A NOVÍSSIMA SOCIOLOGIA DA CIÊNCIA

E SEU APREÇO PELA CIÊNCIA

Desde os anos 70, quando as críticas à Sociologia da Ciência Mertoniana começaram a se materializar em "programa de pesquisa" específicos, que reunificavam a sociologia da ciência com a do conhecimento, esses mesmos programas também se tornaram alvo de ataques dos mais variados quadrantes. Críticas à nova sociologia da ciência (NSS) — o título que agrupa as várias tendências cuja preocupação primeira é a inclusão do conteúdo técnico da ciência dentro dos limites da análise sociológica — partiram de filósofos, historiadores, sociólogos auto-denominados Mertonianos e cientistas que, provavelmente percebem os temas construtivistas e relativistas de NSS como ameaças à integridade e autonomia da ciência.

É importante ressaltar que embora essas novas perspectivas analíticas na NSS compartilhem alguns temas gerais, inexiste um conjunto comum de características que permite visualizá-las como um "paradigma" unificado ou um bloco monolítico de pensamento sobre a ciência. Evidências desse fato são as divergências entre os próprios proponentes da NSS sobre várias questões que incluem, entre outras, a origem dos estudos sociológicos "modernos" da ciência [1], os métodos utilizados [2] e sua relação com os pressupostos de determinado programa [3].

Muitas dessas críticas à NSS têm sido satisfatoriamente respondidas, outras ainda esperam defesa, conforme aponta Vessuri (1991). Não cabe, nesse momento, discuti-las todas, mas creio ser fundamental deter-me em uma questão colocada por Bunge (1991), por discordar do seu ponto vista.

Diz esse autor que "a maioria dos membros da NSS não admiram a ciência (p. 75), e que "não crêem nem na verdade nem na moral" (p. 76). Ao contrário vários proponentes da NSS declaram explicitamente que eles são "pela ciência". É o caso, por exemplo, de D. Bloor (1976), estreitamente associado ao relativismo, que baseia seu "programa forte" no ditado: "only proceed as the other sciences proceed and all will be well" (p. 141). Até mesmo H. Collins (1985), considerado o mais radical relativista, visualiza seu trabalho como uma defesa da autoridade da ciência — "the best institution for generating knowledge abou the natural world that we have" (p. 165-67).

Além disso, os principais "construtivistas" e "relativistas" não são anti-realistas ingênuos e defendem claramente os métodos e a visão de mundo da ciência. Latour (1988), por exemplo, escreve que "the new sociologists of science are no more relativist than Einstein, and for the same reason" (p. 26-27). Da mesma maneira, Knorr-Cetina (1979) distancia sua interpretação construtivista de uma ontologia idealista e não nega a existência de uma realidade independente (p. 369).

Em vista do exposto, parece claro que a NSS preocupa-se em desenvolver descrições novas de como a ciência funciona mas, em nenhum momento, desafia ou critica a ciência moderna como a um sistema de valores, uma visão de mundo, ou uma maneira de trabalhar e viver. A admiração da NSS pela ciência, com todas as "armadilhas" sociais que ela inclui — tais como é evidente, ao contrário do competitividade e elitismo — que afirma Bunge (1991). E nem poderia ser diferente pois, como argumentam Collins & Restivo (1983), construir sociologias da ciência é um trabalho de acadêmicos que se apoiam em instituições construídas por uma visão científica do mundo. Logo, a NSS é parte da instituição social da ciência (p. 19g).

Para terminar, vale lembrar que, em meio aos problemas epistemológicos e metodológicos que rondam a NSS, ela contribuiu, e ainda tem muito a contribuir, para um maior entendimento da ciência moderna. Só para citar um exemplo, é amplamente aceito que os programas relativistas e contrutivistas têm o mérito de haver reavivado o interesse em estudos históricos e antropológicos de descobertas científicas, controvérsias e sistemas comparativos de pensamento. Isso, por si só, significa um grande avanço quando comparado com a sociologia da ciência Mertoniana, que tendia a encapsular a ciência em um segmento estreito da pesquisa sociológica. O significado dessa contribuição para a política científica é imenso, particularmente para os países cientificamente periféricos, que passam a ter a perspectiva de incorporar ao seu planejamento do setor, as características históricas e antropológicas de sua situação particular.

NOTAS

1. Ainda que grande parte dos autores afirmem que a NSS surgiu da crítica à tradição Mertoniana (ver Ben-David, 1978 e 1981; Collins & Restivo, 1983; Bunge, 1991), outros argumentam que ela teve origem independente, a partir de raízes filosóficas e antropológicas completamente distintas (ver Collins, 1983).
2. E o caso, por exemplo, do debate sobre aspectos metodológicos entre H. M. Collins e M. Mulkay que pode ser seguido em Knorr-Cetina & Mulkay (1983).
3. Ver, por exemplo, as observações de S. Woolgar (1981) em relação ao "programa forte" de Barnes e Bloor da Universidade de Edinburgh.

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BACKWARDNESS, RELEVANCE, AND WAYS OF IMPROVEMENT OF THE BIOLOGY OF ORGANIC DIVERSITY IN LATIN AMERICA AND THE CARIBBEAN

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/ **KEY WORDS** / **Biology** / **Organic diversity** / **Latin America** /

One of the striking contrasts in the development of biological sciences in Latin America and the Caribbean rises when confronting those areas of biology dealing with the functional, cellular or molecular level, with biological disciplines related to the study of processes and patterns of biological diversity, commonly referred to as systematics or taxonomy. These sciences, and the scientists who practice them, the naturalists, taxonomists or systematicians, are usually underrated in their scientific standing by opinions of professionals coming from functional and molecular biology and other fashionable areas of the life sciences. Although I shall try to demonstrate that the duty of systematicians is theoretically and practically at least as important as that of any other branch of biology, I admit that these derogatory opinions are not without foundation inasmuch as they describe the present situation of the study of biodiversity in our Region. And they are further bolstered when comparing its development with that of more privileged branches of biology.

In several laboratories of the Region, physiology, cellular biology, biophysics, biochemistry, molecular biology, neurobiology, microbiology and other related disciplines have developed to an international competitive level. They supply a valuable output to world science, and contribute with models of scientific standards in their own communities. These disciplines are practiced in modern and well-equipped institutes and university departments. Their scientists are well known in the world centers of excellence. They publish in highly demanding international journals, and they are usually well supported both by national or international agencies. Moreover, a few regional Nobel Prizes acted as an accolade to the high scientific standing of those disciplines in some of our countries. It is not surprising that they have become highly attractive to students, who are striving to become professionals in the blooming areas of modern biology.

Contrariwise, the old profession of naturalists in describing and understanding organic diversity is left to old fashioned museums and herbariums which suffer an ominous inadequacy of equipment and support. Its practitioners wrap themselves in a mantle of antiquity, and prove to be unable to follow the progress of the world science in their own fields. All too often the ordinary naturalist in our Region is a data gatherer exercising the task of collecting, describing and classifying organisms without resorting to experimental and theoretical work, and unconscious of the reach and scientific requirements of his profession. They publish in local journals of limited distribution and they are rarely known in world circles of biology. Only a small minority of naturalists share an explicit theoretical interest and contribute to an actually interpretative enterprise. Under these circumstances, the study of biodiversity has become unattractive to gifted youth, and the profession as a whole is in danger of extinction.

This situation is the outcome of a heritage of distortion in scientific development in our countries. Areas of basic research connected with natural resources such as biosystematics, were originally fully legitimated and supported by enlightened governments looking for progress and autonomous development. The increasing dependence on the interests of the international market dictated by the industrial northern countries has shaped an eco-

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nomical model of exportation of food and raw materials where science and technology play a secondary role or are provided by central countries. Particularly those branches of basic science closely connected to the exploitation of our natural resources have suffered stagnation or increasing regression. In parallel laboratories connected with research topics of interest to main stream science in central developed countries have been generously supported, and some eventually achieved excellence and provided valuable outputs to world science.

The described scenario of biological sciences in our Region is the result of this process. Fortunately the overall outcome is not too regretable because the downfall and shrinkage of biosystematics has been compensated by a symmetrical growth and expansion in other critical areas of basic biology. But this unbalanced pattern is not a general framework in world science, where different branches of biology have shown a more harmonious growth picture. One must realize that the situation of biological systematics in our Region is just a reflection of backwardness in growth by lack of support by the national systems of science and technology which hampered them from keeping the pace of development of this science in modern scientifically advanced countries. There, biological systematics has quite another profile. As a matter of fact, the stagnation of the study of biodiversity in our countries discloses the action of an outstandingly shortsighted policy, both at the academic and the practical level.

As regards theoretical import, systematic biologists concentrate on the discovery and explanation of differences as well as similarities among organisms. Differences in kind reflect differences in structure, function, biochemistry, genetic make-up and developmental programs and their molecular underpinning, ecological, requirements, and evolutionary relationships. Thus, the discovery of new kinds of creatures open wide avenues of new knowledge to all branches of basic biology, including physiology, cell biology and molecular biology. Besides, classification is an enterprise treated with outstanding theoretical subleties by formal sciences as logics and set algebra, and modern biological systematics not only uses those formal tools, but also has contributed to their own development by posing new theoretical problems.

The history of biology demonstrates that an indigent profile of the study of organic diversity is not in keeping with the role played by the profession of naturalists and systematicians in building modern biological theory. The more general and far reaching theory of modern biology, the theory of evolution, was produced by one thorough naturalist, Charles Darwin who, according to several students, had been influenced by his expertise in the systematics of barnacles to arrive to his conclusions. In addition, naturalists and systematicians such as Wallace, Gulick, Romanes and Karl Jordan among others, were responsible for developing within darwinism the modern theory of species and speciation. Moreover, the transcendental theoretical contribution of Theodosius Dobzhansky to genetic theory was greatly influenced by a previous extensive field study of variability in bugs. Furthermore, Ernst Mayr, George Gaylord Simpson, Ledyard Stebbins, who together with Dobzhansky count among the principal founders of the modern version of evolutionary theory, were ornithologists, paleontologists and botanists, respectively.

In modern systematic biology the traditional bond to morphology has been complemented, and in several cases displaced, by biochemical and molecular approaches in the identification of species and in the reconstruction of phylogenies. Species are not different morphological kinds but rather integrated biological systems of genetic variability, which it is necessary to characterize by the description of their genetic pools, the establishment of their ecological roles and population structure and the knowledge of their behavioral patterns. This complex of biological information is compelling to deal with species in wild-life conservation, in monitoring pests and reservoirs, in the management of species of commercial value and in preserving endangering genetic pools of natural variability.

Thus, modern systematic biology, far from being a sort of feeble-minded relative of contemporary biology is one of the most integrative and depth-reaching branches of biological knowledge. The perceptive inquiry of patterns and processes of organic diversity obliges us to deal with a complex variety of biological disciplines. Together with the traditional expertise in comparative anatomy, the analysis of morphological differences with the tools of sophisticated statistics and specific algorithms is in order. The study of organic diversity obliges us to resort to genetics and its mathematical models are unavoidable. Cytogenetics provides the knowledge necessary to understand several isolation mechanisms between species. Furthermore, in order to understand the mechanisms of chromosomal repatterning responsible for the origin of new species it is necessary to attack chromosomal changes from the point of view of molecular biology. Behavioral biology and biology of reproduction provide the bases for the understanding of other mechanisms of reproductive isolation. Population ecology and its quantitative models, and physiological ecology are also in order to understand the dynamics of species and their adaptive constraints, respectively. Finally, the understanding of the principles of developmental biology gives unavoidable information to know the epigenetic constraints which contribute to the cohesion of species.

As a matter of application of basic science, the study of biodiversity is critical to assure the welfare of our societies. Beyond his role as discoverer and identifier of plants and animals, the systematic biologist provides the basic knowledge to detect and exploit the natural goods of our countries: new sources of proteins and other food, natural drugs of pharmacological importance, plants providing raw materials for industry, fueling and construction. It also provides the information necessary to identify poisonous plants, to detect harmful snakes, arachnids and other maligant animals. Knowledge of biodiversity is also fundamental to control disease-bearing insects and worms, to manage wild-life, to fight against agricultural and urban pests. In this sense, data provided by the biological systematician are an essential underpinning of sev-

eral disciplines of applied biology, such as pharmacology, agriculture, forestry, oceanography, epidemiology or limnology.

But the significance of increasing the knowledge of organic diversity goes beyond increasing mankind's welfare. It verges on the very survival of our own species. There is now a growing awareness of the menacing danger of the cumulative effect of industrial pollution, irrational overexploitation of land and massive deforestation. They are bringing us ever closer to the resilience capacity and tolerance limits of the intricate network of organic and physical interrelationships which allow life to be maintained in the biosphere. To survive, man must understand ever better the whole picture of the complexity of nature. Knowledge of the diversity of creatures in our world is fundamental to understanding the complex system of interactions which are necessary to preserve sustained life on earth.

In Latin America as well as in all the Third World, the applied benefits of a growing knowledge of organic diversity are even more evident than in developed countries. The inventory of our kinds of plants and animals in the rich tropical and subtropical biomes is appallingly incomplete as compared to European countries and in the United States and Canada. There are still thousands of species of potential economical or pharmacological interest to be discovered. However, unbridled deforestation and erosion resulting from heedless exploitation of land is devastating natural environments menacing severely the extinction of biological diversity. Many of the wild species of interest are poorly known in their biology, and several are on the verge of extinction by habitat destruction. Rural diseases such as leishmaniasis, malaria, hemorragic fevers, Chagas disease, are very far from being controlled, and little is known of their reservoir species. Last, but not least, rampant starvation is widespread in many countries demanding more and better food products and an intelligent management of the environment to assure a sustainable development.

As citizens and as scientists we should marshal all the energy we can muster to provide systematic thought and action to save our environment. But first, as biologists, we must be conscious of the new knowledge necessary not only to accomplish that goal, but also to erradicate the scourge of starvation and disease in our countries. There is no doubt that this knowledge will only be obtained after a thorough change in the state of affairs of biological research in our Region. Biological systematics, understood as the scientific study of biodiversity and the related and theoretically founded sciences of evolutionary biology, population genetics, and population and community ecology must be endorsed as fundamental areas of biological research. But to achieve this goal, it would be blind to adverse or diminish support to other disciplines. What we need is a balanced development of all biological sciences, as those disciplines which are now in a backward situation would only reach furtherance by means of the interaction with those which have already gained prominence.

It is not easy to put forth a straightforward remedy to the situation of biological systematics in our Region. The repair will only be effective when its significance would deserve legitimation from the governments. But governments, elusive as most of the Latin American ones have proved to recognize that scientific knowledge is *the* tool for progress and modernization of our societies, may not be immediately responsive. They must be compellingly convinced by the dynamic forces of our society. Among these forces, the scientific community itself has a main role to accomplish as a primary actor.

I strongly believe that it is certainly the community of biologists which must express itself and propose ways of action to push the public powers towards changing the present situation of biological systematics in our Region.

It should oblige to a radical move in its attitudes towards the study of biodiversity, which is now one of underrating more than one of appreciation. Those who have the priviledge to belong to well-developed areas of biology must contribute with their knowledge and action to overthrow the present situation of backwardness of the disciplines connected with the study of biodiversity. To that end, the following actions would be in order:

(1) To strenghten and update the theoretical and technical status of biological systematics in the Region. This should oblige us to a concerted action at the regional level. Good modern systematicians are rare in any of our countries taken in isolation. But in the Region as a whole there is a sizable number of specialists well trained in modern systematics. They must be summoned to contribute to a permanent program of training of young Latin American biologists. In a program of this kind, biologists not directly linked to this study of biodiversity, but skilled in modern biological techniques and knowledge, must also be called to contribute. This action may take the form of a Regional Postgraduate Program sponsored by institutions like the OAS, the TWAS or IDEA.

(2) To iniciate in their own institutions, including institutes of advanced biology and university departments, a campaign to further the significance of studies in biological systematics and their role in public welfare and in a maintained and rational exploitation of the environment.

(3) To interact with their poorer relatives of the biodiversity disciplines in friendly collaboration to transfer new advanced biological knowledge and techniques.

(4) To influence the national governments to deliver substantial funding for the maintainance, development and modernization of Natural History institutions, particularly the National museums and herbaria which are the repository of collections which are the actual bases of the knowledge of biological diversity of each of the countries. But those institutions must be thoroughly transformed from their present situation of refuges of the past. They must no longer be the citadels of amateurs unlearned in modern biology to transform themselves in centers for contemporary biological research in biodiversity in which experimental laboratories and computers must be as important as cabinets to perserve specimens. Their rulers must be well-trained modern biologists acknowledged as respectful peers by their excelling colleagues and capable of driving programs to further the level of research undertaken in their institutions by traditional naturalists. And until a good level is gained in biological systematics and related fields, this will require the guide and counseling of advisory boards including scientists from the well-developed branches of biology.

These actions may be difficult to undertake, given the present situation of splitting and lack of interaction between the two areas of biology which I have tried to depict. But their relevance, not only to the furtherance of the status of life sciences as a whole in our countries, but also to cope with our social commitments as biologists, cannot be curtailed any longer.