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The role of postgraduate education in the improvement of animal health in Brazil

With 200 million heads of cattle, world leader in beef exports since 2004, third in production, leader in chicken exports and, also, fourth in pig production, Brazil has a very important position in animal production worldwide. Regarding pets, the annual financial transactions of the country exceed the amount of 10 billion Brazilian reais. Such amount of animals demands the implementation and continuous improvement of practices that aim at promoting and preserving health conditions.

Reviewing the historical evolution of veterinary services focused on animal health, Kalvin Schwabe (1982) considered five different periods: local actions (from the primitive period until the first century B.C. by setting up military veterinary services); military (from the first century B.C. to 1792, with the creation of the first school of Veterinary Medicine); sanitary veterinary policy (from 1762 to 1884, with the scientific microbiological revolution promoted by Bruce, Pasteur, Koch, and Jenner); mass campaigns (from 1884 to 1960, with the emergence of veterinary services); and surveillance and selective actions (from 1960 on). The paradigm of this fifth period was the emergence of diseases with multifactorial etiologies, the epidemiologic triad (host-agent-environment) and their interactions with one another, as well as epidemiological diagnosis supported by qualitative, quantitative, and economic epidemiological analysis.

The remarkable influence of canine rabies vaccination mass programs for the reduction of rabies cases in human beings, and the emergence of new epidemiologic cycles, like rabies being transmitted by bats, as well as cases of visceral leishmaniasis in the states of the Central-west and Southeast regions of Brazil, in urban areas and in its suburbs, are examples of the intrinsic and extrinsic relationship dynamics between host, agent, and environment. Cases of etiological agents of diseases that cross the lines of animal species and affect human beings, as bovine spongiform encephalopathy and avian and swine influenzas, have been a challenge for the international health authorities and they stimulate the concept of "one health".

Human and animal sanitary programs for communicable diseases control are found in a prominent position and, based on epidemiologic, sanitary, and environmental surveillance actions, they seek to a lasting improvement of selective control actions that target priorities supported by a benefit-cost ratio analysis. The implementation of the attack stage of sanitary programs depends on the private sector, which produces the following required input: rodenticides, insecticides, household cleaning products, antibiotics, ecto/endoparasiticides, bat poison products, disinfectants, vaccines, and antisera.

The growth of sanitary consciousness triggered the emergence of private services and of self-employed professionals concerned about health; pathophysiology; biotechnology of livestock herds; urban plague control; technical responsibilities of the companies that process, distribute, and sell animal source foods; and technical responsibilities of animal shelters, vivaria, and zoos.

New paradigms start to take place and they are all related somehow to the concept of sustainability as they use the available resources without jeopardizing them for future generations: globalization; integrated environmental management; animal welfare; responsible animal ownership; ecology and fauna; flora and biodiversity preservation; organic agriculture and animal husbandry; environment and food waste control; weather control; sustainable agriculture; and animal husbandry that includes recycling and reusing wastes and by-products, biosafety, bioethics, and zootherapy.

The "one health" concept was consolidated with the acceptance that there is an intersection of human and animal health, being created, therefore, the area called veterinary public health that presents four main dimensions: zoonosis control; food safety and animal source food inspection; animal source pollution control; and compared medicine, the use of animals in the study of human diseases.

After the University Reform, carried out in Brazil from 1969 to 1970, the North American postgraduate educational system, *stricto sensu*, was implemented and it includes master and doctorate degrees, which seek for excellence and internationalization of scientific research, graduating high-level personnel qualified to plan, execute, analyze, and interpret the results of original scientific investigations that take place on the knowledge frontier of different subjects. With such policy, universities and research institutes had to be adapted to this new reality by opening new postgraduate education programs of animal sciences. They presented different focuses, i.e. on fundamental sciences, clinic, surgery, pathology, epidemiology, preventive veterinary medicine, as well as animal health and reproduction. This new model provided the

education of teachers/researchers, encouraged them to develop research projects and to seek resources for their execution together with research foundation agencies. Judgment, analysis, and evaluation were made by them. The consequence of this process was an exponential growth in the number of projects that influence directly, as a consequence, the formation of new researchers.

The lines of research of the animal science postgraduate education programs started, then, including the development and improvement of: diagnostic, therapeutic, and preventive healthcare resources of animal diseases; actions that aim at environmental sanitation and risk factor analysis; actions for public health inspections and hygiene of animal source food; rational utilization of industry, agriculture, and animal husbandry by-products; farming management systems of low-environmental impact; biotechnology applied to animal reproduction; and control of wild animals populations, either in the wild environment or in captivity.

Furthermore, we dare to say that the fifth period, which started in 1960 and was referred as surveillance and selective actions, ended around 1990 with the revolution caused by the development and improvement of the diagnostic and preventive healthcare resources, with the objective of improving efficiency, efficacy, and effectiveness indicators applied to the reduction of false-positive and false-negative results, of post-vaccination accidents, and of the interference of immunization programs on the diagnosis, culminating in the development of molecular biology.

The year of 1990 was the beginning of molecular biology, biotechnology, genetic engineering, vaccines and diagnostic procedures produced with recombinant antigen, molecular epidemiology, mathematical modeling, environmental pathology, geo-processing and risk factor analysis. This is the same period in which we find ourselves, times that depend fundamentally on postgraduate education, *stricto sensu*, to consolidate and balance the harmony in the relationship between humans and animals.

Silvio Arruda Vasconcellos
Former Professor and Senior Collaborator of Faculdade de Medicina Veterinária e Zootecnia of Universidade de São Paulo (FMVZ-USP)