations in the mid-1980s following the liberalisation of agriculture, could contribute to the technology transfer; most of them-especially the ones working with vegetable seeds have been importing the seeds and doing only partial field reproduction in Turkey. As far as the fruit saplings are concerned, the inland variety improvement efforts made minor contributions to the production when compared to the illegal importation of saplings from abroad.

Plant biotechnology research started off in that atmosphere in the state research institutes and universities with experimentation of simple techniques, depending largely on individual initiatives and foreign projects financed by the likes of the World Bank and FAO. The major application of plant biotechnology has been the production and distribution of virus-free citrus in the Mediterranean region. Starting as a national programme to stop the spread of effective viruses in this important crop of the South, this initiative developed simultaneously in two separate institutions, due to the conflicts between the Ministry and the University. The certified virus-free saplings as products of this new technology have been recently commercialised largely among the better-off farmers of the Mediterranean region who could afford the more expensive planting material. Yet the diffusion of the technology is more limited by reasons other than the higher prices. On the one hand, there is the problem of low capacity of production facilities and the lack of coordination

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between the Ministry and the University to overcome the bottlenecks. On the other hand, there is the reaction of the very large citrus farmers and the private sapling producers who were used to making large profits through traditional and/or foreign material. These social conflicts around innovation result in the lack of concerted action and thus carry the danger of diminishing the positive impacts of the virus-free material, since as long as these young trees constitute the minority of the planted citrus, they are more prone to diseases.

In the private sector, very few companies started working on micropropagation and no satisfying outcome in terms of commercialisation has so far been attained. Recently, a Japanese firm started micropropagating flowers directly for export. Being well equipped both technically and financially, this seems to continue the business, also contributing indirectly to technology transfer in this field.

The low level of research capacity in biotechnology and its fragmentation could finally draw the necessary attention of the decision makers in the research area. The recent initiatives to strengthen the research base in plant biotechnology in some selected priority areas, aim to concentrate the efforts and start effective capacity building and utilisation. It is aimed to determine the priorities both in economic terms considering the local and international market potentials of crops ; in technical terms considering the problems of production ; and, in social terms considering the access of the farmers to the research results. With the existing social relations around research activities which can be characterised by lack of institutionalisation, the application of these criteria, however, still rely on the power conflicts between the private sector - both local and international -, universities and the government bodies, as well as the personalities of the involved actors in these organisations.

Workshop

Technological capacities and private investment in agricultural biotechnologies in Brazil

Sergio SALLES FILHO*
Maria Beatriz BONACELLI**

Biotechnology-related activities in public research centres have a different development horizon from those organised in the industrial world.

Relations between these two worlds require scientific knowledge (acquired in research laboratories) to be rendered into identifiable and adaptable technical objects. This is done at specific times and in specific places. It is the product of convergence between scientific knowledge and productive practices. It is largely dependent on the economic context within which it has been developed.

The context of the development of agricultural biotechnology in Brazil, is based on «know-how» which public research centres and universities have been fostering for several years. Private research activities are a more recent development. They correspond to two trends of involvement in biotechnologies: on the one hand, strategies pursued by large national groups, notably companies specialising in seed, sugar-derived alcohol and paper and cellulose, and on the other, the strategies of companies specialising in the biotechnologies or *Nouvelles entreprises de biotechnologie* (NEBs - New Biotechnology Companies).

In the first case, the companies regard biotechnology more as an aid in their attempts to improve their traditional production processes and/or the characteristics of their products. The most often cited cases are: Sementes Agroceres, the Brazilian market leader in hybrid corn seed; COPERSUCAR, the sugar-derived alcohol sector cooperative, whose research programme sets out to improve sugar cane shoots; and Aracruz Celulose, which, through tissue culture-related techniques, seeks to produce Eucalyptus shoots as part of its programme to reafforest land that has already been worked.

In the second case, the Brazilian NEBs engaged in agricultural activities aren't very numerous, despite the country's research institutes' traditional involve

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ment in this domain (this situation can be seen in practically every country in Latin America). Partly because of the specificity of the techno-economic dynamics of agriculture, the private investments made in this branch have, in reality, found it more difficult than other sectors to get over the barriers to do with the development of biotechnological activity. Bioplanta and Biomatrix - the two main private ventures in plant-related activities - represent two examples that confirm this situation, and they have had to curtail their operations.

Some of these small companies work in market niches where the value added through agricultural input is not very significant. The examples are: Nitral, which works on innoculations (*Rhizobium*) for leguminous plants (soya, beans, peas, etc.) and the micro-elements intended for them; and SBS-Biotecnologia e Produção Agricola, which also runs a tissue culture programme for application on fruit and forest species.

This article aims to discuss the distinctive features and prospects of agricultural biotechnology development with regard to private investments in Brazil. In particular, we shall analyse the needs of the country compared to investment in market niches, the training of human resources and technological know-how.

Science staff, in fact, seem to be in urgent need of having their knowledge up-dated as far as the utilisation of molecular biology tools is concerned, so that already existing abilities in genetic improvement are prevented from falling into obsolescence.

In this context, cooperation, public-private sector alliances and transfers of technology/knowledge at both a regional and international level (the best example still being COPERSUCAR, which cooperates with international research groups on genetic improvement), seem to be the chosen ways to maintain a continuous and consistent development of biotechnology within the country.

Our paper is based on examples drawn from surveys of companies engaged in research and production in agricultural biotechnology, and revolves around two major themes:

- the characteristics of investment in agricultural biotechnology in Brazil;

- the conditions and prospects for its development.

Workshop

Traditional representations of illness and therapeutic recourse in North Africa

Dr. Hager BAHRI*

The recent development of research work on medical anthropology has clearly brought to the fore the idea that beyond just being a biological fact, illness is also a cultural and social phenomenon which forms the subject of representations and practices closely linked to a society's «vision of the world», its religious references, system of thought, and social and political organisation.

In the so-called traditional society of North Africa, health and illness do not belong to different fields of social activity. Their division into sectors ties in with the domination of the modern medical system left by colonial medicine.

In North Africa, traditional representations of illness and its related therapeutic recourse stem from wider and more varied fields:

- Magic-religion (saint worship, belief in the «Jnoun» and the evil eye, contact with magic healers etc.);

- Scientific tradition descended from classical Arab medicine (chiefly with the theory of moods);

- An empirical popular tradition with a pharmacopoeia based on herbs, olive oil, etc.

The (unfortunately little) research conducted in this region of the world shows how important this «area of traditional therapeutics» really is (a recent survey in Tunisia, for example, found that almost half of the population believes the Jnoun and the evil eye to be at the root of illnesses). One should be wary of only seeing this as a cultural phenomenon without time nor history. The study of traditional representations of illness can constitute a privileged focus of observation for grasping the current social and political issues in North Africa.

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In fact, their persistence is evidence of both social reproduction dynamics via the networks of primary membership (extended family, clan, tribe), and resistance to the hegemonic claims of the state disseminating the norms of modern medicine via its socialising authorities (healthcare institutions, schools, media).

* Jnoun: plural of Jinn, a kind of familiar spirit in Arab folklore.

Workshop

Ethnopharmacology in the tropics: The case of Vanuatu

Pierre CABALION*

Developed countries seeking to enhance their pharmacopoeia are interested in all sorts of «new» molecules modeled on biochemical and biotechnological designs, or stemming from organic chemistry. Developing Countries, for their part, possess lands with great genetic wealth which remains potential as long as it is untapped. What are the least unsatisfying conditions for North-South cooperative research in this area, given the (e.g. economic) constraints?

One option consists of taking traditional medicine into account a priori. It entails an *ethnopharmacological* comparison between various conceptions of a medicine - a methodology which can be useful in both the «North» and «South». This research firstly focuses on reputedly medicinal tropical plants, the double aim being to use natural substances in new patent medicines and to rationalise local remedies and present them in a modern form.

Standardising the quality of extracts stemming from traditional medicine could facilitate their use in primary healthcare (basic medicines from natural sources?).

A register of the plants selected through centuries of empiricism is of great advantage for the guidance of pharmacological trials. At the same time, it provides a written record of traditionally orally transmitted knowledge, thus fending off the threat of its extinction posed by the advance of the world economy.

The case of Vanuatu

70 to 80% of the population still lives in virtual autarky, using the traditional pharmacopoeia. This has developed in three stages. First arrivals imported a few medicinal plants and used the indigenous species they already knew

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about. They then identified other useful plants among the local flora. Finally, came the arrival of new species and techniques, and the progressive renunciation of the desire/need for local autarky.

Local medical practices

These stem from both a very fine knowledge of nature and a magic-based understanding of the world. Researching natural medicines, however, is a perfectly and immediately understandable goal of all cultures, since remedies serve the same purpose everywhere. Having said that, their effects are measured according to the individual yardsticks of the cultures using them.

Magical influence through images: rudiments of magical belief

In Vanuatu and elsewhere, traditional society believes it can influence a person, thing, or phenomenon via its image or symbol. This basic postulate of magic gives rise to the *theory of signatures* following which it has been known for the bean to be prescribed for renal diseases or latex plants for secretion disorders. Put like that, such recommendations are more likely to interest ethnographers than pharmacists. Yet magic-based traditional medicines, too, have been made on the basis of practical results.

The theory of signatures - a traditional way of explaining the world - also serves to put forward hypotheses which are then assessed by the empirical means available. In Vanuatu, the species to try out as medicinal plants are selected by divination too e.g. under the effects of the kava (*Piper methysticum*). This methodology is reminiscent of the Siberian shamans. Such an a priori approach is just as creditworthy as the initial selection of plants through chemistry. In fact, the confirmed activity is actually what determines the sought-after quality: a «medicinal plant» or «biologically active species». This nuance is central to the theme of this conference.

As long as the principle of supernatural influence via images goes uncontested, magical thinking will never be found lacking in its conclusions; any infringement of a taboo, any failure to perform a rite will be enough to render the magic ineffective, without ever invalidating its principles, which might be considered a sacrilegious or disrespectful act. In such a system, successive tests are essentially new attempts to act within a world dominated by supernatural (magical or religious) principles, and not stages in an essentially profane process of experimentation.

In the area of healthcare, a good deal of local experience corresponds to very technical demands.

The empirical observations made down through the ages have gradually become integrated into local knowledge. This schema is probably close to that of the domestication of cereals in neolithic agriculture: i.e. at first unintentional, then increasingly proactive selection on points where significant advantages had been gained. Today's reputedly medicinal plants seem like the product of a parallel health-specific process (food supply/health).

This body of knowledge needs interpreting, which calls for the involvement of several disciplines, ethnomedicine in particular. By decoding the local symptomatology, we hope to be able to decipher the medicinal recipes of the traditional pharmacopoeia and establish some corresponding links between tradition and science. We are interested in such a *bridge between empirical knowledge and scientific knowledge, rather than their geographical origins*, Western or otherwise.

Does research natural medicines, whether stemming from traditions or directly from investigations in nature, favour the *economic or social development of Developing Countries*? The molecules that modern pharmacology can manufacture industrially are rarely extracted from nature if they can be synthesised, and the countries where the plants grow gain little from the economic benefits of the research operation. Acceptable post-hoc compensations then have to be found and research programmes are often organised with a mind to avoiding such unforeseen discussions. This illustration applies to the pharmaceutical industry far more than to food supply or cosmetics, which primarily use natural raw materials.

The hope is that biotechnology processes will tone down the major drawback of plants in modern pharmacology: the variability of their active properties. This solution would allow one to envisage greater local economic benefits in both the North and South. The ethnopharmacological route facilitating the discovery of new natural medicines is one of the preoccupations of ORSTOM, the ReMeD[1] network, and, of course, the SFE[2]. As such, organising trips to the land of magic will enables us to find some of the medicines of tomorrow.

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[1] Réseau médicaments & développement

[2] Société française d'ethnopharmacologie

Workshop

Between China and the West: The place and role of traditional medicine in Vietnam

Annick GUÉNEL*

Traditional medicine in Vietnam has an official place in the country's health system. In the North this has been the case since 1954, in the South since reunification in 1975. It is taught in the universities. Its inclusion in the official health system amounts to a recognition of two features: its specificity compared to the prestigious Chinese medical system and its validity compared to Western medicine.

The first of these two aspects is tied to the whole history of Vietnam. Under Chinese domination for a thousand years (111 BC to 939 AD), Vietnam spent the next thousand years establishing its present-day territory and unity, assimilating other systems and cultures to the south. As officially defined today, traditional Vietnamese medicine is the sum of two constituent parts, the same as were identified by the French missionaries and, later, French doctors of the colonial era: i.e. a Northern, «Sino-annamite» medicine and a southern medicine, often described as «more popular than erudite», these two terms being not so much geographical as determined by reference to Chinese medicine. Lending credit to this notion of a twin inheritance, books on traditional Vietnamese medicine often refer to two systems of medicine in earlier centuries. Tue Tinh, a 14th century Buddhist monk, though trained in the Chinese school, encouraged the use of «southern» remedies, while the 18th century scholar Lan Ong wrote on «northern» medicine, his work being an enrichment and a revival of Far Eastern medical art. Both men rejected Mandarin honours and so symbolise medicine for the people. From that point on, it is its diversity that makes Vietnamese medicine so specific and, in historical terms, implies recognition of Vietnam as a national entity.

The second aspect is connected with Vietnam's more recent history. During the struggle for independence and then for reunification, the traditional pharmacopoeia and traditional healing methods, which had in any case never ceased to be a part of the family economy, not only made up for the shortage of resources but also helped to exalt nationalistic, revolutionary sentiments

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Ho Chi Minh himself, in 1955, sent the following message to his health managers: «We must build up our own system of medicine, based on this principle: scientific, national and popular». He added, «To broaden the scope of medicine you must study how to ally the effects of oriental and Western remedies». The resurgence of traditional medicine, advocated sometimes by the same people who had access to and had adopted Western medical theory, is part of a new and henceforth official view of medical science, a kind of syncretism between East and West. Dr. Nguyen Van Huong is an exemplary figure in this regard. Head of a laboratory at the Pasteur Institute in Saigon in the 1930s, in the days of the resistance he worked in a jungle laboratory producing vaccines; then, under the RDVN, he was Minister of Health. Today, he is still teaching and promoting traditional medicine in Ho Chi Minh City.

A network of State organisations including the Department of Traditional Medicine at the Health Ministry, the national institutes of traditional medicine, hospitals, general practices etc. has been set up to «integrate traditional medicine with modern medicine at all levels». This «alliance» finds approval in the four most important institutes, which combine theoretical and philosophical reflection with research into the «scientific» bases of traditional therapeutic methods. But what does it mean to incorporate into modern science a body of knowledge previously transmitted by a long and complex apprenticeship? The union is already unbalanced because, even after the restructuring of the health system, traditional medicine was long regarded as medicine for the poor. And this field of research is not the most highly valued among students. Present trends, largely influenced by the new commercial stakes (now that the pharmaceutical companies, especially foreign firms, are showing an interest in the local pharmacopoeia) are likely to upset the balance even further, leading to a mere assimilation of «recipes» from traditional medicine.

With changes in the political and economic situation, and a shift of emphasis in international cooperation, the teaching of medicine in Vietnam and, more generally, the whole organisation of the health system, are in the throes of a real crisis. The failure to forge a genuine alliance between traditional and modern medicine, while not the main cause of the crisis, is certainly one aspect among many.

Workshop

Illness and medicine in India according to the Ayurveda

Guy MAZARS*

In India, as in China, although perhaps more than anywhere else in the world, traditional medicine has retained a high degree of credibility. The most widespread and well-known system of medical theory and practice is derived from the Ayurveda («Knowledge (*veda*) of longevity (*âyur*)»), the main theories of which were already established nearly two thousand years ago.

The Ayurveda system, as it appears from the oldest Sanskrit medical treatises, is remarkable above all for its scientific approach. It describes itself as based on reasoned observation. It offers a rudimentary but rational system for interpreting the constitution of the body, its vital functions and its diseases, taking a holistic approach to the human being with all its somatic and psychic manifestations.

According to Ayurvedic doctrine, all illnesses other than those due to accidental causes are the result of «imbalance of the *dhâtu*» (*dhâtuvaishamya*), disturbances of the balance of the elements that constitute and animate the body. Three of these elements are directly present and active in the body: spirit or air (*prâna*), fire in the form of an igneous principle called *pitta* (bile) and water in the form of phlegm (*kapha*), common to all body fluids and secretions.

Disturbances in the functions of «air» «bile» and «phlegm» are attributed to causes called *nidâna* which are to be found mainly in the patient's behaviour and diet, taking external circumstances (climatic or accidental) into account. But Ayurveda is Hindu as well as Indian: despite their scientific spirit, the theorists of Ayurveda took account of certain religious beliefs, particularly those regarding transmigration, and found a place for them in the system.

In practice, Ayurveda gives priority to prevention, placing great stress on lifestyle, hygiene and diet, with a view to maintaining equilibrium among the vital elements. Alongside the preventive measures, the Ayurvedic treatments in most widespread use today are *pañcakarma* therapy to re-establish this

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balance, and remedies based on natural substances of animal, vegetable or mineral origin. *Pañcakarma*, pronounced «panchakarma», means «five procedures», these being bleeding and the administration of emetics, purgatives, enemas and medicines to be sniffed into the nostrils.

Most of the medicines prescribed by Ayurveda are herbal. Ayurvedic medicine used over 3,000 different herbs and plant species, more than a thousand of which are still used today in different forms.

Except where it assimilated foreign influences in an Indianised form, Indian science remained fairly impervious to foreign influences. Traditional medicine ignored or remained very wary of Western medicine, just as it had rejected the medicine introduced by the Moslem conquerors some centuries earlier. And many Indians today are convinced that Ayurvedic medicine is better than Western. Far from fading out in the face of this competition, Ayurvedic medicine has undergone a revival. Since independence, it has been officially recognized and continues to play a significant role in Indian health policy.

In the West, where Western medicine is being called into question and alternative medicine is coming back into favour, Ayurveda is arousing growing interest. Whereas modern medical practice is ever more split up among narrow specialisations, the Ayurveda approach considers the person as a whole; the Ayurveda pratician treats the patient rather than the disease.

Some Ayurveda practices, or so-called, have begun to spread in America and Europe, especially Germany, Italy and France. Unfortunately, this popularisation has so far not always gone hand in hand with a critical consideration of the authenticity, innocuousness and efficacy of the practices involved, and the Western press has tended to exaggerate their potential and their ancient roots.

We will develop these various aspects, stressing the systemic nature of the concepts and practices of Ayurveda, since it is in this respect that Ayurvedic «knowledge» is original and of interest.

Workshop

Traditional therapeutic knowledge versus scientific knowledge: Translation, transfer or sharing?

Christian MORETTI*

The Social and economic implications of biological diversity

Biodiversity is seen first of all as a heritage in danger. The need to conserve it is presented by today's ecologists as a moral obligation for society. But promoting a conservation drive is only really accepted sociologically for objects that have value for society. This has been understood by British and American ecologists who, in recent years, have tried to introduce more telling economic arguments. Many economic evaluations have now been made of biological diversity. The speculative nature of this monetary approach to biodiversity limits its interest. But it does have the merit of taking a better measure of the issues at stake. Biodiversity is not a gift of providence, it is a source of income.

Clearly, the future advantages one may hope for from biodiversity are essentially linked to the discovery of new seeds and new medicines.

Lately, we have seen the launch of «gene prospecting» programmes, mainly in America but also in Japan. They involve cooperation between scientific communities, public institutions and private enterprise. The three main American agencies, NIH (through its international relay the Fogarty Institution), NSF and USAID have joined forces to support the programmes of the International Cooperative Biodiversity Group (ICBC).

Another original aspect of these projects is that they acknowledge the intellectual contribution of local personalities who contribute to the discovery of new medicines by sharing their traditional biomedical knowledge. Specific contracts specify the rights of each to intellectual property and the possible benefits. For the DCs, these benefits may not be monetary, they may take the form of appropriate aid for environmental conservation programmes.

The pharmaceutical firms are taking part in these programmes through biological screening, training drives, donations of scientific equipment and financial contributions.

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Traditional knowledge as a source of therapeutic innovation: «American Indian Shaman Quoted on Stock Exchange»?

The chances of discovering active principles in plants have enormously increased through the development of ethnopharmacology, which seeks ways of exploiting the ancestral knowledge of traditional healers. The discoveries will come mainly from knowledge held by communities still living in isolation, well integrated into their ecosystems and ignorant of the rules of business.

What status should be attributed to traditional knowledge when it becomes the basis of an important intellectual application? Some consider that it has no value in itself and no owner; it belongs to everyone, and only its «translation» into scientific language can give it monetary value. Others point out that in many societies, knowledge is the property of an individual, the specialist; it is not freely available and its «transfer» to the scientific world raises some delicate ethical problems that have yet to be solved and are often glossed over by «ethnoscience» researchers. This knowledge has been built up over the centuries through a long process of trial and error, using an inventive intellectual approach which ought, strictly speaking, to give its holders a right to some of the expected profits. The traditional remedies are prepared from plants selected from among hundreds of others using an approach that is just as innovative as that of modern experimental science.

In the USA, the institutions that are members of the International Cooperative Biodiversity Group now acknowledge the «intellectual contribution» of the traditional healers and local scientists who take part in their «discoveries».

Are we aware of all we owe to the Indian chief Pedro Calysaya who revealed the virtues of the cinchona tree? The discovery of quinine, its active principle, had major consequences for the history of medicine and of the world in general. It is no exaggeration to say that without this drug, most of the world's fertile zones would have been uninhabitable. Ought not the descendants of those who made it possible to discover such heroic drugs as quinine and curare to be compensated some day soon?

In what concrete form can these community intellectual property rights be exercised? So far, no satisfactory answer has been found to this legal problem. However, two relevant points can be put forward here:

• For the most isolated indigenous societies, remuneration for traditional knowledge can take the form of an indemnity used to improve their health system and safeguard their way of life;
• In all cases, care must be taken to bring the scientific knowledge back to the source community and involve it in the project process. The role of NGOs in the field is fundamental here, since they often provide the necessary local relay structures.

One may also wonder whether the debate is still relevant. As early as 1982, at a round table organised by the WHO, Prof. Gottlieb of Brazil declared, «In South America, there is very little chance of obtaining new information on medicinal herbs from indigenous peoples. Ethnopharmacy can only play a relatively minor part in orienting research activities leading to the discovery of new medicines". Have the indigenous peoples not already given us the essence of their knowledge? Poisons used in hunting and fishing have played an essential role in the economies of the indigenous peoples. Other plants, like coca, ipeca and cinchona, given their properties and local notoriety, could not escape the notice of the early explorers and colonisers. And the process of acculturation and/or integration now going on in the most remote regions of the Amazon may have destroyed what was left of this knowledge.

It is unlikely, though not impossible, that the drug that will one day bring a decisive change to cancer treatment is hiding away in some miraculous recipe held by a medicine man deep in the Amazon jungle. But traditional peoples have another, far more important part to play in the study of biodiversity, through their knowledge of the flora and the general ecosystem around them.

Popular forms of medicine, as distinct from traditional medicine, are by no means dying out.

The use value of herbs and food plants is not only the sum of their immediate and future benefits as defined by environmental economists. Estimations of the present-day value of such plants must not be limited to their market value, it must take account of their traditional nutritional and medicinal uses and, in general, their function in the local health system.

The deteriorating economic situation of many DCs has led to a massive concentration of job-seekers in the expanding cities. Elsewhere, as in the Amazon, government colonisation projects are being set up, leading to a considerable influx of migrants to the «pioneer» tropical zones, which governments have difficulty in controlling. These recently occupied areas are under-equipped for medical treatment. In both these situations, medical demand is increasing, stemming from poor states of physical and mental health. Besides the inadequate provision, these poor populations cannot afford the usual medicines, and they make considerable use of popular remedies, mainly herbal.

In Tanzania, there are an estimated 30 to 40,000 traditional healers to every 600 doctors.

One cannot refuse to carry out research into the substances used merely because their objective content is modified by superstition. The efficacy of popular therapeutic practices must be evaluated, with a view to partly or selectively integrating them into official health systems.

In the French overseas territories and departments, preferential use of «traditional» therapies in a society with a modern and relatively accessible health service seems to reflect an assertion of cultural identity.

Scientific implications: involving Southern scientific partners

The objective here must always be to strengthen the research and development capacities of the southern countries. Further, better use must be made of local skills and potential with regard to products of regional importance, and research must be developed on issues of major importance for the DCs, such as treating illness in insolvent markets.

However, there are ethical and political implications as well: for a project to succeed, all the participants must be clearly informed of the scientific and commercial objectives. Fair sharing between public and private partners of the immediate and probable longer-term benefits, in developed and developing countries alike, implies working out and keeping to a common code of conduct for all.

Fair sharing of results between communities, Northern and Southern researchers and industry

It seems hard to lay down a single rule defining the proportionate share due to the DCs, given their differing skill capacities. Countries like Brazil or Mexico are capable of exploiting natural products in their best interests and would want a sizeable share of the patents applied for to protect the findings.

For DCs that do not have a high enough technical level, acknowledgement of intellectual property could involve suitable financial compensation, to be judiciously directed towards environmental conservation programmes.

When profits are expected, the responsibilities of each must be established at the political level, and this must not only involve the scientists. One problem that often arises is how to define the local entity involved: is it a clearly-defined region, an ethnic group? In any case it has to be an organized entity - a local, regional or national authority or institution.

At the local community level, if, through one of these programmes, their herbs were experimentally shown to have objective therapeutic properties, this would help to integrate the validated herb-based therapies into local public health policy.

The author will comment on one partnership experiment currently being run by ORSTOM: in Bolivia, a Franco-Bolivian team is studying the leishamicidal action of herbal remedies used in traditional medicine.

Workshop

Cauchy in Colombia: Useful or academic mathematics?

Luis Carlo ARBOLEDA*

The institutionalisation of the sciences, which started in the 19th century and went well into the XXth century, failed to keep pace with or even build on the great strides made in Colombia's final period under colonial rule. It was unfeasible to embark on an ambitious programme to establish facilities for the sciences and technological development in a society which, since becoming independent, had been unable to resolve the political differences of its factions in a civilised manner. In a country whose priority was to recover from the devastation left by wars, independent cultural and scientific reforms could hardly take pride of place. Visionary politicians were hard-pressed to garner the seemingly elusive social mandate needed to put together a nation-wide plan for a unified state.

The development of «republican science» organisations and activities was not only blighted by the prevailing social context, but was also hampered by a policy towards science which doggedly adhered to the utilitarian model of «colonial science». During times of social stability, the intellectual elite were more attracted by explorations and surveys to make an inventory of natural resources than they were by investigative research into natural science. Institutions fell into the categories of academic associations, basic education establishments and training institutes for the professions or trades. The pursuit of science took place outside of these - in the main, it was undertaken in the exuberant nature laboratory of America, newly expropriated from its European overlords.

The few free-thinking scientists of the time generally directed both themselves and their students towards the solving of technical problems and the search for tangible applications, on the basis that they could thus best assert a national image. Gradually, science came to mean «country-specific knowledge», its aim identified with the vernacular and the worldly. From the Republic's infancy, the conceptual school of useful science held sway over the elite. Its first generations of citizens were thus dealt a poor image of scientific speculation by the «scientists of independence», whose vociferous argu-

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ments challenged all that was scholastic and systematic in spirit. In the decades to follow, the country gradually came under the English and North American sphere of influence, which provided the right conditions for the educated to adopt values of pragmatic science in preference to the French academic and speculative scientific model.

A number of famous scientists in Colombia, equally committed to scientific and social development projects, bucked this trend and advocated alternatives to the utilitarian model. They were apparently well-versed in the revolutionary developments in mathematical sciences emerging from European centres, notably from France, and had heard about institutional teaching and research facility projects being commissioned as part of national modernisation programmes. Some of them, such as engineer and mathematician Julio Garavito Armero, apparently espoused a different interpretation of the Colombian Republic's agenda for science and technology. They called for the creation of a strategic knowledge base, from which more advanced phases of social and economic progress could eventually be launched.

In the present document, we aim to bring to light some issues which led to the emergence of this alternative concept of science and nationalism, as supported by mathematicians towards the end of the 19th century. We shall present the social history of a mathematical treatise written locally, which, in our opinion, represents the culmination of efforts to achieve concurrence on a new scientific creed by members of the elite. It dates back to a stable period in the first Republic which witnessed the final phase of the institutionalisation of the sciences. The document, which promulgated the formation of a separate culture of modern sciences, was drawn up as part of the manifesto of Garavito's circle of intelligentsia. Its primary source was a pragmatic French mathematical opus, itself a study of the unpublished manuscript of the course used at the Mathematics Faculty of the National University of Colombia (Bogota) in 1912 to introduce the country to the teaching of Cauchy's infinitesimal calculus.

Workshop

Scientific language and national identity: Egypt from the 19th Century

Pascal CROZET*

The language question or, to be more explicit, the question of the encounter between the Arabic language and the scientific knowledge and modes of thought introduced from the West, arises automatically for anyone looking at political and intellectual life in Egypt in the 19th century. From the *nahda* to the nationalist movements, language was a constant subject of debate and reflection, an ever-present focus of demands: a focus of the concern for national identity and cultural heritage and, paradoxically, of the desire for reform.

While modernization of the language (rendered inevitable by changes in all spheres, the development of the press in particular) affected style and syntax in particular, it was the issue of specialist vocabulary that seemed to be the main challenge for the first translators. The problem of borrowings from Western languages and their integration into Arabic was to be an increasing preoccupation for most Egyptian men of letters and was one of the main reasons why some of these men suggested, at the end of the century, that an Egyptian Academy be set up. An almost automatic corollary of the translation problem was the problem of deciding in which language science and technology should be taught.

A first debate on this issue, in the 1830s, soon aborted. The official view was to keep to Arabic for science and technology teaching; the opposing view, that French should be used in higher education, was argued on the basis of a general critique of the translation enterprise per se. At the end of the century, when the British occupying authorities took charge of the education system, they used same arguments in almost identical form in favour of English, though the ulterior motives were doubtless different. The same arguments reappeared again when the Egyptian University was set up in the 1920s, and again in our day, since the issue is still periodically raised. The two main arguments are well known:

• The lack of an adequate Arabic terminology makes translation too demanding a task and its results too uncertain to provide a sound base for teaching;
• Translation is in any case bound to be inadequate since it is impossible to translate everything and it is essential to be able to keep in touch with the latest developments in science and technology.

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But these ideas were being formulated at a time when Egypt's State apparatus was being formed, shaped in response to a clear wish for increased independence from both the Ottoman sovereign and the Western powers; one can well imagine that they ran counter to the general trend. So it was that Arabic became the language used, almost throughout the 19th century, for all teaching of modern Western science, at all levels, including the medical school and advanced studies schools. In practice, the question of which language to use for teaching only really arose when the bankruptcy of the State put Egypt under British control, leaving the field free for gradual, total anglicisation.

This link between the language used for science teaching and the national question was of course stressed by the nationalists themselves. Not only was Arabisation of teaching one of their major demands, they also tended to see the early translators of scientific works into Arabic as the precursors of the national movement.

Despite the importance of the language issue in nationalist rhetoric and demands; despite the symbolic need for Arabic to become a scientific language once more and, beyond that, to fulfil its task of «transmitting modernity»; despite the recurrent evocation of the work of the scientific translators from the days of Muhammad Alī on - despite all this, as far as we know no study has been made until now, even superficially, of what we would be tempted to call the reconstruction of a scientific language.

This paradoxical contrast between the lively polemic over the potential or lack of potential of Arabic as a scientific language and the paucity of research into the first contacts between this language and modern science is partly due to the connection with different interests and ideologies. At least a modest study of the question was called for, if only to try to reduce this imbalance. A second reason why this study seemed to us to be necessary was to help assess what might be called the «appropriation» of the new knowledge by Egyptian society, and to show the role played by the traditional sciences in this.

What we are presenting here are the first findings of this research, restricted to mathematics, mechanics and astronomy. More precisely, since it was the teachers and scientists who first introduced the scientific discourse and made the associated linguistic innovations, we are dealing mainly with the language of science teaching and applied science, our sources being essentially higher education textbooks.

So while trying to embrace the range and quality of linguistic innovation from the time of Muhammad 'Alī - an entirely new field of study - we shall try to set this linguistic reconstruction against the background of the contemporary history of science in Egypt and place it in the broader context of the nationalist or reformist movements.

Workshop

Science and conscience: The ambiguous struggle of Cheikh Anta Diop

Dr. Alain FROMENT*

To many Africans and West Indians or Afro-Americans seeking their roots, Cheikh Anta Diop is the greatest scientist the world (or Africa, at least) has ever seen. Alongside his academic life, he was a prominent political activist, the emblematic committed and liberating scientist in person. His approach to anthropology and history, his main subjects, was often controversial. Sadly, though, there was never really any genuine debate with the «official science» school, whose members were not interested in discussing theses (they) generally considered to be marginal. Since his death in 1986, however, numerous successors and enthusiasts have raised his work to a level of great sociological and political importance, thus making debate on their basic content inevitable.

Any such discussion should be strictly technical, so this paper will only talk about positions within the competence of its author, i.e. the domain of physical anthropology: origin and diversity of the human species within a paleontological perspective, and «racial» interpretations, notably in the area of Egyptology. Cheikh Anta Diop was not a specialist in our area of interest, yet it was central to his problematic. He concocted an elaborate mixture of notions gleaned from a variety of works and pure speculation, which, if we go into the details, were often detached from an objective grasp of the facts.

So, unable to produce new elements in paleoanthropology because of his lack of personal research in the field, he sorted through the work of Occidental and South African researchers who had shown cradle of modern man was in Africa, a plausible yet unproven hypothesis which was not new to Europe. It was first put forward in 1813 and then championed by Darwin in the 1870's. The followers of Diop have appropriated the recently fashionable African Eve theory, exciting a feeling of racial pride which has gone so far as to have australopithecine representations like the famous Lucy, which they gladly take to be the first woman, repainted black.

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SCIENCE AND NATIONALISM

Although Diop used craniology to defend the idea of a Paleolithic Negro man, tropical forerunner of modern Europeans, he did not do so with regard to Egyptian skulls, which he avoided analysing, prefering a more subjective approach based on texts and selected artistic representations. By applying various computing methods to the form of the skull, though, Egyptian ones can be proven to be neither European nor Black African. Unfortunately, there is not a scrap of archeological or technical evidence in support of the argument that Black Africa has a direct line of descendancy back to Egypt: i.e., a massive migration of black Egyptians forced to flee the Nile Valley into the rest of Africa by white invaders.

From a more philosophical point of view, and one shared by Césaire and Fanon, the dignity of man or humanity of a people, is not linked to how much they contribute to technical advances, any more than there is greater pride to be drawn from the fact that the first fossilised man appeared in this or that place. It is clear that the whole human species originates from recent, common roots. The thesis suggesting that imperialism seeks to deprive exploitable populations of any culture does not hold water. Prior to independence, archeological research consistently unearthed the traces of ancient civilisations unknown to the natives. This shows that the process of historical research is not, in fact, systematically coupled with the process of colonisation.

In the end, Cheikh Anta Diop's greatest contribution was that he popularised historical anthropology among Africans without access to specialised scientific literature. His work created vocations in a neglected area. However, his tendency to «racialise» research and make it into a platform for a nationalist political claim, leaves a feeling of discomfort. Whereas he himself had been a man of outstanding dignity and merit, there now exists a generation of para-scientific authors who are inspired by him alone and trying to do without a «classic» scientific approach that they suspect as being imperialist. The declared desire for professional competence is not respected. The numerous outbursts we have already seen from the upholders of Afrocentrism in the United States rightly worry researchers determined to promote genuine research in developing countries and to fight against the emergence of a ghetto where an «African science», cut off from the universal community, might generate a narcissistic way of thinking and run a great risk of falling into disrepute.

Workshop

*Foreign polytechniciens** and nationalist movements*

Anousheh KARVAR*

This paper looks at twenty foreign engineers who, having enrolled at the French Polytechnique in the inter-war years, then became actively involved in nationalist movements on their return home.

They came from countries as varied as Iran, China, Vietnam, Tunisia, Lebanon, Morocco and Algeria. Analysing their individual itineraries will bring out the main themes and regularities, and even a career typology.

To begin with, we examine the policies some countries, such as Iran and China, considered for having their young managers trained in science and technology in France. We then go on to study France's policy of scientific and technical education in the territories of her empire (Indochina, North Africa).

This will serve as groundwork to help us establish the reasons why those young students were attending the French *grandes écoles**, and the *Polytechnique* in particular, and what drove them to choosing top level scientific and technical subjects.

Taking up a career on their return from France, every one of our foreign *polytechiciens* went through an initial phase of maladjustment with regard to the existing scientific and technical infrastructures. Despite having been educated in subjects of excellence in France, they were forced to fill subordinate posts in the administration and teaching, supervised by often less qualified, Western experts.

The second phase of their careers, on the other hand, was often marked by a key nationalist political engagement: ministers in provisional independence governments, technical advisers, military commanders in anti-colonial armies, etc.

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** *Polytechnicien*: student or former student of a *Polytechnique*: a *grande école*, or prestigious school of university level (with competitive entrance examination), which embraces several scientific and technical fields.

Could that commitment have been the result of the social and professional frustrations encountered at thestat of their working lives?

Did the years in France influence how the political thinking of those young managers took shape?

How much of the commitment can be attributed to the scientific and technical abilities acquired abroad and how much to politicking?

Was nationalistic engagement solely for engineers as an embryonic socio-professional class? In other words, were engineers the only scientific managers to take functional responsibility in the nationalist movements?

How could the acquisition of Western sciences and techniques be considered as an arm for independence? What sort of expertise could Western-trained engineers contribute to the civic debate?

We shall present our working hypotheses in response to these questions, and try to single out the profile and creed of the inter-war foreign polytechnicien.

Finally, we shall analyse the third career phase of those engineers. This, in the Sixties and Seventies, mythical decades of economic development and planning in peripheral countries, was characterised by a «return to calm» and more traditional duties: State engineers, advisers, planners, ministers in charge of technical briefs, founders/teachers of engineering schools and faculties of science ...

This case study is the fruit of an extensive survey and essentially based on the verbal testimony of living players. It should enable us to shed broader light on the close links between the appropriation of modern science and political independence in peripheral countries.

Engineers from those countries had to earn their room to manoeuvre through commitment of their own or on the part of their peers in opposing the old local and colonial legitimacies. Faced with the growth and technical nature of the problems the political powers submitted to their expertise, their utilitarian roles gained them a level of public esteem comparable to that of any of their Western counterparts.

Workshop

The quest for identity in Science and decolonisation in South Asia

Deepak KUMAR*

Colonisation entailed a massive cultural encounter which influenced profoundly the cognitive and material existence of both the coloniser and the colonised. In this encounter, the role and place of rationality, science and technology has several fascinating aspects. South Asian Society claimed a living tradition and a vibrant culture and yet it found itself caught in a web. The encounter was initially disturbing, even agonising ; gradually, the relations stabilised and the recipients started examining what was living and what was dead in their system, and under the new circumstances what to accept and what not.

In the midst of complete subjugation, a quest for identity had begun. In this quest were hidden the seeds of decolonisation. In the very process of empowerment one can also see the possibilities of disempowerment. The colonial process was self-destructive in this sense at least.

The question of identity was important for a colonised society and its subdued psyche in the same way as the feeling of superiority and invincibility was for the colonisers. The retrieval of this seemingly lost identity was a precondition for regaining lost sovereignty. The paper begins by outlining the early phase of this struggle (especially during the Victorian period) and then concentrates on the events and instances occuring during 1900-45. They are drawn from the professional and institutional activities of the Indian scientists.

Right from early nineteenth century, the Indians began to grapple with the harsh realities of subjection and one can see anti-colonial consciousness in an embroynic form. It took time to develop and the intervening period does give an impression of a comprador-collaborator relationship. But the real situation was much more complex and it can not be explained exclusively in terms of colonial impact. The urge to comprehend modern knowledge and tools

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which the colonisers had brought and to assimilate them was definitely there. This urge came from within and found expression in the writing of Ram Mohan Roy, Bal Shastri Jambhekar, Master Ramchandra and many others. In face of an unprecedented cultural onslaught, the new pioneers were dazed, if not bewildered. They experienced a dual alienation (*a la Cabral*) from the traditional and later from the colonial life and system.

A substantial change came during the late 1870s and 1880s when science education picked up and several scientific societies and associations were established and manned by the local people. The opening of the Indian Association for Cultivation of Science in 1876 is a cultural landmark. The early rays of this dawn were P.N. Bose (geologist), J.C. Bose (physicist) and P.C. Ray (chemist) Strictly speaking, the level of dual alienation had definitely come down by now but these scientist had to wage a different dual fight, one against the local colonial authorities for grant, support, etc., and another against the metropolitan scientists for scientific recognition. By the turn of the century very marked anti-colonial feeling emerged. The deliberations of the Indian National Congress and the Swadeshi movement greatly influenced the Indian scientists and technical men of the time. Demands for more institutions, more facilities came in torrents. The number of scientific papers grew and with it appeared a greater degree of professionalisation and recognition for the indigenous talent.

The formation of the Indian Science Congress was another landmark . New research and new agendas were taken up and it was no mere coincidence that these coincided with the warming up of the national movement for independence. The inter-war years are replete with several instances of the change in scenario, a vision for the future and a clamouring for building up national scientific and technological capabilities. The scientific researches of Ramanujan, S.N. Bose and C.V. Raman were morael-boosting. M.N. Saha and his Science and Culture Group envisioned a future as had never been before. Independence was in sight and the phase of transition had begun. There were clashes of views and personalities. The process of decolonisation was not smooth as the process of colonisation itself. What were the pitfalls ? The present paper will try to look into them with the help of certain private papers and archival documents not used before.

Workshop

Metropolitan struggle for political and economic hegemony in the field of health : The transit from hygiene to public health in Colombia during the 20th century

Emilio QUEVEDO*

This paper is focused on the transit from Hygiene to Public Health in peripheral countries. It studies how this process occurred in Colombia during the first half of the 20th Century. In the first paragraphs the 19th Century antecedents of this process are revisited : three big international Empires struggled for hegemony in the field of health in the Third World during the last 3 decades of the 19th Century (France, Great Britain and the USA). The first initiative was taken by France with its Pasteur Institute that intented to «coordinate microbiological research all over the world». Teaching started with the foundation of the Institute in 1888 with foreign students returning to their home countries to work, retaining a permanent link with their tutors in France. Great Britain, however, soon developed a new discipline, Tropical Medicine, with its own institutions and methods that will enable a successful ability of intervention in the health policies in peripheral countries. But, in Latin America, the USA very soon captured the first place in this race. The paper focuses then on two related events that took place in the sanitary field during the first half of the 20th Century (1914-1960) and favored a gradual turn of the Latin American nations from European dependence towards the orbit of North American influence. These two events will be used in this paper as a platform in order to understand the way this nation got ahead of France and Great Britain in Latin America during the first half of the 20th Century, and the way it influenced the transit from hygiene to public health in Colombia. The first event to study will be the way the international sanitary institutions and the North American philanthropic foundations joined in promoting both their public and private interests in order to strengthen their positioning in Latin America. The International Sanitary Office, that some years later has transformed into the Panamerican Health Office, is considered as instrumental in consolidating North American regional political and commercial interests in Latin America, as it develops a broad space of sanitary organisation parallel to the european previous organisation. In the one hand, this Office strongly promoted the consolidation of local institutions able to start sanitary control in seaports where North American ships had to tie up to the quay, and in continental territories where fruit and petroleum companies had their settlements. Besides, North American presence in Latin America, resulting from economic and political expansion, is legitimised and strengthened

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by the participation of the philanthropic foundations. They integrated their international interests with those of the Federal State,as their sanitary intervention in Latin America constitutes a frame of protection of the multiple forms of commerce and local investment, inside the scheme of «enclave economy». That means to study the role of foreign interests in peripheral countries and their interaction with local actors and geo-cultural contexts. The second event is constituted by the role played by the concepts of «Tropical Medicine» and «Public Health» as catalysts of this process. The old hygienist model, predominant in Latin America since the times of the Spanish and Portuguese Colonial Regime, wase progressively put aside during the firest half of the 20th Century and replaced by the North American concept of «Public Health», developed by the new schools in this field, created since 1914 with the favour and support of the Rockefeller Foundation. This new concept integrates the German developments in microbiological scientific research and the British concept of «Public Health» more focussed in their experience on sanitary institution management. The possibility of intervention over the epidemic and infectious diseases that this new concept strengthens, turns it into a very important and effective instrument to assure healthy local conditions for commercial and productive activities. It will be necessary then to establish the way this new concept of Public Health was constituted ; how this concept developed as the «arena» where scientific theories, sanitary campaigns and health policies were transformed in to political and economicl struggles and how it was articulated to the «architecture» and dynamics of North American models of science, and to the interests behind them, in order to see how they operated in transit from hygiene to public health in Latin America and in Colombia during this period.

I intend to demonstrate two hypotheses : first, a scientific concept is not only a rigorous and systematic mental representation of reality from a specific point of view, but also a social construction that includes in its intimate structure interests and contextual tensions and, can be therefore turned into an instrument for economic and cultural imperialism ; second, diffusion of science is a conflictive and negotiational process between metropolitan science and power and local geo-political, economic, social and cultural contexts and not a passive process from the Metropolis to periphery where rationality and knowledge come to occupy an empty space where ignorance and superstition reigns. My final objective is to bring together the fields of Social History, Social History of Science and Sociology of Knowledge, in order to construct an explanation of the diffusion, assimilation and institutionalization of health sciences and medicine in peripheral countries, as a way towards the future construction of new conceptual frames for the development of more coherent and equitable policies in science, technology and medicine for international cooperation.

Workshop

Patronage, competition and rivalry: The structure of scientific exchanges in the age of colonialism

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The nineteenth century was a century of tremendous developments in the domain of science : the growth of imperialism was the hallmark of the latter half of the century. The transmission of scientific ideas in the colonies was partially structured by the necessities of imperialism. This paper examines the modalities of scientific exchange between the early generation of Indian scientists and their arrived European counterparts ; such an examination provides an interestly vantage point to elucidate the fine structure of metropolis-province interactions, for at stake are the normative values of science inscribed in the professed internationalism of science, counterposed to the politics of knowledge. These interactions can be framed by two essential themes, for convenience we shall refer them to as science and colonialism and science and nationalism. We take into consideration the correspondance between three pairs of scientists : Ramchandra - De Morgan, P.C.Ray - Berthelot, Ramanujan - Hardy, to disclose how at one level of narrativization the European voice is privileged, wherein science is considered to be an immanently European activity. But more importantly, the nature of these exchanges are dependent upon the state of the development of the institutions within which these individuals are located. While the scientist from the colonies is patronised as one to be seduced by the virtues of the mission civilisatrice, the self- professed norms of science blunt the imperialist edge. De Morgan's hope that Ramachandra's Treatise be prescribed as a textbook on elementary calculus for British schools, or Hardy's efforts to induct the «clerk» from Madras into the network of Cambridge methematicians, reveals the context of the internationalism of science. Thus while the metropolitan-province relationship provided structure for the emergence of novelty, a fundamental assumption of the model is that emerging scientists in the colonies needed authority figures to foreward their scientific claims and thereby gain entry to the republic of science. Once entry was gained the internal norms of the scientific community were operational. The supposad internationalism of science was the utopian promise of the «republic of science». But for the scientist from the colonies entry into the «republic» was granted through the mediation of authority figures of science.

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Workshop

Scientific pioneers and nationalism in India

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The object of this paper is three-fold : (i) to present a perspective on the emergence of scientific pioneers in India in the first half of the twentieth century ; (ii) to point out the socio-political milieu in which they scaled peaks of excellence ; and (iii) to reflect, in this context, on the growth of modern science in the post-Independence period.

After elucidating the trend-setting role of J.C. Bose, the pioneering contributions of P.C. Ray (founder of a school of chemistry and pharmaceutical industry) ; J.N. Tata (founder of the Indian Institute of Science at Bangalore) ; C.V. Raman (inspiring research (Leader and Nobel laureate) ; M.N. Saha (propounder of the internationally acclaimed Ionisation Formula in astrophysics) ; S.N. Bose (of Bose-Einstein Statistics fame) ; H.J. Bhabha (architect of Atomic Energy Programme) and others, will be presented in relation to the intensity of the freedom movement and the associated national fervour.

The coincidence of the establishment, in 1876, of the Indian Association by S.N. Banerjea, which in some respects paved the way for the coming into being of the Indian National Congress (1885), with that of the Indian Association for the Cultivation of Science by M.L. Sircar in the same year (both in Calcutta) is more than meets the eye. Significantly, it was in the latter that C.V. Raman, who had no foreign training, did his epoch-making research in 1928 which won him the Nobel Prize in Physics in 1930. It is interesting to note that, between 1928 and 1930, the concept of *Purna Swaraj* (complete Independence from the British rule) as the goal of the freedom movement was conceretised. This non-violent movement, led by men of great vision and high integrity, became mass-based and provided an inspiring ambience especially from the 1920's for nearly three decades. It was in this ambience that the scientific pioneers, who were doubtless influenced by the new nationalistic mood, made their mark. Though they did not actively participate in the freedom movement, their scientific initiatives and high attainments emanated from the national spirit within them.

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SCIENCE AND NATIONALISM

In the post-Independence period, a purposeful wide base for science and technology has been created specially over the last three decades and is being assiduously fostered mainly with the support of the State. The importance of science and technology as veritable instruments for social betterment has been well recognised. As an expression of the nation's committment to science and technology, a Scientific Policy Resolution was adopted by the State in 1958. Over the last two decades, a wide range of scientific and technological capabilities has come to the fore as definitive indicator of the nation's scientific progress.

Yet, there is a growing feeling that the scientific achievements in the post-Independence period have not measured themselves up in such away as to advance the frontiers of science and technology ; nor do they match the earlier pioneering endeavours. On the other hand, there have been major impressive strides of adaptation in atomic energy, space technology, defence science, scientific agriculture and a few others. Could there be any relation between the decline of national spirit, which is noticeable in the post-Independence period, and that of the innovative urge ? We shall reflect on these aspects, of science as well as the need for national spirit in the emerging Indian context.

Workshop

Into the 20th century: Patterns in the relations between Science, Technology and the State during the early industrialisation process

Ian INKSTER*

This paper argues that many of the features associated with the advance of science and technology in recent years and their role in the process of industrial modernisation may be found also during an earlier period of momentous change prior to World War One (1914-18). In particular, an historical treatment of some contemporary themes yields a theory of sequencing which promotes understanding of the linkages between industrial and economic change on one hand and science, technology and the State on the other. The value of the approach is made most apparent during periods of widespread technology transfer between nation States, a programme for speedy modernisation led by governments which, in fact, normally fails at enormous cost to both exchequers and private interests. Successful industrialisation through technology transfer is a rare occurence which has adhered in a group of nations of very differing characteristics, from mid-19th century USA to late 19th century Japan and Russia to 20th century Japan, Europe and the Asian newly industrialising countries, and which is presently a major determinant of the fast pace of industrial change in modern China.

The Introduction surveys sceptical views of the historical relationships between science, technology and the State, whilst Section II introduces a theory of sequencing which draws on both historical and contemporary experiences. Parts III and IV provide the data core of the paper and represents its most substantial sections. They cover the process of technology transfer in the «first climaceric», showing how the years around 1870 to 1914 forged specific relationships between science, technology and the State, and develop general points from research on Japan and Russia. Section V applies some of the lessons of this phase of industrialisation to the interpretation of what we term the «second climaceric» (circa 1970 onwards), the far more recent period in which once again the experience of nation states has diverged and the world has grown more complex. The political and economic significance of recent global changes, especially those centred on the Asia-Pacific, means that judgements about the «proper» relations between science, technology and the State are politicised. It follows that research along those lines will for some time be in danger of yielding far more heat than light.

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Workshop

Japanese business in Mexico: Study of the forms of technology transfer

Arturo LARA RIVERO*

The paper aims to report on the technology transfer strategies of four Japanese electronics companies: Sony (Tijuana), Sanyo (Tijuana), Matsushita - Panasonic (Tijuana) and Panasonic (Distrito Federal).

The study is based on information collected directly from the companies by the author, with a view to:

- charting the technology transfer strategies followed by each of the companies,
- describing the attributes of those agencies instrumental to or benefiting from technology transfer,
- outlining technology transfer, which could be used to build a useful typology to draw up standard proposals for a technology policy.

There follows a sample of the study's findings.

Two establishments owned by the same company and located in two separate regions of Mexico have experienced different technology transfer strategies. The situation prompts us to assert that even within an individual company, there is no exclusive model for technology transfer. In fact, every company and manufacturing site has a specific pattern of technology transfer which emerges from its particular history and context.

We compare both the transfer strategies and the technology paths of each of the companies, and postulate a hierarchy for the variables which play a major explanatory part. The present study leads us to the fundamental conclusion that there are no simple answers. On the contrary, the answers are complex, multi-faceted and dynamic.

Companies' capacity to absorb technology depends as much on structural variables (the technology, the product, the size of company, etc.) as it does on the strategy of the individuals involved.

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We consider individual strategy on the issues of corporate philosophy, stimuli and means of communication to be particularly important.

The study dwells on the means of communication set up between the Japanese engineers and Mexican engineers and technicians, then down line from the latter to the operatives. We are interested in how communication passes between those involved, because Japanese engineers are one of the most important vehicles for the transfer of know-how. A company's capacity for receiving and harnessing technological apprenticeship, and, by extension, the form and rhythm of technology transfer from Japan to Mexico, is shaped by whether the lines of communication are horizontal or vertical, free or bureaucratic,. etc..

Workshop

Technological learning and strategic competitiveness indices: Results of a study of the chemical and petrochemical sectors, and companies drawn from the metalworking electromechanical engineering sectors

Arnoldo PIRELA*

The aim of this exposé is to present the latest results of this research programme, from the empirical viewpoint as well as from a conceptual and methodological approach. It is in this spirit that we present the «Strategic Competitiveness Index» as applied to the chemical and petrochemical sectors, either as applied to a correlation limited to Venezuelan companies or as applied to all the companies from the various participating countries. The «Strategic Competitiveness Index» is also applied to a sample of forty-nine companies from the metalworking and electromechanical engineering sectors which supply the Corporación Venezolana de Guayana (the largest metallurgy and hydroelectric complex in the country). The index offers an appreciation of the complicated inter-relations between a very high number of variables. The latter are all directly or indirectly related to the innovative nature of the companies - either in terms of their ability to respond efficiently *when technological, economic or organisational distortions crop up in their working environments, or their own capacity to cause these imbalances.*

The positioning of individual companies in the Strategic Competitiveness Index is established according to a system and survey developed by our team, which employs statistical analysis and multiple variables. The variables classify companies, indicate the elements which make for long-term competitiveness, and identify the actions required for positive progress through the competitive «ranking» method used by our classification.

As regards the chemical and petrochemical industries, the index is now limited to Venezuelan companies compared to a sample of thirty-five Brazilian companies producing "pure chemicals" mainly for pharmaceutical applications. By the end of 1994, we will have a list of approximately two hundred Brazilian chemical and petrochemical companies, and roughly seventy Argentinian and forty Mexican companies from the same sectors. We should have about seven hundred companies listed from these four countries, and an additional sample of about one hundred and fifty small and medium-sized Canadian, French and North American companies representing the chemical

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sector, by the end of 1995. At that point, the Strategic Competitive Index will have achieved its maximum international coverage.

As regards the metalworking and electromechanical engineering sector, the index currently includes all forty-nine companies in the sample, and by the middle of next year, the survey should extend to some six hundred companies from the same sector which supply the Venezuelan processing industry.

The *Strategic Competitiveness Index* and its analysis can be used to:

• Rank companies in terms of competitiveness for the whole Venezuelan sector and comparatively with similar companies in other Latin American, North American and European countries,

• Identify the strengths and weaknesses of each company and the most expedient strategies to achieve higher ranking,

• Assess projects in terms of capacity and innovative potential of the companies engaged, and provide information to financing bodies and those considering joint venture involvement,

• Assess complex production chains and competitive sectors, again to assist in policy formulation by public bodies but also to identify selection tools suitable for use on groups of companies and complex sectors.

The following main conclusions can be drawn from the work:

• Firstly, the State's role in Venezuela needs to be redefined in the light of the country's new economic circumstances and current political, technological and world trading trends. Hitherto, the difficulty has been that the structural adjustment programmes, characterised by strong international financial backing, were based on the premiss that the State had to be dismantled. However, this was attempted without regard for the culture's success over the last seventy years in creating an industrial backbone of production and an entrepreneurial class. Equally, it appears to have escaped the powers that be that this Venezuelan State simply cannot be summarily replaced in certain areas. On the contrary, a new style of direct intervention is required on new projects to meet the modern-day demands of global competition. Our research programme does not limit us to identifying the key programmes the State should be promoting. It also enables us to start the building-up of one of its most central tools, namely: a technical and economic information system to cover the region's chemical and petrochemical sector, enlisting the main players from among Latin American countries.

• Secondly, up to now Venezuelan companies have only partially integrated the three areas of economic, technological and organisational culture. This has led to a behavioural pattern which, in recessionary times, sacrifices technological and organisational capacities and potential in order to face up to the purely economic requirements imposed by the context. In order to arrive at a new entrepreneurial culture capable of meeting new demands, a very clear picture must be developed of the basic precepts currently held. Then a direct comparison of the cultural characteristics and behaviour of companies in the same business, both within and outside the country, should be made. It follows that the biggest problem to be solved is the ability to call on a tool for comparing and ranking companies, which, in a general manner, examines their capacities and innovative potential and areas of focus, in particular, on their technological potential. The Strategic Competitive Index, together with the information and assessment tools we have developed, is a direct response to these needs.

Workshop

Organisational learning in Venezuela: Companies and research groups in transition

Rafael RENGIFO MAZARINO*
José Gregorio DARWICH *

The paper summarises the preliminary findings of two studies in progress into technological and organisation processes of companies based in Venezuela. Observations are reported by way of working hypotheses, in the context of global and local transition, on the organisational responses of academic research groups to financial, administrative and political restrictions. In the new order, organisational matters and learning how to handle them both explicitly and implicitly assume the importance of strategic platforms for growth and survival of the various agencies in the country and region.

Companies and research centres are gradually emerging as protagonists of a process of universal transition. In developing countries, however, this transition is accompanied by partly implemented modernisation which incurs great social, political and economic debts. This process is particularly complex and critical in Venezuela because of the contrast between the high-profile conventional technological modernisation, funded by oil revenues, and the institutional, political and administrative torpor. A «new techno-economic paradigm» has made its impact just at the time when oil revenues have slumped, creating a scenario where companies and research centres, as well as other corporate entities, are finding themselves under intense pressure to embrace organisational restructuring. As new organisational models are sought, the processes through which organisational knowledge is transferred are emerging through books, specialist publications, conferences and particularly through consultants. They are blueprints for job organisation and evaluation, managerial practices, participation and training patterns - in a nutshell, the models of organisational learning.

At first, we were interested to assess how widespread organisational modernisation was within a technological listing of 122 companies in the chemical industry, drawn up by A. Pirela in the «Technological Behaviour» project. In other words, we contrasted technological learning with some of the key variables of organisational learning. Where there is large organisational inertia in even technologically active companies, the results are particularly indicative of a serious weakness, namely, the lack of synergy between technological and organisational change.

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Secondly, we sought to define some common elements in the processes of organisational learning. With the benefit of direct involvement or by access to the reconstruction process, we concentrated on case studies of companies in various industries - especially those undergoing organisational reform. The synthesis of the sector-wide and micro-approaches enabled us to pinpoint some key problems which were both empirical and conceptual in nature (organisational misadventure for the former and the notion of context as construction versus adaptation for the latter). Moreover, we came to appreciate how businessmen and local managers understand the new organisational models, how they interpret «total quality» or «zero stocks» schemes or how they apply flexibility in employment.

Thirdly, we looked at considerations involving research bodies which arise from intellectual and personal association with the scientific community and its institutional milieu. Organisational learning in research bodies could be described as working hypotheses. The cases of «positive feudalism» as survival strategy or the heightening of tensions between the various models of «academic excellence» illustrate not only the impact of the local recession in all its manifestations, but also the jostling for position taking place inside the international scientific system, currently clouded by the recession. The local scientific community's capacity to take on new forms of local, regional and international links seems to rest largely on its ability to clear up the debate on the various organisational objectives and designs.

Lastly, we posit some general guidelines, which could be taken as a point of departure for organisational modernisation policies in the manufacturing sector and in research centres and bodies. Additionally, we make note of some conceptual and methodological frameworks, which, if linked to specific projects, would enable research, especially comparative research, to be generated. Themes central to these research programmes would be: forms of change in transferred organisational designs for local organisations, shaping organisational learning for local culture, intervention models for organisational exchange and its effects. Comparison of, for example, the French, Venezuelan, Latin-American or any other developing country's version of the interpretation and handling of previously mentioned issues such as «total quality» or «zero stock», and others, such as employee participation, the people-processes desideratum, flexibility and hierarchies, etc., would constitute a step forward towards self-knowledge and co-operation.

Workshop

Knowledge, culture and communication strategies in technology transfers

Jean RUFFIER*

This text aims to shed light on the conditions required for the success of a technical project or a production resulting from relationships established between actors whose systems of representation greatly differ, due to both their nationality (French, Latin American, Chinese), and their sphere of activity (finance, direct production, equipment sales, design).

Backed up by observations of transfers of technology to less developed countries, the paper opens with the way things stood at the beginning of the Eighties, prior to the slump. The difficulty many regions of the world had in getting their industry off the ground was put down either to an insufficient willingness to cooperate on the part of developed countries who would jealously guard the secrets of their own success, or to those countries' own cultural disability. The drawback of these explanations is that they offered underdeveloped countries no way out. They were no more enlightening as to why South East Asia has managed to become industrialised. Such an inability to make an opening pushed the technology transfer debate into deadlock. We believe the debate didn't place the problems of industrial success very well. Transfers are often prone to failure because they aim to build complex technical systems whose workings haven't been well enough explored. Because decision-makers in less developed countries don't know how to go about assembling smooth-running, complex technical units, they pin their hopes on technology transfers that would having trouble fulfilling them.

That said, case studies show that the barriers to successfully building such systems are generally overestimated. In particular, this success has been shown to be less hampered by problems to do with the level of training, than by the complexity of exchanging the information to be implemented. This first conclusion runs counter to a majority-held view that sees training levels as the key to industrial success. Surveys carried out by our international network of researchers show that highly automated equipment can work well, even with a little trained operator workforce. In other words, training needs are overestimated. The reasons for failure lie more in the difficulties of

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communicating relevant information, difficulties that are inherent to complex systems. Experience shows that solving communications problems is no more problematic in the South than in the North, even if the manner of proceeding has to be in keeping with local forms of culture.

That said, communication is not so self-evident. It is impossible to pass everything on to everybody to the extent that with such complexity, a human brain cannot assimilate all the information needed to understand the whole. The problem of communication is knowing what to communicate to whom, and having the will to do so. In fact, willingness to communicate is very often hampered by opposing interests.

This is particularly visible in the case of big industrial projects. Here, the problems of communication increase with the crossing of diverging strategies, as much with the receivers as the despatchers of transfers. In such projects, the multitude of interacting actors calls for delicate arbitration where the stakes have to be well understood. The interests of the sellers are very often divided between the project's technical success and the profitability of the operation. Buyers divide into two camps: those who appreciate having equipment that can be quickly put to work and those seeking greater local command of technologies to be implemented. Siding with one at the expense of the other generally ends up in technical and economic failure which, in the medium term, very often amount to the same thing.

Here, however, the difficulty is not at all specific to less developed countries. It arises because of the complexity of the technical systems in question. Even relatively simple production systems generally have to incorporate equipment produced by far away organisations. Exchanges between outside suppliers and complex organisations only have a relatively small part to play in the difficulty of making these organisations outstanding.

Workshop

Learning and the transfer of knowledge to industry in China

Shahui XU*

This paper indicates the importance of reasonable industrialization within a sound environment in developing countries. It is based on historical reflections on civilizations in both developing and developed countries using the new natural principles that the author found more than ten years ago in France.

The paper also presents China's experience in science and technology transfer to industry from several perspectives.

The interesting phenomenon is that industrialization through science and technology can create urban development in two ways: by moving forward to the Metropolis or by moving beyond it.

Another interesting phenomenon is the duality of science and technology. We realize that some technologies are not good for environmental protection and that technological advantages are different across nations. Therefore, the important thing is to choose science and technology through learning and knowledge, using wisdom and natural forces to develop industries. We can draw this kind of wisdom from «The Book of Lai Zi» and «The Art of War» by Sun Zi, and «The Book of Changes» (I-Ching).

Based on Lao Zi's saying, «good fortune lies within bad, bad fortune lurks within good,» we may argue that the new industrial revolution may happen beyond the frontiers of the metropolitan countries through the use of the new economic science, biological science, renewable energy sources, modern telecommunication technology, etc. The natural biological city—a beautiful and wonderful picture in human civilization—may first emerge in developing countries.

Finally, through her silk sculpture (a new kind of art), the author will express her thinking about global culture:

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All of us are the Children of Nature,
Earth is Our Common Home, Our Unique Home.

In order to enhance the mutual understanding of various countries and to promote global industrialization, we should use well-known symbols from different countries to reflect the common human ideal and our planet's achievements in science, culture, and economics, comprehensively through art.

Workshop

Science on the periphery: Its links with mainstream Science

Subbiah ARUNACHALAM*

Science is a truly global phenomenon and knows no frontiers, but in the real world we live in, production and efficient utilization of scientific knowledge are highly concentrated in a few countries, and a large majority of countries -those on the periphery- contribute precious little to the growth of scientific knowledge. Indeed the distribution of science is even more skewed than the distribution of wealth among nations. As a result of this extremely skewed distribution, the countries on the periphery are left out in the intellectual discourse that is at the very foundation of the knowledge enterprise. The extent of this skewness and the relative neglect of the periphery can be seen, in quantitative form, from publication and citation data. For example, data from *Journal Citation Reports* citing and cited journal packages clearly show that major international journals, which largely mediate the growth of knowledge in different specialities, rarely cite work published in peripheral journals, whereas a very high percentage of references in peripheral journals are to the important international journals. That is to say while peripheral journals draw heavily upon mainstream journals, they themselves contribute very little to the growth of mainstream knowledge. Another fact that becomes clear is that peripheral journals often quote work published several years ago and rarely cite recent references. Often researchers on the periphery tackle problems of no great current relevance and they rarely work on problems on the moving frontiers of science. There is a distinct time lag before scientists on the periphery commence work on a problem. Again, even when they pick up on a problem quickly their work is by and large not in the path-breaking category. The intensity or extent of use made of knowledge produced in the peripheral countries by researchers in the scientifically advanced countries varies from field to field and even from country to country. That is why it will not be prudent to compare the productivity, impact and communication behaviour of agricultural scientists of Thailand with those of physicists and chemists of India who are working on essentially the same problem areas or in the same genre as their counterparts in North America and Western Europe. Besides, literature-based quantitative estimation of this phenomenon is not as easy in fields such as medicine and agriculture as in say physics.

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This is largely because of the varying degrees of the compactness of the literature of the different fields, and the greater dependence of medicine and agriculture on local needs and practices.

So far we have been talking about the striking differences between science done in the mainstream and peripheral countries based on their contribution to the journal literature of mainstream science as it evolved and as it is practised in the West. Surely there is reason to take the views of Jean-Jacques Salomon seriously. Much as they might have tried hard, those on the periphery have not been able to achieve much. To stop here will be to tell only half the story. The other half, not well explored and not well documented so far, is far more interesting.

It may very well be true that mainstream science has not benefitted much from the efforts of the periphery in the same knowledge system or the benefit has been marginal. But the scientifically advanced societies are benefitting from the traditional medical and agricultural knowledge base of the peripheral societies. Countless numbers of plants used in the traditional medical systems of India, China, Africa and Latin America are now being drafted into the Western system of medicine and a number of multinationals are learning from folk medicine and gathering tonnes of plant material from these regions for manufacturing modern medicine. Ciba-Geigy employs about fifty men in Africa whose main job is to talk to old women about home remedies. Smith Klein and Beecham and Merck Sharpe Dhome have large teams in Latin America trying to learn and profit from folk/traditional medicine. Two U.S. companies have patented Neem products -known for millennia in India- and are collecting tonnes of neem seeds from southern India. Western agriculture has benefited a great deal from the germplasm collections made in the Old World.

It is indeed unfortunate that very little of this transfer of knowledge from ancient systems to modern systems takes place in the peripheral countries themselves. This inability of the Third Worlders to perceive opportunities and adapt themselves quickly to changing situations is one of the factors that is responsible for their eternally remaining peripheral and marginal. Fortunately thought, in recent years there has been an increasing trend in collaboration between researchers of the advanced countries and the peripheral countries as evidenced by the increase in the number of co-authored research papers.

Workshop

North-South scientific cooperation: Overall characterisation and dynamics

Rémy BARRÉ*
Denis CHABBAL*

This paper has three objectives:

- to place North-South and South-South scientific cooperation within the general framework of international scientific cooperation;
- to characterise the way those efforts evolve compared to general world dynamics; to identify possible specificities of large Southern regions from this point of view;
- to characterise the relationship between the activity growth of a Southern area and the growth in its collaboration with the North.

We shall begin by building up a typology of trends in cooperation, by large modern field, following their intrinsic scientific natures. We will then examine the facts about the cooperation (as grasped through co-publications) and their typical development over the last 15 years, by sub-continent.

Our plan is as follows:

North-South and South-South scientific cooperation: an outline typology

Modes and instruments of North-South scientific cooperation

Cooperative action assumes a variety of different, varyingly productive forms. Let's single out: cooperation at the country level, cooperation between scientific institutions, cooperation between laboratories and between individuals.

In practice, we need to assess the effects of these forms of cooperation. They should be looked at in the light of: the international mobility of students and researchers; collaboration in research efforts leading to the co-publication of scientific articles; finance flows.

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Scientific fields and inclination towards North-South collaboration: an outline typology

Worldwide scientific research today demonstrates certain dominant trends: heavy science (concentrated and dispersed), multidisciplinarity, relations with technology. These trends intrinsically entail an increase in collaboration, especially at the international level, yet in differing ways. We shall go on to examine the trends leading more specifically to North-North, North-South and South-South collaboration.

Concentrated «heavy science»

This traditionally refers to research requiring extremely costly equipment and installations. Inter-country cost-sharing is one of the main reasons behind cooperation in these areas of «concentrated heavy science» (high energy physics, satellites). Programmes requiring such equipment are barely open to North-South cooperation. Yet there are individual cases where the geographical multilocalisation of the instrument plays a central role and leads to cooperation (e.g. Chile's ESO astronomical observatory).

Dispersed «heavy science»

This new type of «heavy science» is also growing in importance: it involves large-scale programmes which aren't accomplished in any one place, but in a host of laboratories spread across many countries. Programmes like these require strong coordination. We shall make our distinctions according to whether the problematics of dispersed heavy science are:

Primarily linked to the problematics of the North

Two further types of programme can be singled out: those with no marked geographical dimension: so there isn't any particular incentive for North-South cooperation (e.g. investigations into the human genome); those where the geographical dimension plays a central role, which leads to North-South cooperation by force of circumstances (e.g. research programmes on climatic evolution, oceanography, meteorology).

Linked to problematics also of interest to the South

Some dispersed heavy science programmes are of direct interest to Southern countries. For example: Man and Biosphere (MAB), International Hydrological Programme (IHP), and certain biomedical research efforts (e.g. work on AIDS). Some important North-South cooperations are developed in this exceptional case.

«Regular» or «light» science

North country «geographical» science

This involves work requiring access to a particular field which may be found in countries of the South; so there is often collaboration with local scientists. This case is inherent to certain disciplines: geology, botany, ecology...

Priority research for the countries of the South

Often mentioned as belonging to this category are: agriculture, public health, water and environmental issues, some engineering sciences and biodiversity issues. These areas give rise to the forming of South-South networks and North-South relations. The internationalisation of research in the area of priority research for the South has managed to be institutionalised: such is the case of the international agricultural research centres steered by the World Bank (CGIRR). Some Northern countries have themselves created institutions whose job it is to develop research programmes in cooperation with the countries of the South, on subjects which are of priority for those countries (in France, for example: ORSTOM and the CIRAD). Last but not least, some notable national and international incentive funds are available to South country teams, often giving rise to collaboration with North country laboratories or South-South cooperation.

A macroscopic view of the international scientific collaboration efforts of the countries of the South

Various measures exist for characterising cooperation.

Let's mention: the number and the content of treaties and agreements, direct and indirect funding through various channels, movements of scientists and students, co-publications.

For our paper we have chosen *measurement by co-publication.* We shall firstly discuss its scope: justification, methodology employed (partly cross-referencing to appendix), the database and calculation method's limits; significance of the work. We shall then go on to present a two-part analysis of our results: current structure of cooperation efforts and observable trends of the last 15 years.

The general structure of world scientific cooperation in 1993: the place of North-South and South-South cooperation

- Analysis of an «inter-zone» cooperation matrix for 1993 (20 lines, 20 columns);
- analysis of the levels of cooperation

Scientific activity of the zones

The matrix of absolute relations
The matrix of affinities.
General outline

The dynamics of scientific cooperation efforts from 1981 to 1993 and the place of those concerning the South

- Analysis of a 1981-1993 inter-zone cooperation tensor (20 lines, 20 columns);
- analysis of cooperation developments.

Development of continental scientific activities
Development of the matrix of absolute relations
Development of the matrix of affinities
General outline

We sum up with the observable relationship between a growth in scientific production on the one hand, and the development of North-South (and/or South-South) cooperation on the other.

Workshop

Power positions in science journals. Their gatekeeping, demography, ecology and accessibility

Tibor BRAUN*
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The present system of scientific communication depends almost entirely on the primary journal literature. Derek Price introduced the important concept of the research front in science. This briefly says that at any point in time there exists a set of articles belonging to a given subject literature which constitute the active state of the subject at that point in time. The present study analyses the demography, ecology, accessibility and gatekeeping patterns of the relatively small set of journals publishing the papers of the actual research fronts in science, mainly from the point of view of the positions of power they possess.

Demography

The lecture analyses the demography of the population of journals using the demographic models for analysing human populations (e.g., births, deaths, migration, age, marriage, etc.).

Ecology

The overwhelming proliferation of scientific journals and of the literature of science, has resulted in widespread disaffection. One of them is a phenomenon we like to call the Barnaby Rich syndrome. This has led to suggestions of alterations in the system, the most drastic of which calls for the elimination of the journal itself. It is shown that scientific communication can be described as an ecological process and that any drastic attempt to interfere with the ecology of journals may reduce not only the quantity of the journal literature but its quality as well. It is concluded that it would be unwise to tamper with the ecology in any drastic manner and that the proliferation should be controlled without substantially altering the ecology. This can be accomplished by the introduction of quality filters at various key points in the ecological cycle.

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Accessibility

It is pointed out that the easy and quick access to leading science journals presents a decisive advantage for the countries of the Metropolis. This contrasts flagrantly with the very severe handicap of those beyond the Metropolis in this respect.

Gatekeeping patterns

It is shown that editors and referees who control the access to the coveted pages of scientific journals, particularly those who "gatekeep" for the more prestigious periodicals, hold vital strategic power positions in the worldwide orchestration of science. The measurements have shown that more than 75% of positions of power influencing the publication of new results in almost all areas of science, are concentrated in the hands of gatekeepers from no more than about 15 countries of the world.

Workshop

Scientific Africa at the end of the Eighties: General panorama, national strategies, thematic fields

Yvon CHATELIN*

Science in the developing countries is generally belittled because it is more or less explicitly compared to that of Western countries. A fairer picture can be obtained by following three principles: first, science in those countries has the characteristics of a process of emergence structured by inevitable specific constraints; second, developing countries should be analysed in their own right and compared with each other; third, and this doesn't contradict the second principle, world science maintains complex relationships with the science of developing countries and these too ought to be brought into the analysis.

The end of the Eighties marked a watershed for many African countries that had, since independence, followed a voluntarist science policy. With the advent of the Nineties a new period began, dominated by the worsening economic slump, the hardening of adjustment policies, and it is still too early to analyse its consequences on scientific emergence and development.

A bibliometrical study based on the scientific production recorded during the years 1987 to 1990, can give a comparative synchronic picture of the African continent as a whole. The inequalities are considerable, above all when the scientific production (assessed through a number of publications) is looked at in the light of each country's demographic and economic data. A typology can be suggested, bringing out the continent's scientific leaders, those seeming to be on the way to real emergence, those seemingly in a state of expectation and uncertainty, those that are scientifically non-existent.

A national strategy is always partially desired and partially endured. It is expressed through the choice and relative development of the research themes. To become meaningful in the context of developing countries, these themes should be characterised by the nature of the subjects studied, the outcome of research, the methods followed. A national strategy is also largely determined by the relations established with world science. Bibliometricl analysis allows a given country's available scientific production to be divided into two sub-sets: locally produced and externally produced, i.e. in Northern

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laboratories. Each sub-set has its own logic and they are more or less closely linked. Various statistical indicators characterise the researcher communities, by their numerical size, their propensity to associate, their degree of professionalisation.

The structure of the scientific field itself, as defined by its epistemological content, can be best brought out by a computerised automatic mapping of lexical descriptors. Coherent areas and synergies take shape. This way, we see established both a state of science in a set of developing countries, and also some elements of what could constitute a more general model of the structure of both scientific communities and scientific knowledge.

References

CHATELIN (Y.), ARVANITIS (R.), 1992, Indices de structuration de l'activité scientifique. Exemple de cinq domaines avant 1968 en Côte d'Ivoire. Les indicateurs de science pour les pays en développement.. Editions de l'ORSTOM, pp 239-252.

CHATELIN (Y.), GAILLARD (J.), KELLER (A.S.); to be released, The Nigerian scientific community: the colossus with feet of clay.

CHATELIN (Y.), KELLER (A.S.), WAAST (R.); to be released, La science en Afrique. Evaluation de la production scientifique en Afrique de l'Ouest, au Nigeria et au Kenya.

DAVIS (Ch.H.), 1982, Science for Africa: a study of Selected Aspects of International Science Policy and Cooperation in Subsaharan Africa, 1945-1979. Thesis, University de Montréal, 410 p.

Workshop

Scientific and technical cooperation policies

Jeanne MIQUEL*
Jean-François MIQUEL**

The purpose of our paper is to study a few aspects of international scientific cooperation in the ecology and environment sphere.

Our approach has been to make a quantitative analysis of South-South and North-South relations in a few pilot countries in this sphere.

We used two sources:
- A non-specialist file listing all publications in the world for the twelve years 1981-1992. This data base, entitled SHIVA, has been built up from data supplied by the Institute of Science Information. ISI defines seventeen thematic fields plus one multi-disciplinary field. The fields we chose were «Agronomy», «Ecology and environment», «Geoscience» and «Plant and animal sciences»;
- A CD-ROM listing all publications in the world in 1992. This database uses eight fields, including a «Biology» field that covers all the above.

From SHIVA we defined absolute output (the number of «Ecology and environment» publications and the total number of publications from a country) and variation over time, for the topic in question, in the high-output countries.

We chose six countries, on the basis of two criteria: (a) the extent of their absolute and relative output on ecology and environment and (b) the participation of other countries in their ecology/environment publications.

The countries selected were: South Africa, Egypt, India, Thailand, Venezuela, The Philippines.

In this first (macroscopic) stage we examine the scientific output and international cooperation of each of these countries.

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The second phase is a microscopic analysis of ecology/environment policy in the Philippines.

We chose the Philippines because this country devotes most of its research to the «life sciences» and, further, devotes 6.81 % of its total scientific output to research on ecology and environment - more than any other country in the world.

Workshop

Continuity in international scientific collaboration: The example of Mexico and France

Nora NARVAEZ BERTHELEMOT*
Jane M. RUSSELL*

Collaborative research is increasingly important for the advancement of science and technology in individual countries. For developing countries, it is crucial to strengthen existing links and establish new ones, striving for integration so as to promote science.

Mexico, for example, has a tradition of scientific collaboration with France, its second most important international partner. But is such collaboration of a lasting kind ?

A study was carried out to analyse continuity in scientific collaboration. Three databases were consulted: the Science Citation Index (international), Periodica (Mexican) and Pascal (French). The study concerned research teams that had co-authored papers at some time between 1980 and 1989.

A survey was also carried out among Mexican researchers who had published in collaboration with French colleagues in Mexican reviews, to obtain direct answers as to the motivations and antecedents of their joint research.

In the international database, the findings were that collaborative work between the two countries was representative but only moderately continuous. Chemistry and physics were the fields in which there was continuity in collaboration between teams during the period in question (between two and ten publications).

One notable finding was that continuity varies according to the type of research the collaboration concerned.

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For example, with the pure research projects that were making progress and were of general interest to the scientific community, the tendency was to update regularly by publishing results in jointly-signed papers in international journals.

Papers on projects dealing with specific applied research topics and concerning local problems were published in national journals. In general, there was no continuity in these projects.

Workshop

The stakes in Information Science and Technology (IST) as seen through an analysis of cognitive infometry using a method of automatic classification and conceptual representation (NEURODOC)

Xavier POLANCO*
Claire FRANÇOIS*

Information Science and Technology (IST) reflects research activities through quantitative analysis; scientometrics sets out to develop an understanding of the state of science and technology at any given time. On one side, we have the social studies of science: analyses concerning the communities of researchers (scientists and engineers), as well as the knowledge these selfsame actors produce (sociology, economics, politics of science). On another side, the results of research activities are materialised in texts, i.e. written documents; the quantitative or statistical study of these documents today gives rise to the majority of scientometric studies. Yet there is a third level situated between knowledge and texts: information science, which developed at the same time as the communication system and databases.

Our study sets out to outline the problem of linking these three levels of analysis. We shall not follow the chief tendency of traditional scientometric analyses (citations, co-citations, co-authorship, author, article and periodical counts). We are above all else looking at knowledge analysis. To do so, we shall use the NEURODOC programme which:

- automatically classifies documents and keywords that index them;
- positions the resulting categories on a map.

This programme is a computer-based implementation of the axial K-means method (Lelu, 1993), followed by an analysis of the main components for building conceptual maps.

While the procedure we have adopted here is empirical, it is set against the theoretical backdrop of the notion of *science-monde* (Polanco 1990, 1992). It is empirical in that we are reducing the definitions of social studies, scientometrics and information science to a certain number of periodicals selected according to purely empirical criteria. Our proposed analysis therefore has no apodictic pretentions.

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TAKING STOCK: SCIENTOMETRIC APPROACHES

An initial, heuristic application of NEURODOC on a sample of 284 articles taken from the journal *Scientometrics* (volumes 15 to 27), has enabled us to draw up a table of the major areas.

Area 1 of this table shows us the localisation of the study subjects: the mainstream of scientometric studies, here, focuses on industrialised countries. This raises the question of the structure as analysed in our *science-monde*. Area 2: the databases used depend on the scientific disciplines being analysed, yet also on the method; if we are analysing citations, SCI (*Science Citation Index*) must be used. Area 3 concerns studies of innovation, mainly done by analysing the relationship between scientific articles and patents. Area 4 shows the institutional division into disciplines, such as those found to be constituted by defined corpora of periodicals and by specialised databases. Area 5 focuses on the assessment of research activities and the productivity of authors. The international aspect of research is characterised by studies involving international collaboration and cooperation between researchers (area 6); these studies mainly use the analysis of co-signatures and co-authorship. On the subject of scientific literature (area 7), the studies chiefly concentrate on the obsolescence, growth and distribution of that literature. Area 8 examines the statistical methods and techniques in practice and, the traditional questions raised by the empirical laws of bibliometry (Bradford, Lotka and Zipf).

This inventory is by no means canonical. It merely serves to introduce the field we are exploring. We can already see the blind spot contained within: what information science for its part actually analyses. So we turn to another field of research in order to picture it through a limited number of information sources, which nonetheless act as media for the mainstream (*Journal of the American Society for Information Science, Bulletin of the American Society for Information Science, Annual Review of Information Science and Technology, Journal of Documentation, Journal of Information Science*). A total sample of 690 bibliographical references taken from these periodicals has enabled us to draw up another table.

A brief commentary: on this table, the first area looks at the types of information (scientific, technical, legal, medical, social scientific). Area 2 shows us a geopolitical distribution according to country and region of the world (Asia, Africa, America, Europe, Arab countries). The main area is area 3; it corresponds to the study of the information system, its technologies and problems of research and access to information. This information system is brought into being by the databases, libraries and documentation centres (area 5). Scientometrics and bibliometry occupy area 4, chiefly in association with the analysis of citations. And finally, area 6 indicates an area of research on the natural language and techniques of artificial intelligence, namely the representation of knowledge and the building of knowledge bases. This research represents the future of our information systems and areas 4 and 5 seem to be lagging behind compared to the developments forecast by area 6.

When we deliver our paper at the conference, we will present the findings shown in our tables. In this way, we will be able to point out the stakes involved in both the scientometric side of things and in IST, stakes which will influence the research system and, above all else, the system for communicating current world scientific and technical knowledge.

References

A. LELU, *Modèles neuroneaux et incrémentaux pour l'analyse de flux de données documentaires et textuelles*. Ph.D. thesis, Université de Paris VI, 1993.

L. LEYDERSDORFF, *The relations between Qualitative Theory and Scientometric Methods in Science and Technology Studies*. Scientometrics, 15, n° 5-6, 1989, p. 333-347.

X. POLANCO, *Naissance et développement de la science-monde* . Paris, Editions La Découverte / Conseil de l'Europe / UNESCO, 1990; Boston Studies in the Philosophy of Science, volume 136, *Science and Empires*, edited by P. PETITJEAN, C. JAMI and A-M. MOULIN. Dordrecht, Kluwer Academic Publishers, 1992, pp 225-242.

Workshop

Scientopography: World maps and charts based on scientimetric indicators. A bird's eye view on the Metropolis and beyond

Andras SCHUBERT*
Tibor BRAUN*

Topography is defined in the dictionaries as «the science of drawing on maps and charts or otherwise representing the features of a region» or, in a broader sense, the «study of description of a region, system or entity showing specific relations of component parts as to shape, size, position, etc.»

Scientopography is defined by us as the topography of scientometric features (e.g publications and citation-based indicators) of geographical or geopolitical regions. Examples of scientopographical representations include, among others, proportional maps, proximity diagrams and relational charts.

In proportional maps, the relative position of the entities concerned (viz., countries) is more or less «natural», while their size (area) is proportional to certain scientometric extension (publication output, citation rate, etc.). (1) Thereby, the relative weight of the countries are easlly visualized and, assuming an implicit knowledge of the «natural» proportions, significant deviations are readily pinpointed. By complementing the proportional maps with proper shading or colouring (or both), multidimensional representation of scientometric indicators becomes possible(2) .

Proximity diagrams require the definition of a suitable proximity (similarity) measure. Typical examples include various co-occurrence (co-authorship, co-citation, co-word, etc.) maps, where the entities considered are placed closer to each other on the map as the similarity between them increases. For obtaining an exact map, which is rarely the case (with exactly determined positions on the plane or space), the existence of a proper distance function (fulfilling reflexivity , symmetry and the triangle inequality) is needed. More frequently, the positions are only partially determined by the chosen «metric», and the final pattern may contain arbitrary elements (e.g., partial retention of the original geographic order) (3).

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Relation charts have been introduced to correlate expected and observed citation rates(4). Expected citation rates are those calculated on the basis of the average citation rates of journals (kinds of «impact factors»), observed citation rates are those actually received. The position of a country on these kinds of charts reflects simulaneously its publication strategy or ambition, and its relative success or failure in meeting the envisaged standards.

Scientopography appears to provide rather suitable tools in representing and analysing the relation of metropolitan and provincial areas for different aspects of scientific activity, performance, and impact.

1 BRAUN, T., SCHUBERT, A., A. Topographical Approach to World Publication Output and Performance in the Sciences, 1981-1985, *Scientimetrics*, 19(3-4) 159-165 (1990)

2 SCHUBERT, A., BRAUN, T., Three Scientometric Etudes on Developing Countries as a Tribute to Michael Moravcaik, *Scientometrics*, 23(1) 3-19 (1992)

3 SCHUBERT, A., BRAUN, T., International Collaboration in the Science, 1981-1985, *Scientometrics*, 23(1) 3-19 (1992)

4 SCHUBERT, A., BRAUN, T., Relative Indicators and Relational Charts for Comparative Assessment of Publication Output and Citation Impact, *Scientometrics*, 9(5-6) 281-291 (1986)

Workshop

Researchers of the North, researchers of the South: Itineraries, practices, models - an attempt at comparative analysis

Jacques GAILLARD*
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Beneath its professed universality, is science practised in the same way in the North as it is in the South? To what extent do the researchers of the North and South who turn to this selfsame modern and universal science differ in the route by which they have come to serve it, and the manner in which they practise and perceive it?

Three main sources are used to try and answer these questions: a survey of the American researchers working in the field of agriculture (BUSCH and LACY, 1983); a survey of the Southern researchers who have obtained an IFS research grant in several fields of biology applied to rural development (GAILLARD, 1989, 1991); and an assessment of the *Science, technologie, développement* (STD) Programme for supporting North-South collaboration in the fields of agriculture and health (WAAST, 1992, 1993), especially the section dealing with the differences between the North and South (SCHLEMMER, 1992).

As one might imagine, the research scene in rich countries did not turn out to be the same as in the so-called «developing» countries: comparing the above three sources effectively brings out the size of the differences contrasting the researchers of the North with those of the South, and how punishing they are for the latter in performing their research. To begin with, the researchers of the South have to devote a far greater percentage of their time to teaching activities than their Northern counterparts do, to the detriment of their research work. Moreover, they are far more reliant on funding agencies, and what's more, *foreign* funding agencies, whose priorities are not necessarily the same as those with which they might wish to comply. Finally, and above all else, they are sometimes seriously isolated. Perfectly aware that science cannot be done without communicating with the scientific community, it is painfully hard for them to live with the fact of being dispersed around their country's various universities, where they are sometimes the sole specialists of their discipline.

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COMPARING METROPOLITAN SCIENCE INTENDED FOR THE SOUTH AND FOR THE NORTH

The survey of researchers who have been involved in the various programmes subsidised by STD, has provided a rare opportunity for comparison. Indeed, the Commission had issued a ruling whereby only projects combining at least two Northern laboratories and one Southern laboratory would be accepted. Although in most cases the leader laboratory not surprisingly belonged to a country of the North, the Southern laboratory was nonetheless confronted with the same research tasks. So they could therefore be compared to one another «in situ», within a single research context.

We shall thus examine the success rates in the bidding for the call to tender, the research topics put forward as priorities, the working methods of the laboratories and their place in the overall dynamics of the programme uniting them, as well as the volume and nature of the resulting scientific production. The sense of the differences here is clearly as expected: the Commission accepted more of the projects proposed by the laboratories of the North; their themes were situated more in the narrow openings of advanced research; they were more often leaders, defining the objectives and often confining their partners to the simple job of gathering data; their publications were more numerous and of a higher grade. Comparing the differences «in situ», however, allows their true size to be *measured*. So little study has been done on the matter of differences between the North and South in the practice of scientific research, that although they are not surprising, these results are not lacking in interest.

A more paradoxical fact to emerge is this one: whereas the practices and conditions for carrying out research do indeed differ, when it becomes a matter of self-definition according to an idea of science not *as it is done*, but as one would *like* it to be done (according to the image one would wish project of oneself as a scientific researcher), the same idea stands out in both the North and South: i.e. «science for science's sake», science rid of its social constraints: it is impossible to contrast researchers *from* the DC with researchers coming from the North to work *on* the DC: one could conceivably have imagined the former being pressed by an urgent need to resolve the problems confronting his or her country while the latter was looking to capitalise on opportunities offered by a tropical environment for testing the generalisation of a method or discovering original phenomena. Yet despite social pressure, despite a frequently different (more finalised) specialisation, the researchers of the South quite markedly share the same values and ambitions as their Northern colleagues: the same priority interest in basic research, the same desire to publish in top-level journals, etc.

The question remains as to whether these images are representative of the world of research as a whole, or afflicted by the STD Commission's statutory criteria of choice. For want of further material enabling the same type of «in situ» comparison, it is sadly impossible to say, and the generalisation of this similarity between Northern and Southern researchers can only be taken as hypothesis. One which can nonetheless be confirmed by elements from our other two sources. Although the conditions for carrying out research are, as we have seen, fundamentally different, the same cannot be said of the *itinerary* toward a career in science. On the contrary, the general trend in both the South and North (with some exceptions that will be mentioned) is that researchers come from the same culturally privileged milieux (socio-professional origins, by the way, count for even more in the South and, while there may have been many cases of an impressive rise up the social ladder -from childhood as the son of a poor peasant to the lofty status of University dean, world specialist in his or her field- this can be illusory; the importance of sexual discrimination, however, is -paradoxically?- far less noticeable); coming from privileged backgrounds, Southern researchers are otherwise often still doing the same studies as Northern researchers ... in the universities of the North (though they don't keep them up as long); finally, while the amount of time they devote to teaching is greater, the DC researchers nonetheless believe they are maintaining the same balance of basic research/applied research as their rich country colleagues.

Actually, the system of values that Merton tells us is the criterium for belonging to the scientific community isn't formed so much during the scientific career itself as on the route toward it - which, on the whole, emerges as less dissimilar than expected.

1983 - L. BUSCH and W.B. LACY, *«Science, Agriculture and the Politics of Research»*, Westview, 303 p.

1989 - J. GAILLARD, *«Les chercheurs des pays en développement: origines, formations, pratiques de la recherche et production scientifique»*, *(The researchers of the developing countries: origins, training, practices in scientific research and production)* ORSTOM, Etudes et thèses, 220 p.

1991 - J. GAILLARD, *«Scientists in the Third World»*, The University Press of Kentucky, Lexington, 190 p.

1992 - R. WAAST, ed., *«Indicators and Survey of the Researchers - Science and Technology for Development, a European Research Programme»*, CEC DG XII / ORSTOM STD, 114 p.

1992 - B. SCHLEMMER, *«North-South: the Differences»*, in ibid., pp. 87-98.

1993 - R. WAAST, ed., *«Indicateurs adaptés pour guider les stratégies d'un programme de coopération scientifique»* (Adapted indicators for guiding scientific cooperation programme strategies), CEC DG XII / ORSTOM STD, 176 p

Workshop

Development oriented research in the Netherlands

Peter KLOOS*
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Development-oriented research in the Netherlands is widely spread over a multitude of institutions and fields. A working definition for this particular type of research is, «research that is directed towards a wide variety of issues related to the development of nations in the South, including its intricate relationship with countries in the North». Arguably, to the North belong: the USA, Canada, most countries in Europe, most nations that belonged to the former Soviet Union, Japan. To the South, equally debatable, the rest. Because of its colonial past, Dutch research has long been oriented toward Indonesia and other ex-colonies, and on issues that were connected with the presence of the Dutch overseas, such as customary law and oriental economics. The independence of Indonesia in 1949 had far reaching consequences for this research community. The troubled relationship between the ex-colonial power and the ex-colony in the fifties and sixties, but also more general changes in global relations, caused a dispersion of interests. For all the experienced researchers in «colonial studies», the newly developing world became an immense open area. Morever, the post colonial situation favoured an enormous rush of new researchers, which brought about a vast growth of research. This, however, also brought to the fore a debate about quality of research. This debate focuses on two points: (i) the relation of development-oriented research with government policy on development cooperation; and (ii) within institutions, the relation between development-oriented research and research oriented toward «northern» issues.

We address these questions by comparing the output of a sample of research oriented toward the «north» and research oriented toward the «south». We aim at producing «research profiles» of these different communities by comparing a number of bibliographic and sociografic data, such as output in a variety of journals, or particular career differences. To find our samples, we will use a database of research institutes that is presently completed by the SWIDOC (an institute specialized in documentation). We will look for

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correspondence in a number of input and output variables between «northern» and «southern» institutes. Then we will interview a number of leaders in the institutes about their research policy, orientation, goals and problems. This will help us decide on a number of variables to produce the research profiles. Data will be collected through annual reports of the institutes, and through a number of general databases. The goal of this study is to show characteristic differences between research produced for «northern» demand, and research produced for the south. We aim at producing visual representations that show resemblance with what Yvon Chatelin and Rigas Arvanitis have developed for the Côte d'Ivoire (1991).

Workshop

Prometheus and Hermes: Technological mastery and development

Ali EL KENZ*

The Algerian development experience, exemplary in its day (the 1970s), has collapsed in disorder. This failure raises many questions for analysts, and we shall here address one such question: what has become of the industrialization drive that was supposed to remodel the country's economy and modernize society?

Despite being led by an energetic, skilled technocracy, endowed with a steady influx of oil revenues to finance investments and a total power of control conferred by a strong State with army backing, the attempt has failed. The industrial structures it created are today stagnating, with 30 or 40% of their capacity lying idle if they have not already been dismantled or sold to the highest bidder.

Our hypothesis is that this technocracy, developed in the wake of the nationalist movement, saw itself as having a «civilizing mission» to fulfil, saw institutional, social and cultural realities as an «environment» to be transformed from top to bottom by its achievements, and designed and carried out its project in these terms. Institutional frameworks (forms of power), social and cultural structures were regarded, if not as «remnants», at least as «hindrances» to be eliminated.

This technocracy, with its latent Saint-Simonism, firmly believed that power comes from technical mastery and that its increasing control over modern technology, applied step by step to every productive activity in the country, would enable it to revolutionize society and dominate its institutions.

It ignored the concomitant movement developing alongside its own, with different, concurrent objectives that soon came into conflict. This other current wanted not so much to fit society into the technological world (the *production paradigm*), but to restore a national identity and Arab, Islamic values that had been profoundly distorted by the colonial period.

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The group of intellectuals that had adopted this project, had also been formed in the mould of the national liberation movement; but they concentrated mainly on the schools, universities, communications media - in short, everything in the sphere of culture, symbolism, the *language paradigm*.

Skilfully manipulated by the government, the competition between these two groups imposed on each of them, and on society as a whole, a particular dynamic which accelerated with the cross-fertilization between the two movements - the «tenklein» and «legein».

Industrialization and technological performance alternated with the pace of the Arabization movement (primary and secondary schools etc.), religious standardization, the authenticity of values.

It was the second of the two strands that prevailed.

While the first gradually became isolated in the production sphere and got bogged down in bureaucratic red tape, the first economic crises, the first strikes and conflicts of interest, the second, wave by wave, took over the entire sphere of communications and in the end encircled the productive nuclei of the first, which became not centres for disseminating technical progress, as had been hoped, but «transplants» grafted on, with no particular mission other than production.

The Algerian experience seems to us so like a modern re-make of a well-known ancient tale that we could equally have called our paper «Hermes and Prometheus».

Workshop

Syntex, the UN and CONACYT: High-tech Development strategies in Mexico

Henry ETZKOWITS*
Elsa BLUM**

Widely assumed to be mistaken, but little explored, is the question of whether there is any validity to the thesis of a high-tech strategy for developing countries. The traditional dichotomy between «high-tech» and «low-tech» development strategies is typically framed as a dialogue between local country officials who wish to import advanced technology for prestige reasons and international agency officials who wish to transfer simpler technologies on practical grounds. The United Nations Industrial Development Organization (UNIDO) program for lateral transfers of mid-level technologies among developing countries was a creative compromise between aspirations and realities.

The case of the Syntex Corporation in Mexico during the early post-war era provides an intriguing example for analysis of a high-tech strategy. Indeed, the Syntex experience was early proposed as a generalizable model for other countries. An industrial laboratory staffed by US chemists in Mexico City had been established in the 1940's to investigate the potential of «natural products» for drug development. In the course of conducting its research program on the synthesis of progestational components for a contraceptive pill, the Syntex lab began to draw upon the chemistry department at the Autonomous National University of Mexico (UNAM) for staff. The subsequent interaction between Syntex and UNAM encouraged the transition of the chemistry department from a teaching to a research enterprise.

During the 1960's, Dr. Carl Djerassi, a Syntex chemist then relocated at Stanford University, proposed that the Syntex experience be generalized to other developing countries. He suggested the founding of research centres focusing on niche areas of research, like the Mexican experience with Syntex, in which the country had a special resource or problem that would make its research program unique. One such center focusing on insect physiology and endocrinology was established in Nairobi, Kenya, in the 1970's. It was staffed jointly by local and expatriate research scientists.

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SOUTHERN ANSWERS TO NORTHERN SCIENCE: ASSIMILATION, AUTONOMY, COUNTER-HEGEMONY

Has the construction of universities on Western models in Developing Countries simply been a matter of national prestige, or can they actually contribute to development? The Mexican National Science Foundation, CONACYT, with the assistance of UNIDO, attempted to answer this question in the 1980's through the establishment of a technology transfer centre, at UNAM. The mission of the Centro para la Inovacion Technologica was to connect university research, by then highly developed but largely oriented to world science rather than local industrial problems, to Mexican companies.

This paper, based on contrasting case studies of connecting basic research to industry in Mexico, will frame the issues involved in a high-tech development strategy for Developing Countries. Rather than assuming the invalidity of the strategy, we examine instances in which it has been attempted. Our goal is to develop a framework for analyzing high-technology strategies under conditions of underdevelopment in one country, and suggest guidelines for the evaluation of related projects under similar conditions elsewhere.

Workshop

Technological learning and the acquisition of legitimacy: The development of innovation research capabilities in the Venezuelan oil industry

Hebe VESSURI*

The growth of the national R&D capability in the Venezuelan oil sector is analyzed, through the study of three technological innovations produced by the staff of INTEVEP (Venezuelan Oil Technology Institute): HDH, Orimulsion and Promisox.

The features of the Venezuelan oil industry are briefly outlined, with particular emphasis on R&D activities since the oil industry was nationalized in the 1970s.

A broad historical review of INTEVEP provides the necessary background for considering institutional factors and the nationalistic ideology of a leading group of researchers and managers as endogenous variables in the success of the innovations considered.

The three case studies allow us to examine the evolution of R&D capability in the institution, as part of the institutions and therefore, national learning and the research groups' struggle for legitimacy in the local and international R&D scene. Besides, they enable us to study the institutional adaptability to different national R&D work-styles in their joint technological cooperation endeavours.

Thus the first case study, about HDH, involved close collaboration of INTEVEP with the German Veba Oil Company, initiated under the Venezuelan-German Agreement of 1978, between the Venezuelan Ministry of Energy and Mines and the West German Ministry for Science and Technology.

The second case study, on Orimulsion, was closely related in its early stage to British Petroleum Research International, through a three-year Collaborative Research Agreement to study ways of producing and transporting extra-heavy crudes. But after collaboration with BP ended, INTEVEP's original emulsion technology was greatly changed by further developments in Venezuela to become Orimulsion.

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The third case, related to the Promisox patented process, is linked to its marketing under a joint venture association of INTEVEP, who owns the process, and the American firm EER.

The cases under analysis also illuminate aspects of the demand-pull/technology-push controversy with regard to the conditionings of the direction of inventiveness and scientific activity in the production of contemporary technological change.

HDH was a process for upgrading the Orinoco heavy oil, pushed by the researchers, that had to face strong resistance from both national and foreign operating firms. And even after they had proved the worth of the results in Germany, the operating firms in Venezuela continued to resist results originating in Venezuelan research groups.

Orimulsion, on the contrary, was pulled by the operating firms in Venezuela which exerted pressure upon the researchers to obtain quick results against their precaution and willingness to subject results to further experiment. This pressure is easily understandable because of the enormous potential of Orimulsion, since it is an emulsion of Orinoco bitumen in water and stabilized by a specially formulated additive package.

Promisox (an SO emission control technology) allows us to explore a more advanced case in the experience accumulated by the research institute in its international relationships, for it involves a joint venture between INTEVEP and an American firm, Energy and Environmental Research Corp. (EER) of Irvine, California, to develop this new process.

The main goal of the study is to show how the determining factors in the «Southern answers» to challenges in the international technology market were a complex amalgam of institutional and ideological interests with several groups (scientists, industrialists, politicians, etc.) involved.

In the process to achieve credibility and legitimacy both domestically and in the international market, rivalries, temporary alliances, *lobbying* and political articulations intervened, besides and beyond technical capability.

Round Table

A summary report on women and new scientific developments produced by the ad hoc group of the scientific committee of the United Nations, and discussions presented by:

Geoffrey OLDHAM*

with the participation of:

Jeanne BISILLIAT
Renée CLAIR
Suzanne EL KENZ
Maria Margaret LOPES
Beatriz RUIVO

Workshop

The difficult dialogue between researchers and development actors

Pierre CALAME
organiser and rapporteur

Round Table

Choosing science policy, or: How to evaluate collective advantage

Christian COMÉLIAU*

I have two points to make, one regarding science in general and one more particularly on the social sciences.

As regards *science in general*, I am not sure that the science policy choices facing the Third World countries - or rather, their government-level decision-makers - are best analysed in terms of the distinction between science and technology.

Not only because, as we know, it is harder and harder to draw such a distinction, but also because their funding channels differ (governments pursue more collective, less mercantile objectives, often less closely tied to specific application technologies, except in the sphere of their own activities such as, of course, defense).

It therefore seems to me that science policy decisions should be prepared by making a systematic inventory of the *potential collective advantages*, and collective cost, of the alternative policy orientations. The choice between science and technology, insofar as the question is posed, can then be elucidated by an evaluation of their impact on the dynamism of science in general, the possibilities of adapting the technologies and the capacity to control their consequences.

In the *social sciences*, especially those that concern the development process, the requirements seem to me much clearer: the countries of the South cannot afford to limit themselves to applied research and technology; it is essential for them to take part in pure, theoretical and conceptual research, for several reasons:

• world conditions and the stakes involved in development have changed profoundly in recent years;

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• the content of the development problem now concerns every country on earth, not just the South, but it needs to be thoroughly re-analysed, particularly in terms of «development models»;

• in this regard it is essential to reflect on policy, but here the issues need to be clarified;

• all this work is hampered today by the highly unsuitable nature of the existing theoretical and conceptual apparatus of the social sciences and their reductionistic ideological bias in particular. The necessary regeneration of the theoretical and conceptual apparatus must be grounded in true reflection by all concerned, including those with a very different experience from that of the industrialized countries;

• one might add, in connection with the point regarding science in general, that social mastery of scientific and technological development has become a major challenge for the future of the planet and that all countries must contribute. The regeneration of the social sciences is indispensable in this regard.

Round Table

Managing Science and Technology in a democratyicSouth Africa: Opportunities, constraints and challenges

David KAPLAN*

The contribution that S&T could make to improving the quality of life of all of South Africa's peoples is currently a subject for considerable debate. This is not an academic debate, for, as the *ancien regime* departs and South Africa restructures, the protagonists are impacting directly on the reconfiguration of S&T policies and structures.

Two issues, it is widely agreed, are of central importance. Firstly, economic advance in international markets relies ever more heavily upon technology-based trade. This is of particular salience to a country which, all agree, must seek to expand its manufactured exports and decrease its reliance on primary products. Secondly, S&T has a fundamental role to play in enhancing wider access to social infrastructure, such as housing and education. Commitment to speedily deliver access to social infrastructure for disadvantaged communities is the overriding objective of the new government. This is now (in varying degrees) accepted across the political spectrum.

However, precisely because of its manifold commitments to its political constituency in the context of a highly charged political atmosphere, and being already heavily in debt, the government may well seek to economise on spending in areas such as S&T. This would continue a pattern set by the previous government which has, especially over the last five years, substantially reduced its commitment to S&T -to the point where the viability of the system is under threat.

Previous policies had as their principal *raison d'être* the underpinning of minority domination. Strategic/political considerations loomed large, resulting in very considerable resources being devoted to areas such as atomic energy and armaments. These supply driven institutions were managed separately from the national S&T effort. In addition, the management of science was formally divorced from the management of technology - the former being located in the Department of Education and the latter in Trade and Industry. Accordingly the new government has inherited a highly fragmented system and one in which no organisation has effective oversight of the entire S&T system.

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Therefore, considerable challenges face a new government in devising and implementing appropriate strategies and policies for S&T. Of even more immediate significance is how to effect changes to the management of S&T. The task is to create a management system which fulfils the following objectives:

• Ensures effective coordination of the entire S&T management system so as to build longer term capacities;

• Ensures effective mechanisms are created so that trade-offs between the different objectives set (enhancing the competitive position of local firms in the international market versus enhancing access to social infrastructure, for example) are specificed and rendered as transparent as possible;

• Ensures wide stakeholder representation in the management system so as to build a social consensus around S&T;

• Ensures that there is an effective «voice» for S&T at the governmental level which can, in particular, sound a warning if the health of the system is threatened;

• Ensures that the management system for national innovation is itself capable of further organisational innovation in response to changing national priorities and opportunities.

The paper will therefore begin by outlining the major developments in the S&T sphere in South Africa and South Africa's current S&T capacities and their importance to the broader region. This will serve as a backdrop for examining the restructuring of the governmental S&T management system. Apart from detailing the South African "experience", a number of issues of more general relevance are posed : eg. what level of social or stakeholder representation from outside of the governmental bureaucracy is desirable and how should this be effected ; how might S&T be most closely coupled with production while, at the same time, ensuring that organisational mechanisms are in place to develop the building of longer term national S&T capacities ?

Restructuring the management of the S&T system is currently underway. The Government of National Unity has announced the formation of a Ministry for Science and Technology coupled with Arts and Culture. At the same time, a major organisational grouping, the Science and Technology Initiative (STI) whose membership includes all of the principal "players"- government, scientific societies, business, labour and political groupings-has been undertaking considerable research and commissioning work in this area. The writer has been closely involved in this work and will draw upon a number of published and unpublished reports in formulating this paper[1] .

1. Very little is published on the South African S1T system. The following is a good general background reading and was seminal in stimulating debate on the South African ST system: International Development Research Centre (IDRC), Toward a Science and Technology for a Democratic South Africa, IDRC (Canada), Mission Report, July, 1993.

Round Table

The failure of bureaucratic initiatives

José LEITÉ-LOPES*

The very fact that today there is a question of a choice between sciences and technologies is in itself very enlightening. Indeed, it demonstrates on the one hand the difficulties encountered through years of developing scientific research in third-world countries (now known as the countries of the South), and on the other, a certain prejudice towards these countries which, in some people's view, could be condemned to remain under-developed forever.

Many initiatives have been taken by the rich countries (such as the *Alliance for Progress, Atoms for Peace*) and by international bodies such as UNESCO, the United Nations body which instituted decades of development. In 1953 there was a United Nations Conference on the application of science and technology for the benefit of little developed regions. The biggest names in the science administrations of industrialised countries examined these problems and published countless reports. And yet, those initiatives did not succeed in preventing growth in the gap between the North and South.

The reasons for this failure are many. Whatever the case, however, science and technology programmes will never succeed if they are neither preceded, nor accompanied, by an even more significant effort towards a basic education for less developed peoples, so that their populations are prepared for life in the contemporary world.

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Round Table

Science for development: Is it a public science?

Rigas ARVANITIS*

Recently, Michel Callon called into question that simple idea holding science to be public property, i.e. property that no economic agent has a genuine right to claim wholly for themselves, whose use cannot be denied to others. In fact, researchers all think they are working for the good of humanity, especially those working for development. From this point of view, ORSTOM is an excellent observatory: here we have a body that funds and carries out basic research geared to dealing with development problems. Anything produced by the programmes with our partners is available to anybody who wishes to use it, be it improved plants, advanced technologies or methods for fighting tropical diseases.

However, we also often see those results going unused. Over the last ten years, the authorities' insistance on development has ended up producing an awareness of the need to go beyond laboratories and closely observed fields and offer advice, machinery and tools in order to do something other than science, and contribute to development. So, even though the linear model of the science-development connection is being demolished all the world over, researchers working for development (not just at ORSTOM) still champion that old, yet evergreen, vision of research: first there's science, then development.

Elsewhere, I have shown that the linear vision's basic flaw is its indifference to the comings and goings between defining a problem and resolving it, forgetting that end users are never the ones researchers have in mind; that instead of a research laboratory «product», they want a negotiable item they can adapt to their needs; and that, in a nutshell, research results go unused because of a vision which not only separates research and development, but makes the latter dependent on the former. Here I would like to emphasise another premiss of this model: science is public property, and those wanting to appropriate its results have to engage in some hefty investment. This would take the form of development, i.e. paying researchers, engineers and

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technicians to perfect the «applied» results for application, purchasing equipment, setting up the best infrastructure for the utilisation of such results. So the non-utilisation of research results comes about because of a lack of investment: there isn't enough of a «public» interested in this «applied» science. Which gives rise to a policy of encouragement making the investors responsible for under-development.

Now, the results of the sociology of science paint a different picture. Science is a good which depends on others and is totally local. Biologists cannot produce a genome map without a suitable laboratory. Furthermore, as Callon points out, «two similar scientific affirmations in two different situations constitute two different goods whose use requires specific investments».

All these aspects (details of which I will give in my paper) result in *science being private property* whose basic cost doesn't lie in the fact of its use, but in rendering it public. This is enormously expensive: funding the creation of public institutions for ensuring the production of science and handling the circulation of information. Without such public intervention, scientific results will always remain private. So the vital investment between public and private science is that which enables a private science to become a public science, and not the other way round.

Accepting this premiss has some important consequences: the market always tends to put limits on how much science is produced. Its most restrictive action is that which influences the variety of science. Indeed - and this is a well known phenomenon - the economies of scale obtained through apprenticeship proportionally limit the diversity of results, work, approaches and techniques. Investment in activities rendering science public, is thus where the diversity of approaches lies. At the same time, though, the side-effect is that science becomes disconnected from the market and society.

This, in my opinion, is where lies the «essential tension» of development-serving science: public science, for tremendous means are devoted to releasing it from private interests, needs to be returned to the private sector if it wants to be applied. A tough, thankless job, for it involves refuting the considerable effort that has already gone into instituting public goods.

Today, the governments of most Developing Countries with a real scientific base, tend to adopt the liberal viewpoint maintaining that the market will be able to make its own decisions and hence, that more private investment is needed. The researchers, sensing the threat to scientific enterprise as a whole, rise up and demand greater support from the State.

Unfortunately, neither converting private science into public science, despite its cost, nor abandoning science to its «natural (i.e. private) course», will be enough to be able to ease that tension. Taking examples from the real-life experiences of Venezuela and Mexico, this paper will attempt to put forward some suggested solutions and actions to be undertaken.

Round Table

The changing environment for private sector technological cooperation with Developing Countries

H. Robert COWARD*

Technology, particularly advanced technology, has increasingly come to be perceived as playing an important role in economic development. Spurred by the economic achievements of the «Asian tigers» - Japan and the Newly Industrializing Countries (NICs) of the Pacific Rim, this is demonstrated by national policies and the programs of institutions such as the international development banks. While private cooperative arrangements, such as offshore manufacturing facilities and technology transfer efforts increased substantially during the 1970s and 1980s, various factors have recently impacted efforts to establish private sector arrangements between advanced and developing countries. These include the end of the Cold War, the legitimation of market economic approaches to development, the need to be integrated in the emerging global market place, and the rising importance of environmental issues. For Developing Countries, «appropriate technology» for economic advancement has increasingly become advanced technology. This has altered the environment and range of issues affecting efforts at technological cooperation between the developed and developing world, particularly for the private sector.

Technology based relationships are becoming less concerned with low-wage offshore manufacturing and the licensing of technologies as wages have risen in the NICs, licensing arrangements have become entangled in questions concerning intellectual property regimes, and changes in manufacturing practices transpired. Product improvement, innovation, and other factors have become as important in creating comparative advantage as low wages and imitation. Patterns of limited co-dependence are giving way to greater interdependence between partners in fields such as telecommunications, computer software, and biotechnology. While developed countries grapple with obsolete export restrictions derived from the Cold War, the developing world seeks a modern communications infrastructure, access to global markets, and technologies that fit into the concept of sustainable development.

Other developments have diversified opportunities and complicated the definition of private sector arrangements. Relationships among industrial corporations, especially those involving large multi-national companies based in

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the developed world, were circumscribed by political factors affecting both sides of partnerships. These included limitations on foreign ownership, state-ownership or socialist economy requirements, and historical attitudes toward U.S. policies and corporations. Direct cooperation in R&D was largely limited to government-sponsored and university-based programs. Now opportunities include those resulting from moves toward privatisation in Developing Countries, the international extension of support for university-industry cooperative arrangements, and the complex adaptations needed to accommodate the emerging relationships between the traditionally state-funded laboratories and industries in Eastern Europe and the former Soviet Union. Regional approaches to development must confront the fact that many Eastern European countries have more in common with countries in various stages of development in the Third-World than with some of their neighbors, while the NIC phenomenon can be expected to expand from the Pacific Rim to other parts of the developing world.

This study involved the examination of recent cases of private sector cooperation in Latin America, the Pacific Rim, and the former Soviet Union. Each is an area in which important changes have presented new opportunities, as well as a variety of risks. Some of the background leading to the present situation in each region is discussed in this paper.

Case studies were selected from recent literature and the current press, as well as interviews with researchers and consultants active in the field of technology transfer and the formulation of international arrangements. Appropriate contacts within the (U.S.) corporations involved were identified and interviewed about their experience with a variety of factors and issues. These included :

• Types and origins of technology-oriented arrangements ;
• The role of the U.S. and foreign governments ;
• Political, economic and social factors involved ;
• The scientific and technological base of the arrangement ;
• The matter of parity and other special issues ;
• Outcomes and the assessment of achievements.

Details are discussed in the full paper. In general, the types of arrangements covered ranged from traditional market penetration strategies to the innovative environmental and biotechnology-based agreement between Merck and INBio in Costa Rica. Satisfaction with advanced technology agreements was generally high, although circumstances in Russia presented substantial difficulties. Foreign governments have played a more pro-active and encouraging role than the U.S. government in promoting such arrangements, while parity issues presented constant, but not insurmountable, challenges. Most cases were viewed as successful with some qualifications, while near-term profitability was neither a clear nor omnipresent criterion of that success. Some implications for government policy are explored, particularly the need for governments to eliminate barriers and foster efforts by small and medium sized enterprises : the multi-nationals will take care of themselves.

Round Table

From import substitution to liberalisation: The response of science policy in India

Ashok JAIN*
G. SANDHYA*

Science Policy in India has undergone changes over a fifty year period (forties to nineties) in terms of the regime of issues that constitute science policy and the network of institutions and actors through which legimitation is sought for R&D programmes and their outcomes. Three phases of overall Indian science policy are discernable. The infrastructure phase (forties to sixties), the reorientation phase (sixtes to seventies) and the economic accountability phase (eighties and nineties). The changing character of science policy during these three phases is discussed. The manifestation of these policy changes at the level of a laboratory are traced by examining the functioning of a publicly funded chemical laboratory.

The infrastructure phase was characterised by a tendency to steer science policy (including technology policy) into a distinct regime of R&D issues separable from economic and industrial policy issues. Rapid expansion of publicly funded R&D system took place with legitimation derived from a network of elite political and science leadership.

During the reorientation phase, efforts were made to recognise overlaps between the policy regimes of science, economic and industrial policies. Several steps were initiated to realise this broader policy perspective for science, such as derivation of R&D programmes from the requirements of socio-economic sectors (the exercise undertaken by the National Committee on Science and Technology), changes in the patent act, tax incentives for company R&D etc. A critical examination of these steps and efforts reveals that the policy instrument that had some impact on establishing networks involving actors and institutions outside the R&D system was that of «import substitution». At the laboratory level, its impact is clearly brought out by an analysis of the projects undertaken, the flow of funds and the output in terms of papers and patents. The factors that prevented the realisation of the intended reorientation of science policy are also discussed.

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INTERNATIONALISATION AND PRIVATISATION: IS A SCIENCE POLICY STILL POSSIBLE IN THE SOUTH?

The third phase (eighties onwards) of science policy is dominated by the economic structural adjustment programme with accounts on globalisation of economy, liberalisation and privatisation. Marketing of R&D, accountability in terms of returns on investments and commercialisation have become the kernel of science policy articulations. The initial impact had been a change in the channels through which national resources flow to R&D systems. Gradually, new actors and institutions involving finance, business and industry have come into the science policy arena. The emergence of a «new» technology policy and the response of industry and R&D laboratories obtained through an opinion survey shows that compared to industry, the R&D system is unsure of the direction of change. The response of the chemical laboratory (selected as a case study) to liberalisation and privatisation has been examined in detail.

The overall conclusion is that with the changes in the economic and industrial policy, science policy in India has moved R&D to a wider regime encompassing production and commerce, i.e.. generally toward innovation policy. However, the alignment of actors and institutions that constitute networks for legitimation of actions is still unclear. The internalisation of shift from science policy to innovation policy at different levels of decision-making will have to go through a process of accommodation and conflicts.

Round Table

The privatization of Science and Technology and its impact

Shigeru NAKAYAMA*

The trend towards the privatization of science and technology is part of post-Cold-War reality. It is perhaps inevitable too that the American military-industrial complex, will look for ways to privatize of. Old socialist regimes, such as the People's Republic of China, have adopted this strategy in a desperate attempt to survive. Even in countries accustomed to high levels of social welfare, we now find the phenomenon of the increasing privatization of universities. Governments are no longer able to meet all the costs of higher education. The Japanese experience of modernization since the 1870s has shown us the lesson that most science and technology transferred from the West to the public sector has failed. This was especially the case for market-oriented technology which could not be managed adequately by the technocrats who planned modernization by hiring Western experts, sending students abroad, and establishing government-owned factories. After several years of experiment, they were forced to transfer their projects to the private sector, where market-oriented technology could survive and prosper. Although military intervention often hindered the speed of privatization in the pre-World War II period, the Japanese repeated the nineteenth century experience once again after the War, their strategy being to transfer Western technology into the public sector and then gradually transfer from the public to the private sector. MITI played a leading role during the 1950s and 1980s, after which time the privatization phase was essentially completed. (This has led many to suggest that government intervention should be accordingly reduced.) The fact that more than 80 % of Japanese R&D funding comes from the private sector reflects this reality. Although the privatization of science has yet to truly occur, the above-mentionned trends seem to have been evident in Asian NICs since the 1970s. That is, technocratic governments took the lead early on and gradually turned over their development initiatives to the private sector. On the other hand, the nationalization of science has been until recently another world trend, ever since Vannevar Bush sought to shape the postwar scientific community and military-industrial complex along nationally-orien-

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ted lines, especially in big enterprises such as nuclear and space research. Still, thanks to Bush, academic science has been well protected under the auspices of the military and public science. Now, with the demise of big national science, which is also now too big to afford, it seems unavoidable for academic science to take the market-oriented direction of privatization. However, we have already seen the disadvantages of the overprivatization of science and technology in the case of Japan. This suggests that it is high time we examined the nature of privatization and its human costs.

Workshop

What sort of mathematics for the Amerindians?

André CAUTY*

They may have been conquered, exploited, exposed to bacterial attack, enslaved by colonisation, torn by wars of national independence, subjected to evangelising missions, policies of assimilation, the eradication of their vernacular languages and the appetites of commercial and industrial companies and so on and so forth, yet the Amerindians have survived for over half a millenium, refusing the models of industrial societies, reasserting their identity and standing up for their right to be different.

Owing to their tenacity, the international community has opened its ears to the Amerindians, and the national governments are one by one coming round to acknowledging a minimum of rights for ethnic groups inhabiting national territories that used to be theirs.

This historical context of lesser intolerance has given some indigenous organisations, especially in Colombia, the (sometimes first ever) chance to voice a pressing and very pointed demand for education, in terms such as these: «bilingual education», «education to counter ethnocide», «ethnoeducation»...

Ethnoeducation is basically defined by a pronounced desire to respect indigenous cultures and necessities; assimilation has been replaced by indigenisation and socialisation as an integral part of a radically new development policy, which is both sustainable, fair and geared towards complementarity.

One of the main distinctive features of ethnoeducation is that schooling and reading and writing are administered in the local tongue by teachers who share the same language as their pupils, and that textbooks reflect realities with which the ethnic group is familiar (in its three dimensions: cultural, biological and environmental) before introducing the realities of national and international life.

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This linguistic (and cultural) requirement stems from a two-sided affirmation. Government authorities acknowledge the fact that schooling policies carried out in the official language have been held in check and invariably led to massive learning difficulties and counter-productive failure rates. The Indians, meanwhile, point out that those same policies have produced something of a vicious circle: native children doing well at school are seen by their community as being lost souls, while children failing at school become eternal misfits, as uncomfortable among the Whites as within their own community.

The example of the Sierra Nevada of Santa Marta (Colombia) clearly illustrates this historic change, and gives insight into two fundamental points: on the one hand, scientific knowledge can be disseminated within the framework of ethnoeducation, without any excessive amount of acculturation; on the other hand, this dissemination is but one particular element in a complex matter of policy, the solution to which is beginning to be understood as requiring more than the unilateral efforts of either indigenous organisations or governmental or international bodies alone.

Beyond the above affirmations, the Sierran Indians realise that they can no longer avoid face-to-face meetings with the Whites and that, because times have changed, there doesn't necessarily have to be any violence. Furthermore, besides the indigenous organisations, there are groups of «specialists» (nationals and foreigners) now surfacing throughout Columbia, which are well able to grasp the complexity of the problems, and to take part in drawing up new educational models that respect local tongues, and are open to linkages between Western «academic» knowledge and autochtonous «natural» knowledge.

Several important points can be considered to have been acquired:

• raised awareness that disseminating science, especially from the hard core of mathematics, is just one constituent part of an enthnoeducation policy;

• there is a recognised need for respective stakes involved in establishing «market» arithmetics and/or «mathematic» arithmetics to be weighed up;

• the whole indigenous community needs to be involved in the defining and implementation of any education policy;

• an essential part of controlling the system and developing the ethnosciences needs to be left to the indigenous community;

• «experts» need to have a substantial knowledge of indigenous languages, cultures and aspirations;

• to establish a real mathematics teaching system, instead of translating solutions from Western scientific cultures, fundamental problems need to be introduced and a presence maintained at the debates these problems unfailingly excite within the communities.

This last point appears essential to me, and could constitute the kernal of the discussions of the Workshop on the theme of conditions for transmitting certain mathematical concepts within the framework of ethnoeducation.

Workshop

The challenge of science education in Developing Countries

Paulo DOS SANTOS RODRIGUES*
Leopoldo de MEIS*

Institutionalized science began in the mid-nineteenth century. This promoted an exponential growth of new knowledge that led to major changes in the social organization of the planet. The estimated world population was 300 million inhabitants at the beginning of the Christian era and hardly tripled during the following nineteen hundred years. Advances in medicine -including the discovery of vaccines, antiseptics and antibiotics, and the mechanization of agriculture, that multiplied food production- fomented a world population increase from 900 million in 1850, to 5 billion in 1990 (Aurelio Peccei: *100 pages pour l'avenir. Reflexion du club du Rome*, Editions Economica, Paris, 1981). The production of knowledge that lay behind these changes originated in a few countries : USA, Britain, Russia, Germany, Japan, France and Canada. Scientists in these countries are responsible for about 75% of the indexed scientific papers published every year (Martin et al., *Nature*, 330: 123, 1987). These countries account for only 17 % of the world population and have been considered as producers of new knowledge (de Meis & Longo, *Biochem., Educ.*; 18:182,1990). In contrast, the rest of the planet -comprising 83 % of the world population- is composed of countries that consume knowledge: their social and economic development is closely dependent on those countries that generate knowledge (de Meis et al., *Biochem., Educ.;* 17:127,1989; de Meis et al., *Ciencia e cultura*, 43:278, 1991).

The impact of science on the economy and social structure of modern society has led to a growing demand for scientists and engineers in both developed and developing countries. From 1976 to 1986, the number of employed scientists and engineers in the USA increased from 2,331 to 4,626 thousand, i.e, by a factor of 1.98. Meanwhile, the total enrollment in institutions granting doctorates in science and engineering increased by a factor of only 1.21. This lag of human resources increased the median age of active scientists in the USA. Such a workforce deficit in the USA and other developed countries may be partially influenced by a decrease in their 0-24 year old population. In 1990, the estimated population of world youth (0-24 years old) of Developing

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Countries was 2.2 billion (83 %), while in the developed countries it was 466 million (17%). The proportion expected by the year 2000 in Developing countries is 84% (*Statistical Year Book*, UNESCO, 1984). Thus, a great challenge for worldwide science education is that most of the young population lives in countries which do not have a tradition in science and have a small scientific community. In addition to the demographic factor, a negative image of science has been prevailing in society, leading young people to reject scientific careers. Misinformation about science and scientific activity play a role in the negative stereotyped image of science and scientists existing among students, both in developed and in developing countries (Grynszpan & de Meis, *Biochem., Educ.*, 18:167, 1990; de Meis et al., *Biochem., Educ.*, 21:75,1993; de Meis et al., *Biochem., Educ*, 21:195,1993). There are at least two causes generating this situation:

• during school years, memorization of scientific facts prevailed over more creative processes capable of introducing students to the world of science;

• the overwhelming amount of new scientific knowledge produced each year that has to be continuously worked into interesting teaching material. Such massive growth of information has given rise to fear rather than enthusiasm for science. The negative effects of these two factors are amplified in Developing Countries with small scientific communities.

The Department of medical biochemistry - Federal University of Rio de Janeiro, Brazil- has been engaged in the development of a «Program on human resources for science», since 1988. This project is committed to strengthening the links between university and society by promoting science literacy through science education. Its aims are directed to improve interaction between active scientists and the community through school teachers and students. The program is designed so as to amplify its range of action through the joint efforts of professors and their graduate students. Besides its traditional activity in biochemistry, the department has its personnel -professors and graduate students- involved in the following program activities:

• graduate student tutorials of undergraduates and high school students, on direct bench-science training, at the department's laboratories. Some high school students are necessarily talented youngsters from low income families;
• organizing two week intensive courses at the university, offered to school teachers and second level students, each year during summer (July) and winter (January) school vacations. Courses are intented to emphasize science process in generating the construction of scientific knowledge. Up to now, over 60 second level teachers and 1,000 second level students have attended the courses. The courses are particularly relevant for students about to make an option related to their future professional careers. They also markedly influence teachers' attitudes with regard to their current professional activities;

• long-term project activities carried out in schools right through the year. These activities are intended to help schools on science programs that enable their teachers and students to promote science teaching activities and to learn science through hands-on experience;

• research on education and sociology of science. Second level teachers are selected to work at the department on education projects and they also collaborate on projects related to science policies and sociology of science. The activities described above represent an experimental project which aims to foster science education in Brazil.

Workshop

On ethnomathematics and the transmission of mathematical knowledge in and outside schools in Africa south of the Sahara

Paulus GERDES*

An important feature of «*African Thoughts on the Prospects of Education for All*» (UNESCO, Dakar, 1990) is the fact that two themes keep recurring in all contributions : the focus on the crisis in African contemporary culture, and the theme of African languages (as vehicles of culture and medias of education). The crux of the crisis of African cultures is the issue of African cultural identity. A people's cultural identity (including their self-awareness of such an identify), is seen as the springboard of their development efforts (p.10). Africa needs *culturally-oriented education* which emphasises originality of thought and encourages the virtue of creativity. Scientific appeciation of African cultural elements and experience is considered to be «one sure way of getting Africans to see science as a means of understanding their cultures and as a tool to serve and advance their cultures» (ibid.,p.23).

In «*Educate or Perish : Africa's Impasse and Prospects*» (UNESCO-UNICEF, Dakar, 1990) the historian Ki-Zerbo stresses that today's existing African educational system is «unadapted and elitist» and «favours foreign consumption without generating a culture that is both compatible with the original civilisation and truly promising». Reminding us of the apt African proverb «*When lost, it's better to return to a familiar point before rushing on*», Ki-Zerbo underlines that «Africa is in serious trouble, because ever since the colonial period, they have had their foundations removed from under them» (ibid.,p.82). This is particularly true in the case of mathematics. African countries face the problem of low «levels» of attainment in mathematics education. Maths anxiety is widespread. Many children (and teachers too ?) experience mathematics as a rather strange and useless subject, imported from outside Africa. One of the causes thereof is that the goals, contents, and methods of mathematics education are insufficiently adapted to the cultures and needs of the African peoples.

The African mathematical heritage, traditions and practices have to be «embedded» or «incorporated» into the curriculum. It is in the context of

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trying to respond to this challenge that ethnomathematical research started in various African countries. Ethnomathematics may be considered as the study of the relationships between culture, cultural development, mathematics, and mathematics education. In the case of African countries ethnomathematical studies may analyse in particular :

• mathematical traditions which have survived colonisation, mathematical activities in people's daily life and ways to incorporate them into the curriculum ;
• other cultural elements with mathematical potential that may serve as a starting point for doing and elaborating mathematics in and outside school.

The first results of the Ethnomathematics Research Project in Mozambique are included in the books «*On the awakening of geometrical thinking*» (UEM, Maputo, 1985 ; ISP, Maputo, 1992 ; UFPR, Curitiba, 1993), «*Ethnomathematics : Culture, Mathematics, Education*» (ISP, Maputo, 1991), «*Living mathematics : drawings from Africa*» (Scipione, São Paulo, 1990) «*Ethnogeometry : cultural-anthropological contributions to the genesis and didactics of geometry*« (Franzbeckerverlag, Hildesheim, 1991), «*African Pythagoras : A study in culture and mathematics education : cultural starting points*» (ISP, Maputo, 1991), «*Lusona : geometrical recreations of Africa*» (AMU/ISP, Maputo, 1991), «*SONA Geometry : reflections on a drawing tradition in Africa south of the Equator*» (ISP, Maputo, Vol. 1 and Vol. 2, 1993 ; Vol. 3, 1994), «*Numeration in Mozambique : Contribution to a reflection about culture, language and mathematical education*» (ISP, Maputo, 1993), «*L'ethnomathématique comme nouveau domaine de recherche en Afrique : quelques réflexions et expériences du Mozambique*» (ISP, Maputo, 1993), «Sipatsi : Technology, Art and Geometry in Inhambane» (ISP, Maputo, 1994).

Some illustrative examples will be discussed for the transmission of mathematical knowledge in and outside schools, i.e. for bringing mathematics and mathematics education «in tune with African traditions and the socio-cultural environment» (*African thoughts*, ibid.,p.23).

Workshop

Science teaching in Moroccan schools and colleges

Gabriele GÖTTELMAN-DURET*

In the Sixties, many developing countries launched wide-ranging programmes aiming to support science teaching, notably at secondary school (Am.: High School) level, for training their middle and top-level managers in those areas they considered as particularly important for rapid and sustainable economic growth. IIPE has conducted an in-depth case study on Morocco as part of a research project on the planning of science education in secondary schools. This is a particularly telling case because Morocco has put much store on science education, seeing it as a step towards economic and social development: they opted both to pass on a minimum of scientific and technical knowledge to the greatest possible number of youngsters (at middle secondary school level) and to introduce highly intensive and specialised education for pupils selected from the science streams at that level, and destined to become the country's future scientific and technical managers.

The IIPE research had the following objectives:

• to study the dynamics of «producing» young science-educated people at secondary school level (middle and upper school);

• to analyse the conditions (teachers, material conditions, programmes, assessment systems, etc.) under which science education is conducted in the schools (Fr.: *lycées*) and colleges;

• to measure the impact of investments in such education on the development of the country's human resources, basically through an analysis of the continuation and success rates of science *baccalauréat* holders in higher education.

This research rests on a basic statistical study, an analysis of the teaching programmes and examination system, a survey of the teachers and establishment heads, and a follow-up study of science *baccalauréat* holders

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The interim conclusions that can be drawn from this case study are chiefly as follows:

• Despite some fall-off in the numbers of *baccalauréat* holders due to the lower rate of pupils moving from middle to upper school classes, increasingly open access to middle school and the science-streaming of around 40% of those moving up from these classes are culminating in the «production» of a large (slightly growing) number of science-educated *baccalauréat* holders wishing to continue with the sciences in higher education. There is still an extremely limited number of maths-physics *baccalauréat* holders, in spite of a slight relaxation of access to this stream (Am.: track) over the past few years.

• The public authorities have invested heavily in the development and improvement of science teaching at middle and upper secondary school level: virtually all science teachers are now qualified; great effort has been put into equipping laboratories and providing scientific materials; teaching has been arabised and text books are produced locally; a revision of middle school curricula has recently been completed and upper school curricula are currently under review.

• Some indicators, however, raise questions about the efficiency and quality of science teaching and then, the actual conditions under which it is done: the increasing numbers of drop-outs and retakes; the downward trend in student demand for science streams; and, above all, the ceaseless and extremely worrying growth in the numbers of failures and drop-outs from science subjects in higher education.

• The analysis of science teaching and teacher training programmes and the (now decentralised) science examination programme, carried out as part of the Morocco study, reveals certain inadequacies which can be assumed to be contributing to this problematic situation: overcharged programmes, badly prepared teachers, especially in the experimental side of their duties; overly frequent, often badly designed and badly marked examinations/assessments.

• Other aspects of the reality of science teaching and apprenticeship - e.g. the lack and/or defective state of equipment and materials, the inadequacy of the teacher support system, problems in assessing and guiding pupils, etc. - could also be at the root of apparent shortcomings in science teaching in higher education. With the results of the survey of teachers and establishment heads (which are just being processed and analysed) we will be able to elucidate on the actual conditions of science teaching; they will be integrated into the IIPE paper to be delivered at the ORSTOM Conference.

• This research raises some crucial questions for future options in secondary school science teaching, e.g.:

• Considering the (deteriorating slightly) job prospects for young people qualifying in the sciences, should so many pupils still be guided towards the science streams?

• How can access to scientific subjects in higher education be better controlled?

• Given the budgetary austerity requirements, how can investing in science teaching be made «cost-effective», as is not the case today (the pros and cons of investing in the laboratories, the possibilities for improving teaching quality through better adapted in-service teacher training, etc.)?

• To what extent should science education be developed and improved in secondary schools not specialising in the sciences, and how?

Round Table

Where does the Biodiversity Convention go from here?

Michel BATISSE*

The Biodiversity Convention is now in force and the first «All Party Conference» will assemble this November in the Bahamas. Implementing the Convention, however, is causing problems of such complexity that one may well wonder how it is likely to proceed.

The Convention has been said to be bringing biodiversity-rich Third World countries into conflict with technology-rich industrialised countries. This slightly immoderate simplification emphasises an initially unforeseen aspect of the Convention: the use of biotechnologies to enhance certain plant, animal or micro-organism species, varieties or even tissues.

The Convention only barely deals with the explosive appearance of the industrial world and its procession of public and private economic interests, questions of lifeform engineering patentability, of biological safety, technology transfers, access to genetic resources, etc. under a number general principles whose enforcement risks coming up against the realities of scientific, economic, even political power struggles.

At the same time, problems stemming from questions of using genetic resources and biotechnologies could obstruct the initial goal of the Convention's promoters, i.e. to improve the protection of vegetal or animal species and ecosystems (a lot less tricky in the North-South context, but difficult on the national level due to conflicts over use of space). The Convention's funding mechanism (governed by the GEF), however, is designed essentially to encourage protection and, will inevitably be dominated by the viewpoint of those who give priority to this aspect of biodiversity.

Whatever direction the Convention's implementation takes, it will demand special efforts on the part of Southern countries to train specialists and technicians capable of protecting species and ecosystems, mastering biotechnologies and negotiating fair agreements with the countries of the North.

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Round Table

Industrial usage of exotic botanical species: Biodiversity in the service of food production

Patrice DESMARETS*

The PERNOD RICARD group specialises in the production of fruit drinks and preparations for the dairy industry, transforming large quantities of plants of varying kinds and origins. In the main, we are talking about aromatic plants (aniseed flavoured plants such as *badiane* and fennel, gentian root, liquorice, angelica...) and fruits (especially strawberries, raspberries, cherries ...).

For these two types of agricultural produce, PERNOD RICARD generally figures in the category of minor agricultural production, or even of spontaneous plantation harvesters.

That fragility of supply sources gives those products a more or less pronounced strategic nature, which justifies the efforts the *Centre de recherche PERNOD RICARD'* puts into the matter and mastering of aromatic fruit and plant supplies. The CRPR compiles a register of used and useable species, assesses them, improves their production and quality, and thus widely resorts to biodiversity as shown in the following examples.

Experimental cultivation of a tropical aromatic plant in Indonesia: the *Clausena anisata*

Research on the various potential sources of natural *anéthole* has enabled us to identify the botanical species, *Clausena anisata*, as being particularly promising. The experimental plantations we have been running in Indonesia since 1987, have allowed us to calculate the production potential of this forest shrub - from the third year of cultivation, they began yielding around 350 kg/hectare of essential *anéthole*-rich oil. For the possible future development of the plant, resorting to biodviersity involves not only the cultivation and multiplication of the species, but also research into the most *anéthole*-rich and robust clones, those that can best adapt to the production regions.

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Development of a tropical fruit crop in Brazil: Acerola

The acerola, or West Indian cherry (*Malpighia glabra*) is a small fruit growing widely throughout the Caribbean and into Latin America. Unlike the previous example, it is a long known, yet little developed, domestic crop. Its originality lies in its high vitamin C content (something of the order of 30 g/kg), making it the richest fruit there is, way ahead of the citrus fruits. As is often the case with domestic species that haven't undergone modern varietal improvement, there is very great genetic diversity, chiefly in the fruit's size, taste and colour. With a view to a possible future use in fruit preparations for the dairy industry, the CRPR has undertaken the selection of clones remarkable for their dark red colouring, a necessary feature for this type of enhancement. In this particular case, the biodiversity in question is constituted by the great variability of a minor domestic species.

Botanical species introduced through selection: the case of the strawberry

The cultivated strawberry plant - *Fragaria x ananassa* - is a recent botanical «creation», since it comes from the accidental hybridisation just over 200 years ago, of two octoploidal botanical species (2n = 56): *F. chiloensis* and *F. virginiana*. The varietal improvement of the strawberry plant since then has almost exclusively been done according to classic selection methods, by hybridisation of complementary octoploidal varieties and selection on the outcome produced. To increase the useable variability and add new characteristics, it seems interesting to refer to other close botanical species. The diploidal species *F. nilgerrensis*, for example, has the particularly interesting characteristics of aromatic richness and hardiness. We are considering incorporating its genome with that of the strawberry by crossing a reduced tetraploidal form of *F. x ananassa* and a doubled tetraploidal form of *F. nilgerrensis*.

Conclusion

Biodiversity is thus being put to various different uses, depending on individual cases: from identifying and multiplying botanical species to improving domestic species through their own variability or the variability of similar wild species.

Round Table

The Earth Summit and the promotion of environmentally sustainable industrial innovation in Developing Countries

Charles DAVIS*

With the end of the cold war, issues of environment and development are assuming greater international salience. The interlinkages and overlaps between these two issue areas promise to become denser in the future, increasing the complexity of the environment and development agenda. Problems of environmental interdependence must be addressed by international and national policies, but major uncertainties exist about viable modes of response.

In June 1992, the largest intergovernmental conference ever held was convened in Rio de Janeiro : the United Nations Conference on Environment and Development (UNCED, or the Earth Summit). UNCED attracted 105 Heads of State or Government, 8,000 journalists, and 15,000 participants from non-govermental organizations (NGOs) at UNCED or at the parallel conference held simultaneously in Rio. It produced a consensus action plan of about 700 pages : Agenda 21.

Agenda 21 reflects a complex configuration of demands for institutional arrangements that support environmentally sustainable technical and socio-economic change. It covers five broad sets of issues : socio-economic, resource management, waste management, and cross-cutting issues, and roles of major socioe-conomics groups.

Agenda 21 presents massive challenges for international cooperation as well as for national and private actors and scientific and technical institutions. The development of environmentally sustainable forms of industrialization in the South requires expanded and improved international cooperation. The scope and extent of transboundary threats cannot be addressed unilaterally by any single country or group of countries. The North's greater resources and greater responsibility in causing global environmental degradation require its continuing involvement in the search for solutions, including ones applicable to newly industrializing countries.

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ENVIRONMENT AND DEVELOPMENT: THE STAKES OF THE GAME AFTER RIO

The international dimension of environmental questions

This paper first provides an overview of the structure and contents of Agenda 21, the Earth Summit's action plan for environmentally sustainable development. Cooperation, policy development, linkages, market development, capacity-building, financial measures, training exercises, better regulatory regimes, and improved technical support organizations are examples of the kinds of initiatives that are frequently advocated to put the technological trajectory of the South on a more sustainable footing. Most of these activities are among the abundant action items put forward by Agenda 21.

A consistent theme of Agenda 21 is that of «access to technology», and the two chapters bearing most directly on industrial innovation are Chapter 34, «Transfer of Environmentally Sound Technology», and Chapter 30, «Stengthening the Role of Business and Industry». This paper describes the arguments and proposals put forward in these two chapters in the context of current and emerging international arrangements to promote cleaner industrialization pathways in the South. Among the proposals that are being taken up by various actors are : to increase the flow of information about environmentally friendly technologies, to increase industrial self-regulation, to increase the importance of markets in allocating values, and to promote improvements in environmental performance of industry in the South.

Most new initiatives intended to improve the environmental performance of industry in the South are largely based on an implicit strategy of accelerated incremental technological innovation through international transfer and diffusion of improved production technologies. The issue then becomes one of identifying and promoting good practice among institutions that support incremental technical change in industry. As the recent joint IDRC-Earth Council workshop on «Research Priorities in Technology and Environment» remarked, «many of the challenges in the field of environment and technologies demand not so much new technologies or even new policy instruments, but rather new types of institutions to improve the diffusion and 'uptake' of existing technologies». Some of these institutions and associated policy issues are discussed in one section of the paper. The final section explores some of the implications and possible consequences of the incrementalist approach to industrial innovation in the South.

Round Table

The social dimensions of scientific ecology

Pierre LASSERRE*

The Man and Biosphere (MAB) Programme was a logical outcome of the surge of interest and triumph of systemic ecology in the Sixties which brought to the fore man's role in the preservation and management of natural systems. This period began with the International Biology Programme (1963-1973), the Biosphere Conference (1968) and the Stockholm Conference (1972), saw the creation of UNESCO's MAB Programme (1971) and the elaboration of the concept of biosphere reserves, peaking with the major «Ecology in Action» meeting of 1981. The MAB Programme developed through the 1980's in tune to the general trend of the time, whereby research work became increasingly specialised and knowledge became limited in scope and highly dispersed.

Fortunately, the Rio Conference of June 1992 (United Nations Conference on Environment and Development) vigorously endorsed the renewed interest in global and regional approaches and the social relevance of ecology. It also called into question the disparities of the development of the countries of the North and South. In this respect, UNESCO's MAB Programme seems to be well-placed to promote more equitable natural resource management, notably by encouraging local populations to take part in decision-making.

MAB activities now centre on four fields of action concerning man's relationship with nature: biodiversity and ecological processes; sustainable natural resource management; capacity-building; communication and information. These activities are developed for representative models, stretching from mountains to deserts, forests and urban systems, continental waters and their wetlands and through to coastal and island systems. Emphasis is placed on consolidating the international network of biosphere reserves, whose legal statutes will be discussed at the Seville International Conference on the Biosphere Reserves (March 1995).

There are currently over 300 biosphere reserves in 82 countries around the world. They constitute a network that is a flexible tool which does not chal-

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lenge the countries' territorial sovereignty and enables a whole range of programmes, comparative studies, biodiversity inventories, long-term monitoring and training to be accomplished. It should promote better cooperation between scientists and the managers of parks and reserves, improved dialogue with the local communities and broader international ties between decision-makers and international authorities.

The biosphere reserve concept is being successfully applied to coastal systems and islands in an increasing number of countries. Developing coastal States with rapidly growing populations are those where a dialogue with the local population is most necessary. Besides this, thinking on «Regional Units of Sustainable Development» which began in 1993, could accomodate the concept of biosphere reserves on a broader spatial scale, by combining complex systems consisting of a continuum of terrestrial, lake and coastal ecosystems, including urban areas (e.g. the Mata Atlantica in Brazil and Lanzarote island).

The South-South cooperation programme launched at the Manaus Conference (June 1992) shortly after Rio, concems the humid tropical zone (Africa, Latin America, Asia) and constitutes an important means of improving relations between the countries of the South. UNESCO provides the secretariat for this programme. Its aim is to identify the centres of excellence to be established and to accomplish joint research programmes.

The Chairs in *écotechnie* recently introduced by UNESCO and J.Y. Cousteau are being established successfully by a growing number of universities which are forming themselves into a network. *Ecotechnie* is ready to become a fully-fledged discipline that should combine the most advanced data from ecology, economics, the social sciences and adapted technologies. The aim is to offer future decision-makers really multidisciplinary training which takes the long-term consequences of development into account.

Although the planetary dimension of environmental issues is now universally recognised, it will not eclipse the extraordinary diversity in the relationship of man's relationship with his environment. This diversity is not only of an economic order; each society is sensitive to its own prevailing nature; our perception is fashioned by the major religions, history and landscapes which put into question the way we picture relationships between man and nature. This awareness and these different perceptions have been unjustly and dangerously neglected by our economic models, which are essentially the product of the Western world. UNESCO cannot neglect this aspect and is duty-bound to contribute sound information about the way nature is represented in civilisations, and to transcend the cliché of man-nature symbiosis.

Round Table

International solidarity is required to solve the equation of environmental protection

Mohamadou EL HABIB LY*

Every nation in the world quite obviously needs to exploit natural resources for satisfying vital requirements, and to develop industry for economic growth. The challenge is consequently to reconcile survival and/or development needs with the protection of the environment for the benefit of future generations.

However, some current trends and practices are casting seriously threatening clouds over our natural resources, thus compromising the certainty all the living beings of the Earth might have of living in a healthy environment tomorrow.

The threats may be many and varied, but certain situations are becoming of vital interest: take, for example, the future of the climate on a worldwide scale. In fact, the greenhouse effect, a natural phenomenon when all's said and done, has been growing worse for over a century owing to the human activities that add to the considerable increase in gas levels, along with other especially active elements like chlorofluorocarbons (CFC). What's more, climatic models and studies of paleoclimates show that the future rise in the levels of such gases will, in the hundred years to come, lead to an average warming of 1.5 to 4.5°C, accompanied by sea-level rises of 0.30 to 0.60 metres. This will have very serious consequences for the whole of humanity and for all the planet's ecology: the resulting atmospheric changes would affect the entire human race.

This being a question of biodiversity, the Rio conference has, among others, raised awareness of a new danger clouding mankind's future: disappearing natural environments and species. With regard to ecosystems, the most often mentioned case is that of the tropical forests considered as gigantic reservoirs of biodiversity, harbouring more than half of the Earth's living species, yet disappearing at a rate of around ten million hectares a year. Other equally endangered sites of biodiversity located in species-rich temperate regions or

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primary forests, have progressively been replaced by secondary forests and plantations. Biodiversity is just as important for health, since over a half of all medicines come from plants. Biodiversity represents both a challenge for food security and the health of populations, and an economic challenge of the utmost importance; access control regulations are at the heart of international negotiations such as with GATT.

Furthermore, it so happens that poverty in the developing countries is one of the prime causes behind the destruction of the environment. Indeed, in their daily struggle for survival, their populations have virtually no choice but to cut down trees to meet their fuel needs, and to destroy the forests so as to reach fertile crop lands. On top of that, demographic growth is exacerbating the already strong pressure being brought to bear on natural resources. If such a cycle continues, the whole of humanity will suffer, directly or indirectly, if only because of the role that forests play in regulating the climate, carbon storage and the conservation of biodiversity.

These examples show that in fact, beyond national borders, the world is just a global village with a seriously endangered environment without physical barriers; no country can envision protecting its own air or not be concerned by the loss of biodiversity: so respect for the environment consequently concerns one and all.

As such, the complex and interdependent problems which must be solved in the area of the environment call for an approach that must go beyond individual interests.

The stakes in the wake of Rio will thus be engraved in the ability of the whole human race to show solidarity and complementarity to face up to these threats. A better balancing up of the terms of North-South exchange; transfers of know-how and technologies for sustainable ecological development; firm commitment on the part of the countries of the North to deploy 0.7% of their GNP in the development of the countries of the South; flexible access to funds from, for example, the *Fonds pour l'Environnement Mondial* (FEM) aid agency; all these are elements for decisive international cooperation due to the global nature of environmental problems.

Round Table

The contribution of the African Academy of Sciences to African Science and Technology capacity-building

Dr. Iba KONE*

Since the dawn of time, scientific and technical creativity has been unevenly dispensed in the various human societies that have left their indelible mark on universal civilisation. Each cycle of history has seen technically dynamic societies existing alongside technically dormant ones. The great civilisations of Egypt, China, India, Greece, Rome and pre-Colombian America are all noted for the grandiose works which enabled humanity to progress in its continuing quest for knowledge. The great difference existing between these highly developed societies and their less developed contemporaries constitutes what we today call the "science and technology gap". Having said that, technical progress in ancient times was not continuous. Sooner or later, the most advanced societies would lose out to other, more dynamic and enterprising ones. Today, Africa is still a dormant society which should be awoken so that it too might take part in enriching universal civilisation. Far from falling into «Afro-pessimism», our presentation strives to objectively analyse the root causes of the science and technology gap between Africa and the rest of the world.

It divides into two parts. Part one is devoted to a review of certain key indicators of the continent's science and technology research. It pays particular attention to examining the sources of funding for scientific research, the human resources available, the circulation of scientific information and the magnitude of industrial collaboration in Africa.

Part two surveys the African Academy of Sciences' experience in science and technology capacity-building in Africa. Facts and figures are given to back up our presentation of the Academy's action.

Finally, we shall conclude with a very succinct résumé portraying the Academy's vision with regard to national cooperation.

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Round Table

Cooperation policy in development serving research: Criteria of choice

Michel NUCÉ DE LAMOTHE*
Michel EDDI**

At CIRAD, defining the themes and programming of research activity geared to the economic and social development of the countries of the South, is subject to a double contingency:

- that of the demand: activity themes have to be defined to meet a demand expressed by a development partner, be they French or otherwise;

- geographical contingency: research and development projects are settled jointly with the Southern partners, and carried out at the institutions involved, in both France and host countries alike. CIRAD researchers thus have direct access to the fields of experimentation by means of being posted abroad.

In order to define, plan and enforce a policy of scientific cooperation, to circulate the knowledge and results and enhance the resulting products, the establishment must be able to mobilise a varied range of abilities, each corresponding to a link in the process which, by appealing to a research activity, enables development-related questions to find answers adapted to the specified needs. These various stages correspond to as many fields of activity which together go to make up the research finalised through the development which CIRAD has to master and which presents the following characteristics:

- it sets CIRAD apart from other research establishments;

- it results from the fulfilment of nine fields of different strategic activities or «professions» that must be mastered, and gives them coherence and an overall logic;

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• there is no a priori hierarchy among all these «professions», particularly those oriented towards research and development;

• it is oriented and programmed around field projects responding to the specific demand of partners. Its themes and fields of activity are defined in partnership;

• these projects help determine the scientific abilities required and the basic areas of research that need to be covered. The analysis enables the cooperation agreements CIRAD has to conclude with its scientific community partners to be mapped out, and their contents defined; it has to resort to outside contributions, because it doesn't have all the necessary financial and staffing means internally.

The CIRAD can thus offer several possible professional configurations: as well as being a research establishment, under certain conditions it can also act as a research consultancy, a development agency, a commercial company and training centre. Correct proportioning between these activities constitutes the institution's strategic heart; this it must devote to raising awareness and promotion so as to be able to:

• characterise and assess the development potentialities of each on-the-ground situation via diagnosis and expertise;

• link research projects up with development actions carried out in partnership.

To do this means having to produce a combined research activity (laboratory, experimental station and real environment), whose themes and approach incorporate the representations and preoccupations of the actors in the field, i.e.:

• to make the linkage with development operational by stepping in to offer projects technical support, as much at laboratory level as in the field;

• to produce new knowledge through syntheses of pertinent work conducted at a spatial, temporal and thematic level by the establishment and other institutions;

• to manage a standing mechanism set up beyond the Metropolis via cooperation agreements and networks involving partners at a national or regional level. Management and administration are essential activities for providing expatriated staff with support;

• to circulate the knowledge and learnings among users through training and scientific and technical information;

• to optimise the establishment's production through the sale of material and non-material products including services.

Although these various activities do not muster the same abilities, when need be, CIRAD scientific managers should be able to exert them simultaneously or successively in the course of their professional lives.

They define a map of CIRAD professions, with intercommunicating zones specialising in research, technical support or the mounting and managing of projects and partnership networks.

In this context, the initial training profile (e.g. doctor) plays some part in polarising the possible future professional trajectories. Yet first-hand knowledge of real environments and the experience of having conducted an activity away from home, are also important factors in determining whether one can work in some of these professions.

The machinery's orientation towards development demands, the multiplicity of partners involved, the variety of funding sources and the instability of its geopolitical environment have led CIRAD to setting up activity guidance tools that can be used to keep its supply of abilities permanently tuned to the realities on the ground. Getting them working presupposes a strategic centering of the whole establishment and the use of choice and decision-making criteria for picking out the best of the cooperation opportunities, while bearing in mind the medium-term orientations and objectives the establishment lays down in agreement with its supervisors.

Round Table

Choice of technology policies: A new focus

Carlos OMINAMI*

The aim of this paper is to contribute to the establishment of conceptual bases for a new focus in the choice of technology policies. It does so by reflecting on the effects of technology policies applied in Latin America and, in particular, on recent Chilean experience.

Traditionally, technology policies promulgated by the public sector in Latin America have functioned as a no-go area for the business world. It might be truer to say that mutual mistrust reigns both in the private and public sectors, to which can be attributed the absence of major interfaces between the two. The premise that the private sector was only casually disposed towards technological innovation led the public sector to echo these features in formulating policies. The public sector, being somewhat messianic, has identified important technological priorities and sectors and has sought to pave the way for research programmes in the fields of basic sciences and their corresponding technological applications.

As was to be expected, these programmes have had somewhat limited success. Although some countries have managed to supply themselves with a degree of technological infrastructure, they have not made any substantial contribution to the output figures of Latin American economies.

The new technological focus is derived from completely different premises. To start with, it is taken for granted that we are part of a global economy in which the notion of competitiveness is essential. At the same time, sustainable development criteria are starting to play an increasingly important role in this new approach, while developments based on wide-ranging exploitation of natural resources are facing ever-harsher difficulties in terms of reproduction. This is what brings us to posit the idea of a *second phase of exporting development,* characterised by a higher ratio of added value, more skilled labour and consequently more technological sophistication.

We believe there are four elements essential to establishing this new direction.

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• Firstly, the development of a *culture of innovation* which must be promoted in all segments of society, both in the private sphere and in the public sphere,

• Secondly, schemes must be devised which will provide countries with the appropriate *technological infrastructure* to meet the requirements of the global economy, by developing programmes in the basic sciences and their technological applications,

• Thirdly, *modernisation of the legal framework is essential*. Many aspects are involved here. We would point out, among the different cardinal considerations, the updating of legislation on intellectual property. This is a key factor in enhancing technological transfers through the encouragement of national patenting of products and processes. It rarely happens in the scheme of things, and thus subsequently, intellectual property is afforded little protection. Likewise, revision of legislation pertaining to the development of different types of technological services such as consultancy, software transfer, etc. is axiomatic. By the same token, quality certification systems for exports should be established on the understanding that the imposition of certain requirements implies the introduction of new technology which goes hand in hand with conformity to these new standards.

• Lastly, and crucially, the application of specific devices aimed at *reducing the cost of technological innovation.*

There can be no doubt that the high cost of innovation operates as a very powerful brake for the development of innovative directions in developing countries. The idea behind this new approach is not, as traditionally perceived, that of simply substituting the private sector by developing large-scale public-sector programmes. Rather, it revolves around the creation of conditions which will enable the private sector to take on relevant technological undertakings. There is an essential ramification to this to be considered along with the above factors, which is related to the lowering of the costs of innovation, by means of putting a *technological subsidy* in gear, as it were. This new technological direction implies a re-definition of traditional industrial policies. Basically, it means a transition from policies which favour specific productive sectors to policies which, while not abandoning public intervention all together, assign clear restrictions to it. We are not talking about giving preference to the development of certain sectors, which are often prioritised for bureaucratic considerations, but making available to the private and market sectors elements which do not involve a definition of priority sectors. This, of course, does not invalidate the fact that, at a later stage, certain sectors may be identified as meriting priority because of their supply of natural resources or other elements.

Round Table

Cooperation programme criteria of choice

Moriba TOURÉ*

Cooperation is generally understood to be support, aid or policy by which means one country or body contributes to the economic, technical, scientific or cultural etc. development of another. As such it assumes several forms according to time and space. It generally involves two parties, i.e. the donor and the beneficiary.

In the case of a well-balanced type of cooperation, the beneficiary is also a donor and vice versa; whereas in the case of aid donations, the exchange most often appears unequal. All the same, cooperation as a rule aims to protect or guarantee the mutual or contradictory interests of both parties involved.

By virtue of its diverse nature, cooperation can manifest itself in the shape of (isolated or enduring) donations or as programmes, i.e. series of actions implemented at set times and places. That being the case, upon what bases do the said cooperation programmes make their choices? Thinking at this level furnishes the answers to the questions constituting the framework of the general and specific objectives of the cooperation programmes.

Actually, in practice we see that the general objectives respond to the following criteria:

- the values upon which the development models to be promoted are based;
- the donors' ability to implement the programmes (by diverse means, including expertise);
- the programme beneficiaries' receptiveness to the values advanced or interiorised by the donors.

Specific objectives are, for their part, justified by:

- needs suggested or revealed by donors and felt or expressed by beneficiaries;

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- the unsuitable or weak productive forces of beneficiaries;
- the strengthening of the beneficiaries' capacities to be taken care of;
- the programmes' profitability.

So the general objectives appear to have an ideological nature and an unmentioned motivation, i.e. to hold beneficiaries to their roles, for a variety of reasons (political, economic or both).

The specific objectives, however, rest on criteria reflecting the situation of the beneficiary countries.

They can also give cooperation programmes a great deal of credibility, while at the same time bringing out the donors' humanism, selflessness and generosity.

So it is important to answer the following questions:

- Who are the programme criteria of choice determined by? How? Why?
- How do the effects of the programme criteria of choice show themselves in both beneficiary and donor countries?

We have seen that in defining their criteria, the cooperation programmes obey a variety of considerations (ideological, economic, political, scientific, etc.) possibly for the domination of the donors on the one hand, and on the other, on psychological, cultural and material grounds with the beneficiaries. The effects of these criteria can thus be considerable.

If, in some cases, the seriousness of the effects in the beneficiary countries can be toned down by the success some cooperation programmes have had, in other cases they have conversely managed to strengthen the donors' domination over the beneficiaries and, create and develop the latter's habit of being perpetually assisted.

The collapse of the countries of the East, the end of the Cold War and the failure of a good many cooperation programmes have contributed to bringing out the impertinence of some cooperation programme criteria of choice, not with regard to their ideological and materialistic characteristics, but with regard to new criteria such as the respect for human rights, democracy etc., which were nonetheless massively ridiculed virtually everywhere in the countries of the South when the Cold War was at its height.

The North is increasingly tending to accentuate the criteria of profitability and the basic needs of the underprivileged populations of aid beneficiary countries.

COOPERATION PROGRAMME CRITERIA OF CHOICE

Looking at the failures recorded in the area of cooperation, the growing impoverishment in the countries of the South and the economic slump shaking the countries of the North, a redefinition of the cooperation programme criteria of choice would seem to be in order, so as to give them new, more pertinent objectives that are more likely to bring about development. This reformulation, far from being of a generic nature, should be adaptable to both the areas of cooperation and the geographical and socio-economic contexts.

As such, in scientific cooperation between the North and South, the basic presupposition likely to underlie the defining of the programme criteria of choice could, for example, turn on a definition of the development concept which is in itself scientific, i.e. without any ideological or technocratic premiss and connotation.

Instead of mechanically dumping a development model conceived for one context onto a different real-life situation, those making the choices for cooperation programmes should account for all the specificities of the countries or bodies in question, so that they may be integrated into and adapted to the universal norms of progress.

From here on, the cooperation programme criteria of choice are required to be transparent, which should restore their credibility and make them into the (theoretical and practical) bases of reference for the actions to be enforced with a view to the progress of science within given contexts.

Actually, it appears that the notions of need and development tend to become confused, insofar as the latter creates both the state and the conditions that enable a society to satisfy the former. Satisfying society's basic needs is only possible because it (society) makes use of all of its available (scientific) knowledge and ability to (technically) transform nature.

In the area of basic sciences and technologies, the scientific cooperation programme criteria of choice must now above all else include training, research equipment, the ability to create production and transformation techniques and technologies.

As far as the social sciences are concerned, training and equipment could be joined by other criteria: research focusing on the basic needs of societies and the conditions under which they can appropriate production and transformation techniques and technologies adapted to their own situations.

Workshop

North-South scientific cooperation in the world of plant biotechnology: ILTAB, a model amongst others

Claude FAUQUET*
R.N. BEACHY*

Plant biotechnology offers tremendous potential to improve human health and welfare, and there is no doubt that they will impact greatly agriculture in the 21th century, especially in Less Developed Countries (LDC). Independence in food production and consequently the social and economical development of LDCs will necessarily include the acquisition of these new technologies by the national research institutes of these countries. The fundamental question involves how to ensure the transfer of relevant technologies to these institutes.

The transfer of scientific technologies to the LDCs implies a number of constraints, such as :

- the permanent transfer of new knowledge ;
- the scientific and technological training and re-training of young scientists from LDCs ;
- the access to biological tools, many of which are owned by private and academic institutions in advanced countries ;
- adapting relevant genetic engineering technologies to tropical crops ;
- identifying funds for research in biotechnology for LDCs ;
- securing minimal equipment for biotechnological labs in LDCs ;
- establishing new rules and regulations for the usage of modified organisms in LDCs ;
- the recognition and use of intellectual property rights.

Research in the biotechnological sciences is progressing at a rapid pace, particularly in genetic engineering. Transfer of relevant technologies is a continuing process where communication, persistence of efforts and scientific interaction are some of the key issues of success.

There are many ways to reach research goals in biotechnology, some of which can be summarised here :

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NETWORKS, PARTNERSHIPS, CENTRES OF EXCELLENCE:
Variety of form and criticism

A - It is important to build international institutes that are capable of biotechnology in LDCs where developed countries will send trained scientists, equipment and technologies, etc., and where scientists from LDCs will receive training, scientific and technical support. Such institutes are, for example, the ICGEB (International Centers for Genetic Engineering and Biotechnology) and certain CGIAR (Consultative Group for International Agricultural Research) international centers.

B - It is essential to encourage the development of specialized networks which will promote communication, develop training, transfer techniques, and search for funds ; for example ISAAA (International Service for the Acquisition of Agri-Biotech Applications), ABSP (Agricultural Biotechnology for Sustainable Productivity), CBN (Cassava Biotechnology Network), RBNet (Rice Biotechnology Network), etc.

C - Develop specialized laboratories in advanced countries that will be the basis for hosting, training, informing and helping scientists from LDCs; ILTAB is a pioneer of these labs.

Each system has advantages and disadvantages and we will present arguments to illustrate each of them, summarized as follows. Option A (above) is static, very time consuming to set up and necessarily limited in space. In addition, these institutes suffer from the same problems as the national laboratories ; including inherent physical and political constraints, financial problems and above all scientific isolation, a problem common to national institutes. The implementation of scientific networks has been extraordinary in the last few years and shows the needs ; such networks are complementary to the other systems. However, they have the disadvantage of not directly offering a research component. The third solution, although limited in its capabilities (first points above), has the advantages of requiring limited structures correlated to the development of science. Above all, it offers a direct exposure to constantly updated research developments and a permanent connection to a critical mass of scientists in the institutes of advanced countries.

ILTAB, The International Laboratory for Tropical Agricultural Biotechnology, located in La Jolla, CA, USA, is hosted by The Scripps Research Institute, a basic research institute. ILTAB is derived from the association of ORSTOM, a French public research institute and TSRI. The laboratory is international in scope because it receives money from organizations in both France and the USA, and above all because research and training are done by students and scientists from all over the world.

One of the primary goals of ILTAB is to open the door of modern and sophisticated research to scientists from LDCs that are interested in adapting such research to tropical plants. This laboratory transfers advanced technologies, first demonstrated on model plants, to real problems prevalent in developing countries.

The research conducted at ILTAB is directed to tropical plants and plant viruse pathogens in LDCs. Furthermore choices for research were made in accordance with the economic importance of these diseases in relevant LDCs.

ILTAB is a research as well a training unit, scientists of all ages and with diverse scientific backgrounds, are hosted regularly. These scientists keep in touch with ILTAB when they are back in their own institutes.

ILTAB collaborates with national and international research institutes in Africa, Asia and South and Central America. After setting up a few research projects on our own, in response to the requests of several agencies of cooperation, ILTAB is now in a phase of bilateral collaboration for the new projects.

ILTAB is permanently connected with scientists from all over the world, originating from advanced and developing countries, in all aspects of genetic engineering for tropical crops. ILTAB has participated to the establishment of several scientific networks in order to facilitate the spread of information relevant to the development of tropical genetic engineering, and to promote the training of scientists from LDCs in this particular field of science.

Finally, all the biological and technological products of ILTAB are made available to LDC scientists upon request.

Workshop

Scientific patnerships with NGOs? Twenty years of non governmental cooperation for development

Bernard HOURS*

International cooperation in the area of development has experienced recent, rapid changes linked to the evolution of ideologies which has palpably altered the shape of North-South relations. In the context of this, the NGOs (non-governmental organisations) have gained an important place, the historical background of which should be illustrated before dealing with the importance and limits of partnerships to be established with them within the framework of co-managing the «global village». Here, the NGOs, like research, take a place that must be specified, compared and distinguished.

Third-Worldism and humanitarian ideology indicate the two most marked periods in the history of the NGOs. From the conference of non-alligned countries in Bandung to the public questioning of the white man's woe in the Eighties, the mythical view of the Third World presented the South as a messianic figure of history. In the name of justice and solidarity, Marxists and Christians struggled together against exploitation, injustice, unequal exchange, the plundering of the Third World, all classic ingredients of their ideology.

In France, the humanitarian age dawned in the early Eighties with the direct marketing-based «charity business» targeting potential donors.

The *Liberté Sans Frontières* foundation was to be the tool to put an end to the *Third-Worldist* hegemony. The *Third-Worldist* development creed faced a head-on assault from an anti-Marxist, neo-Liberal movement. Anti-Third-Worldism ran high among the emergency associations which considered it to mark a beginning to development. In anti-state-controlist terms, it claimed to be inspired by human rights and advocated economic neo-liberalist recipes, up until the end of the Eighties, at least.

Those associations** favoured a technical and pragmatic approach to development, not neglecting the affects face of the most glaring injustices. The

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State was seen as an obstacle to development, but that stance has eased since 1990. Saving victims means having to compromise with the States, while steering clear of shady deals.

Characterising the profile of NGOs in the Nineties is a prerequisite for tackling their place and role as scientific partners. They are *political* agents, since «humanitarianism» is the major element in considering world unification, along with the market economy. They have become outstanding and complex mechanisms engaged in increasingly technical, if not technocratic, intervention. They are made up of experts and consultants, some of whom then go on to international consultancy. Moreover, they carry out bona fide cooperative efforts as substitutes in States sometimes reputed to be incapable of assuming their own responsibilities. Replacing national players also means replacing the agents of the noticeably withdrawing French Ministry for Cooperation.

So, thanks to their popular support and familiarity with state and international procedures, the NGOs now have a great deal of power, despite any remaining anti-state feeling. They confirm their power through a skillful use of the media and an ability to bypass the local States and inform world opinion from remote villages.

Theirs is nonetheless still a lobbying power, i.e. that of pressure groups. NGO action comes up against international, local and military constraints which are beyond their control. One could say that these organisations have a lot of impact, but modest power. They furthermore remain highly dependent on the international bodies financing major development programmes.

Under these conditions, cooperative development research can hardly ignore the NGOs' place in the field. In the projects they implement, they constitute a laboratory of paramount importance for the study of local and global development realities.

Some of the favourable and unfavourable factors for partnership with NGOs can be analysed. Many of their projects include a demand for research, e.g. where volunteers aware of what's lacking, ask for knowledge about the local environment. Those same projects constitute a vital area for development research which can find there the essential questions and problems it confronts.

Many NGOs are ready to collaborate. Yet the collaboration is often seen to be basically utilitarian and instrumental. Research supplies tools that do not challenge the contributors' approach. Researchers appear to remain more reluctant because the ideological leanings influencing the NGOs might not be entirely compatible with some of the ethics of scientific research. Although such reservations are slowly easing off, the number of research programmes carried out in conjunction with NGOs is still quite low, while many of the development projects they conduct have some facets of research to them. Although these do not always conform with academic principles, they do indicate the need for researchers to be more open in this sense and, that the ideological prejudices or slews which the NGOs are prone to, need to be overcome.

Greater willingness on the part of researchers to open up; NGOs with an ideologically more mature attitude towards the countries of the South ... such would seem to be the main conditions for better scientific partnership between researchers and NGOs, implying mutual enrichment rather than impoverishment.

Workshop

Research networks: Why are they not fulfilling their promise?

Marie de LATTRE-GASQUET*
Jean-François MERLET**

The current success of the network notion applied to both research and political institutions and enterprise, summons to view an effort to define and clarify. It has been advanced in Developing Countries over the past ten years on the grounds of critical mass, efficiency, and for financial reasons. The network notion has been shown to be very useful for describing the phenomena of technological creation.

Today, though, we see that the organised network isn't coming up to the expectations. Reference to the network model has mainly been reactive, i.e. the network has appeared as a magic formula to overcome the inadequacies of existing structures.

We shall try and demonstrate that people have sought to use a concept adapted to certain situations that aren't always found in the world of agricultural research in Africa.

To begin with, we look at the principles of setting up a network and its consequences, so as to gain a clear understanding of its basic concepts.

Working within a network comes about because of a change in the environment. It derives from a new reality of limited means and increased competition.

Networks firstly entail the horizontalisation of structures and relations between actors. A network should enable its members to keep in touch with each other and contracts to be settled. It aims for decompartmentalisation, coordination via direct interaction. It is an alternative to vertical integration and diversification.

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Secondly, networks entail hybridising knowledge and rules. A network is a body of technical means, rules and norms defined publicly or in private. It is a tool enabling growth in learning abilities, a means of creating a critical mass of scientific expertise that can work together towards resolving identified constraints.

Thirdly, networks entail the dynamic growth of structures and relations. The network notion is often linked to the notions of limited-term projects . Network frontiers are porous. People enter, people leave. Such adaptability stems from voluntary belonging and explicit agreements of network members, as if the internal cohesive forces were compensating for external instability and the lack of future propects.

Working within a network is economical, for functional collaboration can lead to functional complementarity, cost-sharing, growth in efficiency and access to a market.

We go on to describe and appraise the strengths and weaknesses and prominent features of several research networks in Africa (the CORAF network, networks initiated by the international centres of the GCRAI, the SAFGRAD network).

The lessons learned from studying these networks are presented in part three, along with a few recommendations:

• networks are transnational. They link up individuals from different countries. There really is structural horizontalisation at the international level. Sometimes, individual members are unable to retransmit what they acquire at the international level to the national level, for they don't have a national network of their own (owing to legal, material or financial reasons);

• networks are created before joint research projects are defined. The network is a structure that is added to existing structures. It doesn't come into being spontaneously. Networks have generally been set-up on the initiative of international financial backers or institutions. This accounts for duplication. There are no set criteria for entering or leaving a network. Networks need to be simplified and their lifespans limited;

• there are at least two types of network members: those working at national, and at international or developed country research institutions. Each group-type has its own objectives. Their member initiation procedures differ, and the right conditions aren't always combined for real trust-based relationships to exist between members. Networks nonetheless replace the technical assistance that national institution researchers no longer want. The idea of dynamic growth in structures and relations is still not yet sufficiently in force;

• networks conceal the laboratories and the diversity and quality of their teams. Good products and results cannot be expected to come from a network where the teams at work are of unequal quality. The reputation of coordinators and members vary. So the quality and reliability of the networks depend on reputation gained through peer review;

• the funding supplied via the networks helps top up the budgets of national and international institutions, yet often aggravates accounting problems. When researchers adhere to several networks due to material interests, their activities are dispersed. The present state of the data makes it very difficult to determine how much is saved through working within a network.

Workshop

The Boumerdès experiment in technological cooperation: Actors and institutions

Hocine KHELFAOUI*

Analysing a «cooperation» effort is no easy matter, especially when it teams a «North» country up with a country of the «South». The Boumerdès centre of technology (Algeria) offers a telling example of how difficult it can be: chiefly shown through the web of rational principles and interests governing the functioning of the cooperation effort.

First of all, there are the two sets of institutional principles represented by the bodies cooperating. These two partners constitute two distinct, if not divergent sets, as much in terms of their interests -one is selling, the other a consumer- as their social and organisational values -professional norms, organisational norms... Will those one seeks to promote be adhered to by the other?

The principles of the cooperating institution

In the main, this set of institutional principles shows that the cooperating institution's relationship with the cooperation project is very strongly influenced by what's at stake for its present and future. Also, the quality of the services offered and the material and human resources mustered for the project depend on its interest potential.

Actually, to situate itself within this context, a project often characterises itself through numerous commitments whose differing sizes and importance depend on the evolution of the cooperating institution. In this respect, the way the project will be dealt with is somewhat affected by both local and international commercial prospects. The project should assume the same order of importance for both partners.

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The principles of the beneficiary institution

Although driven into the untoward position of petitioner, the beneficiary institution will seldom relinquish its autonomy in decision-making, even with regard to the most technical matters that the cooperation is supposed to subcontract out. Even though it plays the passive role in the relationship with its partner, it is always the one to determine the ultimate orientation of the said cooperation and, the project's ultimate success or failure. Balance between internal principles embodied in local norms/values and outside principles, is what comes out in the phrase so often repeated by the actors: «the success of the cooperation depends on he who sits before the cooperator». So institutional reasoning is thus left behind in favour of that of the cooperating actors.

The actors' principles

Actually, the institutions' principles bound together in an interest-based contract, are combined with the autonomous behaviour of the actors. This is reflected in a dual confrontation: between the actors and their own institution; and between the actors of the two countries involved in the cooperation.

Since the actors on both sides are actually working on the ground, they are better placed than the decision-makers to see the discrepancy between the knowledge being offered on the one hand, and the specificities of local realities and the cooperation beneficiaries' aspirations on the other.

Owing to this, they appear more inclined to be self-critical and, hence, to ponder the terms of cooperation. Sometimes it leads them to adopt courses of action running counter to the orientations of their own institution.

In seeking out new avenues, a fresh sense of meaning for their work, cooperators themselves often become the learners. Yet this behaviour pattern also seems to be a response to the Algerian partner's expectations: that the cooperator be both effective and able to take care of its specifically local preoccupations. It is chiefly from this latter requirement that the tensions bringing the actors of the two institutions together and feeding the bulk of the discussions over cooperation, will spring. An equally noteworthy point in these relations, is that there is some reaction on the part of Algerian actors to what they perceive to be attempts at «scientific hegemony», whether tinged with «paternalism» or not. Having said that, they also tend to regard cooperation less as a «business contract», with each partner legitimately seeking to make a maximum amount of profit, than as an effort of solidarity which, beyond any mercenary aspects, consists of an eminently moral responsibility. And this has some effect on their relationship with the cooperators and the expectations built up by the cooperation effort.

Finally, in the light of the answers to these questions, a two-level comparison will be established:

• on the one hand between cooperation models coming from different institutions and countries;
• on the other hand, between Algerian institutions whose emergence can definitely be said to have come about thanks to a cooperation effort.

This paper shall investigate the influence inherited traditions have had, particularly on science, the style of science, methods of management and organisation...

To conclude, let it be pointed out that this paper is the end-product of a survey conducted at the technical centre of Boumerdès (Algeria). It drew on a number of different types of cooperation and countries. There were two basic sides to it:

• the gathering and processing of a quantity of documents, letters, notes and so on, concerning various phases of the cooperation effort;

• interviews with Algerian actors, chiefly project managers and teachers who were former colleagues of cooperators or former pupils...

Workshop

A contribution to develop Science and Technology in a delocalized way in a developing Country: The Caldas network

Jorge CHARUM*
José GRANES*

As in many other Developing Countries, the emigration of scientists, engineers and other qualified professionals has been increasing since the late sixties in Colombia. An estimation of the number of Colombian professionals actually working in S&T activities abroad is about 2000. Until recently the policies applied to recover this scientific and technological potential abroad consisted mainly in repatriation programs. These policies corresponded to those of some international agencies, for example, the International Organization for Migration (IOM). The effects of these policies in Colombia have been limited. The scientists' migration, and its capitalization through repatriation programs, has been analyzed until now in the frame of brain drain and, more recently, brain gain theories.

An original program to capitalize, for national scientific and economic development, on the competence and experience gained abroad by Colombian professionals began in 1991. This program, the Caldas Network, goes far beyond simple repatriation policies. The Network intends to create and develop links between Colombian scientists and professionals working abroad and their peers in Colombia. Thus it creates possibilities to expand national research networks through participation and insertion in international networks. The originality of this project consists in the creation of new possibilities for scientific migrants to participate, in a delocalized way, in the development of Colombian national science. The Caldas Network is part of the National Program of Science and Technology that is being developed in Colombia. The Program includes, among other issues, legislation that encourages scientific activities, the creation of a national system of Science and Technology, and an important increase of resources to finance projects.

Since its creation, the goals and programs of the Caldas Network have become more concrete and have been enriched considerably. In the beginning, the emphasis was put on the creation of a database that would help professionals abroad to create the capacity of project evaluation to be used by

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the national system of Science and Technology. This capacity would make it possible to evaluate national projects using international standards. The organization of professionals in nodes which work in various cities of the world (at present, these organizations have been created and are functioning in 21 cities), the regular flow of information between them, the diffusion of information to all members, exchange programs for short periods for expatriated researchers to work in Colombian laboratories, and simple repatriation programs, have made possible the integration of more Colombian scientists to the international conditions of scientific and technological production. It has even been possible to develop projects in cooperation.

The nodes are conceived as autonomous entities with legal status. They can organize events, establish links to international programs of scientific cooperation, and collect resources to finance national science.

The activities generated by the network, specially those that come forth through the nodes' own efforts, contribute to maintaining the interest of expatriated scientists in developingSscience and Technology in Colombia, and strengthen their feelings of identity as Columbian nationals.

The Caldas network can be considered as an instrument to intensify links for the benefit of national science. Through the application of recent network theories in the analytical framework of the new sociology of science and technology, one can explore the richness of relations that can be established.

Workshop

International scientific migrations today

Charles HALARY

The major event in the last quarter of a century has been the fall of "scientific socialism" in the Soviet Union. The powerful Soviet scientific community is today undergoing full reconversion in order to deal with this change, to which it contributed considerably. The new international circulation of researchers around Russia is one of the most important manifestations of this reconversion.

This new international Russian circulation brings to the analyst's mind a model that is located outside of classic theories on brain drain or brain gain.

The integration of Russian science into the international scientific community reinforces interpretations of science as a global system of cultural unification established by countries of Northern European culture with regard to Southern countries. The core of this entity lies in the new cooperation between the United States and Russia.

There is no longer Western or Eastern science, bourgeois or proletarian science, but rather a global scientific system based on shared communications networks and similar processes of evaluation. It is focused in the North, spreads towards the South and finds its sustenance in the rising generations it produces.

In this sense, the new international circulation of Russian scientists homogenises science's Nordic geopolitics. It also suggests a new Eurasian arrangement for science, which could offer an alternative to developments currently underway around the Pacific at the initiative of Japan and the United States.

Workshop

Brain return and institutionalisation of frontier areas of S & T in a Developing Country context

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The international migration of scientists from the developing to the developed world has been widely researched by social scientists and international agencies under the UN for quite a number of years now. The problem of brain drain has been bothering the developing world ever since these countries embarked on the expansion of a modern science and technology infrastructure in their own national contexts. A plethora of literature on the brain drain, explored the migration in terms of various quantitative data and as an economic factor through input and output analysis drawing our attention to the loss of monetary capital. Further, the material conditions and the «dazzling» value of the US «dollar» in the West dominated the analysis. Some studies also drew attention to the economics of monetary reptriation to the home countries from whence the brains migrated. While the human losses incurred through the brain drain, and the corresponding economic dimensions can hardly be disputed. The *economic dimension* should not be taken as the only dimension or major aspect of the whole concept of brain drain. One rarely comes across the qualitative features of this problem.

Beyond this economic dimension, there is indeed a sociological dimension or the other aspect underlying, the concept of brain drain. Two important considerations draw our attention to this qualitative or sociological aspect of brain drain. On the one hand, the problem of brain drain is largely related to the processes of presence or absence of professionalisation and the status of viable scientific communities (or specialist groups of researchers) in the context of the developing country. The most viable groups are understood as the most effective both in terms of professional standing and from the viewpoint of their being able to forge linkages with the industrial spectrum of production. There are «specificities of scientific fields» in terms of social organisation and socio-economic legitimators, which have a bearins on the brain flow issue. In other words, the operation of an effective scientific community or specialist group in a given speciality checks the process of brain drain to a large extent.

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On the other hand, there is the dimension of brain return or brain gain, and its connection to both the emergence and strengthening of he existing areas of research in the frontier ST of a Developing Country These sociological issues have not yet attracted the attention they deserve by social scientists.

The present paper explores these sociological issues, particularly the issue of brain return or brain gain by empirically grounding it in the Indian context as an example of a Developing Country context. The paper is structured in terms of four sections :

• The first section maps out the frontier fields of S&T in molecular biology, biotechnology, laser research and telematics from the decade beginning 1980. Various contours of this mapping show the growth of the fields, institutions, research groups and professional configurations before 1980 to the current period.

• The second section will attempt to draw the «cognitive» connection of these fields to the return migration of scientists through an appropriate methodology.

• The third section will explore the way in which the concept of scientific community or specialist groups is related to the problem of brain drain, particularly, in relation to checking the problem, or contributing to the dimensions of gain. Given the limitations of time and resources, one of the above areas (i.e molecular biology or biotechnology) will serve as a case study.

• On the basis of Indian experience, the fourth section puts forward three arguments :

1 In the era of a dynamic changing world of scientific and technological fields, it has become imperative for the countries of the developing world to maintain constant international connections of science through migration. This is so, because research «fronts» are constituted in the developed world while the developing world perpetually lags behind. Thus the out-flow and in-flow of human «intellectual capital» could be considered as an important determinant, with appropriate strategies, for the process of «catching up» with the cutting edge of new S&T areas of research.

2.."Brain mobility", in terms of out-flow and in-flow is also an important determinant for arresting the fossilisation of «local» scientific fields in the frontier areas of S&T and in updating them in terms of new ideas.

3. Innovating appropriate institutional and organisational measures for facilitating brain return provides an important S&T policy strategy for the developing world. Further, the groups and individuals who are located in the developed world could be mobilised as important «agencies» for the transfer of new knowledge and as sources of «information feeders» for the home countries. There are already trends emerging on this score. Failure on some on all of these measures will most likely cause the countries of the developing world to fall further behind their existing position, particularly, in this era of globalisation and internationalisation of R&D.

Workshop

How to assess the recent brain drain phenomena

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The so-called «brain drain» has been much discussed in the postwar period, especially with respect to Third World nations *vis-a-vis* the United States. It has been said that 60% of Third-World scientists and engineers who hold American degrees never return home, as financial and research conditions have not matured sufficiently so as to be able to lure back highly-trained scientific personnel. Only in the 1980's has the phenomenon called «brain reverse» been noticeable in Asian NICs countries. For the first time, the industrial sector of the Third World has grown to such an extent that it now needs American-educated Ph.D.s in science and engineering. This event may be historically significant as it constitutes a watershed in the flow of intellectual migration. For such reasons, a research team was sent to NICs to observe, interview and attemp to account for this significant change. Most typical is Taiwan, where the rapid development of a local computer industry may have induced brain drainers to return home. The Taiwanese government established a law in 1974 to facilitate the «brain reverse». This involved granting return air-fares, raising the returnee's salary and research funds for the first two years of his or her appointment at home, and providing an apartment or house. Even the returnee's family received incentives. Most of the returnees have been hired by the university sector and Academia Sinica, the National Central Institute of Research. It is rather unusual to find American-educated PhD.s working in the industrial sector in Taiwan. The brain reverse policy of the government has thus tended to be an educational policy rather than a MITI-style industrial policy per se. The «brain reverse» law was discintinued last year for national universities, as migrant Ph.D.s in the U.S. have recently found job security, namely tenure, difficult to obtain. An increasing number of them are willing to go home, as long as positions in prestigious national universities, which are by now mostly filled up, are open to them. The government now finds it unnecessary to encourage them by granting various privileges. But less prestigious private universities have been disappointed by the scrapping of the law, as they have been recruiting brain reversers by using it to their advantage. Whether we can say that this constitutes an historical watershed and how best to assess its significance still remain to be seen. From the viewpoint of the Taiwanese government, the brain drain phenomenon no longer constitutes a threat, that is as long as Taiwanese Ph.D.s return home after finishing their graduate education in the U.S.

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