VETERINARY BIOLOGY

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The dependence of applied biology, including veterinary science, upon the development of biology, is indicated in the development of biomedicine, agroecology and pathobiology. Only veterinary biology (VB) is still under development nowadays. The requirements for VB, bio-organic chemistry and mathematics are continuously rising every day. The increasing importance of achievements in biochemistry, biotechnology, physiology, virology as well as microbiology and genetics, and their increase in relative importance in veterinary medicine and especially in the veterinary sciences refers to this circumstance.

Veterinary biology represents the generalizations of the biological fundamentals of the veterinary sciences. Its main components are veterinary ecology, veterinary genetics, and veterinary selection. *Veterinary ecology* (VE) researches infectious (host – pathogen – environment) as well as non-infectious (host-environment) systems in their concrete habitats (see Lochmiller, Dabdert, 1993); their control and evolution. The objects of v*eterinary genetics* (VG) are domestic (and wild) animals, and their parasites-pathogens, like viruses, bacteria, fungi, protozoa, helminths etc. (Pavel *et al*., 1988). The goal of *veterinary selection* (VS) is the direction of the evolution of hosts and to a certain extent of pathogenic microbes (pathogens), that means the correction of the consequences of natural and artificial selection. In other words the preference of the average animals, i.e. the adaptive norm (see Altukhov *et al*., 1979), by eliminating the extreme phenotypes from breeding. While zootechnical (animal) breeding represents directional selection, veterinary selection prefers stabilizing selection.

Thus the goal of VB is to avail the genetic and physiological adaptation of animals to concrete habitats (see Waddington, 1959; Taddei *et al*., 1997) and to achieve control over pathogenic and opportunistic microflora (microbial populations).

The most important branch of VB is veterinary ecology. The latter ables one to correct the results of the impact of unfavourable environmental conditions. VB tries to eliminate through the veterinary selection sublethal and lethal genes, to enhance the resistance of animal populations, also thus performing the selection of pathogens.

The main research levels of VB are the organismic and population level, using modern biochemical and molecular-biological as well as mathematical methods. Ever growing role in VB does biotechnology for VB and veterinary medicine. It is worth emphasizing to research into developmental disorders, and ontogenetics (i.g. the role of CNS in the development of the immune system). Important are, the discovery of new adaptogens and immunostimulants.

One of the significant branches of VB is epigenetics (Jablonka, Lamb, 1995; Rollo, 1995; Keller, 1995, Jiang, Stillman, 1996).

One cannot also ignore population immunology (PI). PI is an important branch of VB in enhancing and maintaining the immunity of herds (Pavel, Peterson, 1989; Pavel *et al*., 1980; Lochmiller, 1996).

Veterinary medicine has to solve two outstanding problems: the prophylaxis and fighting (elimination) of still-occurring infectious diseases, and the prophylactic medical examination of animal herds (especially of cattle and pigs). The prophylactic examination should take into account the main traits if innate immunity (i.e. non-specific resistance), and to some extent specific resistance (immunity), while the majority of animal diseases are caused by the weakening of non-specific and specific resistance (see Distl, 1990). This can be realized by population immunological monitoring.

Population immunology (PI) is a new branch of population biology. It determines changes in the phenotypic structure of animal and microbial populations in space and time. Therefore the main object of PI is also the variability of the pathogens' virulence (Pavel, Peterson, 1989).

In the light of new results in veterinary selection (Mallard *et al*., 1993, 1998; Magnusson *et al*., 1997, 1998; Wilkie *et al*., 1997) a new scope in veterinary selection is opened up — assessment of the innate and adaptive potentials of immunity in herds. The veterinary-genetic categorization of animals through the determination the state of their immunity (especially innate immunity) must be carried out at breeding farms. We have found that the occurrence of immunologically weak cows (through the bactericidal activity of blood serum) in Estonian cattle herds is about 25 % (Pavel, Viltrop, 1996; Pavel, Kumar, 1998). In chicken the degree of resistance depends on many factors, including egg productivity (Pavel *et al*., 1981; see also Pavel, Viltrop, 1996).

From the above discussion the rising role of VB in veterinary medicine and animals breeding becomes clear, i.e. the biological, chemical and mathematical way of thinking in the veterinary practice and in the sciences.

It goes without saying that for the generalizations of VB are necessary in all veterinary disciplines.

In conclusion one may say that the most important aims of VB are the control and direction of individual development, its ontogenetics, and the population immunological evaluation of herds. Comprehensively the

epidemiological monitoring of herds is not to be neglected (see Thrushfield, 1995). Concerning the ontogenetic development of animals the research of neurohumoral control, as well as the impact of foods and feeding in an animal's development and the stimulation of the function of the immune system are emerging fields. It is also inevitable to assess the reaction of different phenotypes to various remedies, and the comparative exploration of the expression of resistance genes in different animal species. Also the processes of the formation of drug resistance in microbes must be researched.

VB as the generalization of veterinary sciences has to give the veterinary disciplines the theoretical bases for further development, i.e. for epidemiology, epizootiology, parasitology, microbiology and virology, as well as for zoohygiene, but also to applied (clinical) biochemistry, physiology and pathophysiology.

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Veterinaarbioloogia

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Kokkuvõte

Rakendusbioloogia, ka veterinaaria sõltuvust bioloogia arengust näitab biomeditsiini, agroökoloogia ja patobioloogia tekkimine. Puudub veel ainult veterinaarbioloogia (VB). Vajadus VB, bioorgaanilise keemia ja matemaatika järele kasvab aga iga päevaga. Sellele viitab biokeemia, biotehnoloogia, füsioloogia, viroloogia ja mikrobioloogia kui bioteaduste osatähtsuse pidev tõus veterinaarias.

Veterinaarbioloogia kujutab endast veterinaarteaduste üldistust, bioloogilisi aluseid. Tema tähtsamateks koostisosadeks on veterinaarökoloogia, veterinaargeneetika ja veterinaarselektsioon. *Veterinaarökoloogia* (VÖ) uurib nakkuslikke (peremees-patogeen-keskkond) kui ka mittenakkuslikke (peremees-keskkond) süsteeme vastavates elukeskkondades; nende süsteemide kontrolli ja evolutsiooni.

Veterinaargeneetika (VG) objektideks on koduloomad ja ulukid ning nendel esinevad parasiidid-patogeenid, nagu viirused, bakterid, seened, algloomad, helmindid jt. *Veterinaarselektsiooni* (VS) ülesandeks on koduloomade (aga ka ulukite) ja teataval määral ka tõvestavate mikroobide patogeenide evolutsiooni suunamine, s.t. loodusliku ja kunstliku valiku korrigeerimine. Teiste sõnadega, keskpäraste võimetega (incl. resistentsusega) loomade (nn. adaptiivse normi) eelistamine, elimineerides tõuaretusest äärmuslikud (ekstreemsed) fenotüübid.

Seega VB ülesandeks on kaasa aidata loomade (ja karjade) kohastumise (ja kohanemise) tõstmisele konkreetsetes elutingimustes ning teostada kontrolli patogeensete ja eriti potentsiaalpatogeensete mikroobipopulatsioonide üle.

VB tähtsaim haru on *veterinaarökoloogia.* Viimane aitab korrigeerida ebasoodsate elutingimuste ja valiku (nii kunstliku kui loomuliku) tagajärgi. Seejuures VB oma haru veterinaarselektsiooni kaudu püüab eemaldada loomakarjadest subletaalseid ja letaalseid geene, tõsta loomade resistentsust, teostades sel teel ka patogeenipopulatsiooni selektsiooni.

VB tähtsamateks uurimistasemeteks on organismi ja populatsiooni tase, kasutades seejuures kaasaegseid biokeemia ja molekulaarbioloogia ning matemaatika meetodeid. Üha kasvab biotehnoloogia roll VB-s ja eriti praktilises veterinaarmeditsiinis.

Esiletõstmist väärivad isendiarengu füsioloogia ja biokemismi (aga ka arengu normist hälbimise) uurimine ning ontogeneesi geneetika uurimine (nagu KNS osa sedastamine immuunsüsteemi arengus). Vähe tähtis ei ole ka uute adaptogeenide ja immunostimulaatorite otsimine.

Mainimata ei saa jätta populatsiooniimmunoloogia (PI) kasvavat osatähtsust karja tervise tõstmisel. Ka PI on VB üheks tähtsamaks haruks.

Ülaltoodust nähtub, et loomakasvatuse ja selle veterinaarse kontrolli tagamisel on üha suurenev roll täita VB-l. See tähendab bioloogilise, keemilise, aga ka matemaatilise mõtlemise juurutamist veterinaarias, eeskätt veterinaarteadustes (aga ka praktikas).

VB-alased üldistused on vajalikud kõigi veterinaarsete distsipliinide edasises arengus. See väide ei vaja enam tõestamist, nagu veel hiljaaegu esinenud arvamus, et geneetika ei ole veterinaarmeditsiinis vajalik. Elu on näidanud, et on, ja veel vägagi.

Kokkuvõtvalt võib öelda, et VB tähtsamateks ülesanneteks on isendiarengu kontrollimine ja suunamine ning karjade populatsiooniimmunoloogiline hindamine. Arusaadav, et esimeste hulka kuulub ka karjade epidemioloogiline seire. Mis puutub ontogeneesi, siis tõuseb vajadus uurida selle neurohumoraalse kontrolli osa, organismi arengu sõltuvust söötade koostisest ja söötmise tehnoloogiast ning immuunsüsteemi talitluse stimuleerimist. Samuti on vältimatu uurida loomade reaktsiooni ravimitele ja resistentsuse geenide avaldumise võrdlev uurimine eri loomaliikidel ning ravimresistentsuse tekkimise vältimise võimalikkuse uurimine patogeenidel.

VB kui veterinaarteaduste üldistus peab andma olulise panuse eeskätt selliste veterinaardistsipliinide arengusse, nagu seda on epidemioloogia, epizootoloogia, parasitoloogia, mikrobioloogia ja viroloogia, ning zoohügieen, aga ka soodustama rakendusbiokeemia ja -füsioloogia ning patofüsioloogia arengut.