

## Czech research in veterinary medicine

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**ABSTRACT:** The task of applied research is not only to acquire new knowledge, through which it contributes to the development of economy, to the consumer protection or to the training of qualified experts. For state-supported veterinary research, this means striving to protect people's health against diseases transmitted from animals, food-borne diseases, contamination of feed and foodstuffs by toxic xenobiotics, a reduction in food quality through the use of low-grade raw materials and an adverse effect of environmental pollution. The territory of the state must be protected against the infectious diseases and animals against the negative effects of environment and technologies which often strive irresponsibly for the highest profits without regard for the consequences. The contributions of the Veterinary Research Institute, Brno, and other Czech research facilities to increasing knowledge on cattle health and reproduction are documented by the list of 105 references of papers published in peer reviewed journals since 1992. This article is available on <http://www.vri.cz/vetmed.asp> and the reprints of cited references can be requested by e-mail to <[vri@vri.cz](mailto:vri@vri.cz)>

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Veterinary research cannot be simply defined. It is not carried out only by veterinarians; sometimes this research is only indirectly devoted to the health of animals and the methods used are far from the classic disciplines of study and work of the practical veterinarian. Successful research is judged upon its results, which must, above all, be published in peer reviewed international periodicals. This ensures that uneconomic use is not made of financial resources by repeating experiments already published, that the experiment, which is essential for testing a hypothesis, is correctly designed, and that the results are well interpreted and have produced the answer to a well posed question. The application of the results in animal breeding and veterinary practice is also important.

The Veterinary Research Institute in Brno was founded in 1956 and employs 230 people. It is financed by the Ministry of Agriculture and co-operates with the Veterinary and Pharmaceutical University in Brno, with institutions of the Academy of Sciences of the Czech Republic, and with universities and research institutes in the Czech Republic and abroad. It is involved in the diagnosis and prevention of viral and bacterial infections not only in the main farm animals, i.e. cattle and pigs, but also in fish and rabbits. The Department of Immunology is engaged in the development of modern vaccines and pharmaceutical carriers. The Department of Reproduction contributes to the diagnosis of the quality of bull, boar and stallion semen. The Department of Mammary Gland Physiology and Pa-

thology studies the etiology and prevention of mastitis and the Department of Animal Nutrition and Health studies the influence of feed on health and the biological value of foodstuffs. The Department of Genetics focuses on genotoxicology, particularly the negative consequences of environmental pollution on genetic information disorders, but it also examines hereditary diseases of animals and is involved in the mapping of the pig genome. Great attention at the Institute is devoted to the assessment of materials which pollute the environment. Apart from sophisticated instrumental analysis, *in vitro* bioassays are used, facilitating the study of the effect of toxic xenobiotics on cell cultures according to the induced changes of the metabolism. The experience gained from using immuno-analytical methods for assessing viral and bacterial antigens and antibodies is also applied in the immunoanalysis of haptens, especially steroid hormones and the residues of certain pharmaceuticals, pesticides, herbicides and toxic pollutants like polychlorated biphenyls and dioxin-like compounds.

At present research cannot be performed without good methods and well-equipped laboratories. A basic prerequisite is the use of computers and access to information. A computer network at the Institute is equipped with 110 computers having access to the Internet and the ability to use the Current Contents, Medline, Pub Med, Dairy Science Abstracts, and Web of Science databases, the Page Library, databases for nucleic acid and protein

sequences and image analysis programmes. Molecular biology methods such as DNA fingerprinting, nucleic acid sequencing, polymerase chain reactions, hybridisation of nucleic acids in situ, the isolation of chromosomes by laser etc. are used for the identification of bacteria and viruses and chromosomes. The Institute prepares its own hybridisation probes and polyclonal, monoclonal and recombinatory antibodies. Immunochemical methods are applied not only in the production of diagnostic kits for classic enzyme immunoanalysis format ELISA, but also in other formats, such as flow immunoanalysis or biosensors.

Institute employees collaborate in international teams working on projects supported by the European Union and different grant agencies and companies. The Institute is a World Health Organization Collaborating Centre for Research and Education in Veterinary Public Health, and National Coordinating Centre of the Food and Agriculture Organization Established Veterinary Biotechnology and Epidemiology Network for Central and Eastern Europe CENTAUR. The Veterinary Research Institute publishes the electronic bulletin CENTAUR NEWSLETTER FLASH INFORMATION, which is distributed in many countries on all continents. The journal VETERINÁRNÍ MEDICÍNA (Vet. Med. – Czech), publishes original papers and reviews in English and is included in the most important bibliographic databases. Papers are available in full pdf format from the web since January. Institute considers an important element of its activity to be the cooperation with medical research both in the projects and in national and international scientific societies. As part of the Czech Republic's foreign assistance programme, the Institute equipped laboratories for immunoanalysis in Mozambique, Uganda and the Ivory Coast, and trained workers to use them. It has had the opportunity to welcome on long-term study stays many young colleagues not only from many countries in Europe, but also from the USA, Mexico, Columbia, China and Australia. The workshop on paratuberculosis diagnostics, epidemiology and research has been held for participants from 11 EU countries in March 2001.

Cattle are an important area of interest for us. We consider good evidence of data, facilitation of management and checks that obligations have been met to be the basis of breeder and veterinary care for cow's health and reproduction. For this reason a programme was developed already in the 1970s enabling the use of computers in the daily care of dairy cows, based on information about their locations in barns, calving, insemination, results of pregnancy checks, progesterone concentration in milk and veterinary treatment, and facilitating the systematic observation of heat, their use for insemination, pregnancy checks, the intensive treatment of sick animals, drying up, preparation for delivery, the control of puerperium and following other important tasks. In the 1980s, almost 200 thousands cows from all the regions of the former Czechoslovakia were connected to this system.

Radioimmunoanalysis, which makes use of an exceptionally sensitive antibody and a ligand marked with iodine has been developed for the assessment of progesterone in milk. This method facilitated the assessment of progesterone in centrifuged milk without extraction and proved itself effective in judging whether insemination had been conducted at the appropriate time and whether, three weeks after insemination, heat without clinical signs had not taken place. After the insemination performed in the period when it is possible to demonstrate the presence of progesterone in milk, it is necessary to observe the cow and often it is possible to inseminate it 8 to 12 days later. The reason is it had previously been inseminated in the diestrus and had indicated heat under the influence of estrogens of the interovulatory follicle. The repeated assessment of progesterone every other day, that is, on Mondays, Wednesdays and Fridays is appropriate while observing disorders of the ovarian cycle and while checking the effect of treatment. We have also used the radioimmunoanalysis of progesterone to observe the biological half-life of this hormone, which is shorter in cows contaminated by polychlorated biphenyls or other toxic materials. Lower progesterone concentration may be a reason of impaired reproductive parameters, which is further affected by a shortage of beta carotene as a precursor to the synthesis of progesterone. It is necessary to observe carefully cows which, three weeks after insemination, in the period when corpus luteum function is not evident, again do not have progesterone in their milk and probably have not been successfully inseminated. Following heat carefully it is possible to inseminate these cows again after three weeks.

The radioimmunoanalysis of polychlorated biphenyls in milk or subcutaneous fat enabled us to separate contaminated animals from uncontaminated and through the separation of milk from healthy cows from that of contaminated cows allowed strict limits for polychlorated biphenyls to be maintained even in herds which had had problems with the contamination of animals in the 1980s.

Among other diseases, attention is devoted to infectious bovine rhinotracheitis and rotavirus and coronavirus infections in calves. The Institute has contributed to the development of the ELISA diagnostic kit for the eradication of bovine leukosis in the Czech Republic, which together with bovine tuberculosis a brucellosis is now part of history, and we must all strive to ensure that this satisfactory situation does not change. It is also necessary to act very responsibly regarding risks which have not yet affected our agriculture, such as BSE. To check that the ban on feeding ruminants meat and bone meal is being maintained, a method for determination of the specific bovine DNA was introduced at the Institute. Certain other risks may, however, already affect us, without us knowing or rather without us wishing to admit it. An example of such a risk is the paratuberculosis of cattle, given its possible relationship with the Crohn's disease. At the present time

paratuberculosis is a serious problem in cattle herds in the Czech Republic, which we had not met prior to the opening-up of the economy and borders to imports of animals from Western Europe. A highly effective laboratory is in operation at the Institute under the direction of Dr. Ivo Pavlik, contributing to the diagnostics and the molecular epidemiology of paratuberculosis in cattle, sheep and wild ruminants. It also contributes to international research participating in several projects of the European Union. Paratuberculosis in cattle requires the attention of breeders and strong state support in its control. The Czech Republic is in a relatively advantageous position compared to other developed countries in Europe and overseas because this illness was imported to us only during the last ten years and its occurrence is still lower than abroad. While efforts and resources are concentrated on eliminating paratuberculosis through the use of available diagnostic methods, clinical observation and organisational measures, hopes of success are high, as Dr Pavlik has managed to demonstrate in certain herds.

A major health risk for people is the contamination of foodstuffs by toxic pollutants, pesticides, herbicides, and residuals of antibiotics and chemotherapeutics. It is therefore vital to protect the consumer against receiving toxic xenobiotics. It has been possible in recent years to limit significantly certain dangerous contaminants or almost rule them out of the food chain. This outcome has been reached with the help, for example, of the ban on the use of mercury preparations, the production and use of polychlorated biphenyls, the removal of old coatings from technical equipment, the reduction of lead additions to petrol, more consistent limitation of emissions, the installation of filters and purifiers for waste water etc. Nevertheless many materials remain in the environment and in the food chain, and although they do not exceed the permitted concentration limits, it would be preferable to eliminate them entirely. It is likely that, with the introduction of new types of products and with new discoveries regarding their activity, the spectrum of these materials will spread further. As a consequence of contamination with chemical materials, not only are animals and people directly threatened with acute poisoning, but more frequently their state of health suffers inconspicuous long-term effects. The threat need not directly carry the risk of the appearance of tumours, but can result in a worsening of the progress of certain illnesses, allergy based diseases, an increased need for vitamins, anti-oxidatory materials etc. Certain heterogeneous materials have the characteristics of hormones, others may provoke the resistance of microorganisms to antibiotics or chemotherapies and thus reduce or completely eliminate the effect of treatment for illnesses caused by these pathogens.

Healthy, resistant animals adapted to the conditions of the herd are fundamental to the success of animal production. Every breeder must not only keep to the principles ensuring the optimum conditions for animal welfare and

provide animals with the appropriate rations, but must also together with the veterinarian actively contribute to limiting the risks threatening his herd and, in the case of infectious illness, other breeders too. Current difficulties regarding the sale of animal products have led to demands for various subsidies to support exports. Increased profits, which represent the difference between costs and yield may, however, be achieved by limiting costs through the reduction of unnecessary losses. In a herd of cattle this means, for example, making better use of its reproductive capabilities through intensive treatment of reproduction disorders, consistent checking of heat and return to heat, and the checking of pregnancy as soon as possible after insemination. Through these relatively simple organisational measures, the optimal production and reproductive parameters may be attained and the life-time of cows prolonged. Another requirement for the economic effectivity of milk herds is conformity between the genofond for milk production and the ability of the breeder to ensure animal nutrition. Ensuring that those tending the animals are qualified and that their work is checked may also contribute to success. On the other hand, a lack of responsibility and insufficient expertise on the part of not only tenders but sometimes also breeders are a frequent source of major problems.

Systems of potential risk reduction and the speedy identification and apprehension of the real originators should form the basis of a responsible approach by state authorities to risk reduction. The dioxin affair, which in 1999 spread from Belgium to many countries of Europe, is a good example of what can easily happen. About 8 litres of transformer oil got into 60 tonnes of fats intended for processing in the animal feed industry. This may occur both as a result of an unfortunate accident, for example during the collection of used cooking fat, and as a result of criminal action aimed at harming competitors. The problem was not brought to attention through the systematic observation of contamination, but through a reduction in egg hatching and disorders in the development of chickens. Ordinary monitoring systems would have shown up the contamination much later and would have identified the cause only with difficulty. For many states, including Belgium, the essential investigation of the consequences of this affair meant a massive financial burden and a problem which was difficult to solve.

An agricultural development strategy must therefore include systems of protection not only for the consumer, but also for producers. It requires a change in certain systems, for example, the monitoring, or rather the obligatory checking of critical points in feed production. Potential sources of contamination such as susceptible industrial processes and waste stores and incinerators should also be subjected to intensive checks. It is vital also to count on the threat of biological terrorists, who can use toxic materials and germs of infections dangerous to animals with much less risk than explosives or kidnappings. Re-

sources should not be spared either in compensating any who have been harmed, or, above all, in developing new, effective and economically advantageous methods for proving the presence of toxic materials and microorganisms and in introducing an effective system for their exploitation.

Veterinary medicine brings to agriculture interdisciplinary contact linking the environment, feed as the product of plant production, animals as the sources of food of animal origin and people as consumers of food and breeders of animals. Biological education gives the vet a good basis for understanding the risks of agricultural production and for cooperating with the health service. The practical vet is an almost daily participant in all activity in the places for which he works. He has the chance to compare the situation in different herds, he can notice even small changes manifested by animals and can identify many links. For example, dealing with mouldy straw may, under certain circumstances, be a major risk for the human being. The medical doctor, caring for those affected, does not become involved in the agricultural process and will not discover the possible link between lung cancer and the patient's work environment some years before even through detailed anamnesis. The vet should be the person who knows not only about the potential consequences of mycotoxins on health and animal reproduction, but who warns in good time about the risk for human beings. By ensuring that regulations are maintained, veterinary supervisory employees contribute not only to the well-being of animals, demanded by the ethical norms of developed society, but also the efficiency of production. Through measures taken to limit infectious illness and by eradication of outbreaks, veterinarians also serve agricultural production and for a whole series of illnesses directly protect human health. By checking that foodstuffs are irreproachable on health grounds, and maintaining limits on the contamination, the veterinary medicine directly contributes to consumer protection. Veterinary research today contributes to the resolution not only of basic problems, but also to the development of many border fields of interest impacting on the problems of human and animal health and environmental quality. This is why veterinary medicine has an irreplaceable role in the strategy for developing agriculture and nutrition and in caring for human health and the state should devote great attention to this field. In many developed countries, the range of state veterinary supervision, great support for the training of vets and opportunities for the use of the most modern diagnostic methods bears witness to the understanding of these links. Other important factors are effective legislation and consistent checks that it is being maintained, and the prestige which vets have not only with their partners in agricultural concerns, but also throughout state administration. There are countries in which vets hold high positions in industry, in the army and in state administration and countries which in the catalogue of

diplomatic posts have a column for veterinary attachés. Workers in any field must deserve their position through their abilities and results. Veterinarians have a good basis for this and development strategy should count on them.

### **Selected papers of Czech authors related to cattle health and reproduction**

1992 to 2001, peer reviewed journals only  
Abstracts and reprints are available on-line at  
<http://www.vri.cz>

Authors or co-authors from the Veterinary Research Institute are in bold

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