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Denmark's research school for animal production and health (RAPH)

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Introduction

In 1998, the Research School for Animal Production and Health (RAPH) was founded as a sister institute to the Research Centre for the Management of Animal Production and Health (CEPROS). Both institutes were set up largely to support Danish agriculture, which wanted the results of much-needed research, but which also recognised the need for researchers capable of understanding and solving complex multidisciplinary problems related to animal health and welfare.

Today, agriculture in Denmark is thriving and forms one of the country's most successful economic sectors. Its strength has complex origins, but during the last twenty years the rapid adoption of new technologies has undoubtedly benefited Danish farmers enormously. Initially, the research concentrated on increased production, but more recently animal welfare and food quality and safety have received far greater attention. This shift has led to the need for a new type of researcher, someone who understands the complexities of multi-faceted problems in animal husbandry. Clearly, multidisciplinary research teams are essential, and researchers must be able to work and communicate in large interdisciplinary collaborations.

RAPH's objective

The main objective of RAPH is to provide Ph.D. students with a multidisciplinary training in animal health and production. In addition, the Research School wishes to support collaboration between research establishments that offer a Ph.D. degree training. To achieve these objectives, RAPH is committed to exploring new ways of designing and running Ph.D. courses.

The formalities

Officially RAPH is part of the Graduate School for Veterinary and Agricultural Sciences in Denmark. The Royal Veterinary and Agricultural University initiated its establishment, with the support of a group of Danish research institutions. It runs its own PhD programme (see Appendix 1), but under the auspices of the Graduate School's general Ph.D. programme, and has its own Head and Scientific Panel (see Appendix 2). It also manages its own funding. Currently there are 37 students registered for the Ph.D. programme, and nine more are due to enrol before the end of the current project period.

A broader approach to research education

RAPH aims to create an atmosphere that is both stimulating and academically attractive. It encourages scientists and Ph.D. students to see one another as colleagues; to support this idea it organises team-building events such as races on a military obstacle course, which soon eliminate any feelings of

superiority due to differences in scientific experience. Students are also offered short courses on complementary topics like project management and academic writing for scientists.

The scientific traditions of open discussion, constructive criticism and international collaboration are important in a research environment, and to help cultivate these ideals RAPH has appointed a panel of five Danish professors (see Appendix 3)- all leading scientists in their respective fields of study.

RAPH fosters a sense of identity and individuality. It recognises that many of the skills needed to become a successful research scientist cannot be taught in the classroom. Students are encouraged to discuss the concepts of research quality, both in Denmark and abroad, on a regular basis with their supervisors. Without their effective input, a research school can achieve little, and the supervisors at RAPH are all associate or full professors selected for the wide range of topics and experience they can offer the students.

Are RAPH students different from other Ph.D. students?

Projects at RAPH have a particular format, which is characterised by a strong emphasis on interdisciplinarity (see Appendix 4). The aim is to teach students problem-solving skills that can be applied to complex situations in clinically, epidemiologically and economically challenging aspects of animal production. However, there is no scientific method by which multidisciplinary skills may be gained. Thus, the Research School organises biannual interdisciplinary seminars, during which students are encouraged to participate in discussions with researchers and students from other disciplines. Much can be learned in this way, for instance an epidemiologist can advise an animal health economist, who in turn might advise a virologist on the economical feasibility of a particular test.

RAPH students also become competent in methods used for animal production research, with particular emphasis on those related to animal health and welfare. Most projects are designed to border two disciplines, such as pathology and clinical science. Every student also has to take a course in advanced statistics, which concentrates on methods most relevant to biological situations and covers a range of topics to ensure students acquire a broad knowledge of techniques and problems in animal research. After completing their Ph.D.s, RAPH students should be suitable for positions in a variety of organisations.

Finally, following a second mandatory course - Ethics in Science - RAPH's Ph.D. students achieve insight into the professional, ethical, legal and socio-cultural issues related to the different aspects of animal production. Many researchers today have little or no idea of the ethical considerations they must take into account when designing their research projects; most tend to think ethics is simply related to how well or badly they treat their experimental animals. Ethics in Science teaches students to analyse selected ethical and methodological problems related to research in livestock production and health. Students are expected to become conversant in a wide range of research practices and they also examine the interaction between scientists, including conflict between individuals, scientific fraud, issues of copyright and authorship. In addition, every student has to submit a report on an ethical issue related to his or her

research project. Ethics in Science has become one of the most highly rated courses by the students when they graduate.

The Danish Ph.D. education is a 3-year course. This is a short time span considering all that is expected of students for the completion of their degree. Further to the two mandatory courses mentioned, RAPH's students are encouraged to spend time abroad, to play an active part in the Research School and to attend the seminars and summer schools on offer. In this regard, the compression of the curriculum in to three years is a major drawback.

Will RAPH make a difference?
We cannot answer this question yet, but we have great confidence in the project. The programme is highly attractive to students, and so far they have developed into confident researchers, and, importantly, the feedback from supervisors and other researchers is positive. The school's first evaluation takes place next year, and measures will be introduced to ensure a good standard of quality, for example the bibliometric analysis of students' publications and the statistical analysis of time and money invested in the initiative. The real impact of this interdisciplinary training may not be apparent, however, for another ten years from now, when these students have become leaders of or advisors to research groups.

The creation of RAPH has inspired a number of other initiatives in Denmark, and we have often been asked to give advice. The two most important recommendations we would offer are:

- To select and maintain quality - be it in teaching staff, projects, students, research or teaching programmes, funding, etc.
- If people are not truly enthusiastic about an idea then do not pursue it - unanimous support is essential for success.

Appendix 1
Rules for students studying for a Ph.D. degree at RAPH

Study at RAPH follows the same general rules that govern Ph.D. students in Denmark, with some additions.

- Every student must have two supervisors: one from KVL (the main supervisor), the other from the respective research institution.
- Students are expected to spend a minimum of two months at both of their supervisors' institutions. Students affiliated to a research institution will normally be expected to fulfil some teaching commitments during their period at KVL.
- Students must participate in a minimum of two summer schools arranged by RAPH. Attendance at a summer school is worth six ECTS points.
- Students must participate in biannual seminars, unless they are attending research institutions abroad at the time.
- Students should spend a minimum of four, preferably six months at a research institution outside Denmark.
- Students must gain a minimum of 30 ECTS points during their Ph.D. course.
- Students must gain six ECTS points in Advanced Statistics.
- Students must gain six ECTS points in Ethics in Science.

Successful RAPH students will receive a special PhD diploma, stating the subject of their education and their area of research.

Appendix 2
The Scientific Panel
The Head of RAPH collaborates with the Scientific Panel to plan the activities in the Research School. As mentioned, the members of this group are key persons within the fields of research covered by CEPROS. The CEPROS Board appoints them for a five-year period. The objective of the RAPH Scientific Panel is to assist RAPH's Head in the scientific evaluation of Ph.D. applications, education programmes and Ph.D. theses. The panel also contributes to the planning of RAPH's seminars and summer schools. If deemed necessary, members may invite special advisors to participate in the Panel's work.

Members of RAPH's Scientific Panel are:

Chairperson
Dr. Pia Haubro Andersen, Associate Professor, DVM, PhD, DVSci, Head, Research School for Animal Production and Health, KVL, Frederiksberg, Denmark. (Veterinary Clinical Sciences)

Other Panelists

Dr. Niels Agergaard, DVM, dr.med.vet., Research Director, Danish Institute of Animal Sciences, Foulum, Denmark. (Animal Physiology)

Dr. Jens Nielsen, DVM, PhD, Senior Researcher, Danish Veterinary Institute of Virus Research, Lindholm, Denmark. (Immunology and viral diseases)

Dr. Kristian Møller, DVM, PhD, Research Director, Danish Veterinary Laboratory, Copenhagen, Denmark. (Microbiology and Parasitology)

Dr. Henrik B. Simonsen, DVM, dr.med.vet., Assistant Professor, Institute of Animal Production and Health, KVL, Denmark. (Etology and Animal Welfare)

Professor Lars Gjøl Christensen, dr. agro, Institute of Animal Production and Health, KVL, Denmark. (Animal Breeding and Genetics)

Statistical Advisor

*Professor M. Skovgaard***,** dr. scient., Institute of Mathematics and Physics, KVL, Denmark.

Appendix 3

Guest professors at RAPH (listed alphabetically)

Dr. Jeanne Burton, Department of Animal Science, Michigan State University, USA. (Immunology, nutrition and genomics)

Dr. Paul Coussens, Department of Animal Science, Michigan State University, USA. (Molecular biology and genomics)

Professor Dr.h.c.mult. Marian Horzinek, University of Utrecht, The Netherlands. (Quality assessment and international relations)

Professor John McInerney, Agricultural Economics Unit, University of Exeter, UK. (Animal health economy)

Professor Dirk Pfeiffer, London, UK. (Epidemiology and Risk Analysis)

Professor David Platt, University of Glagow, UK. (Microbiology)

Appendix 4

Project profiles

Advanced statistics and planning of experiments

The multidisciplinary research characteristic of RAPH and CEPROS encourages the collection of data that are new, fundamental or of strategic value. When undertaking fundamental or applied research at the highest level, Ph.D. students at RAPH must also acquire a substantial insight into related fields of research. This enables them to integrate and understand their work in a much broader context. They are also expected to develop ideas that cross the borders between traditional disciplines.

Research at RAPH consists of three principal clusters:

- Management of animal health and production - cluster A
- Pathogenesis of production diseases - cluster B
- Animal health economics - cluster C (see below for details)

At any given time there are several projects running within each of these clusters. The core of a student's research profile will normally be at the interface between the research clusters and thus is sometimes difficult to assign to a single cluster.

RAPH aims to facilitate and encourage continual interplay between the highly specialised research disciplines of each cluster, on the one hand, and the multidisciplinary perspectives, which arise in areas of overlap, on the other.

Cluster A: Management of animal health and production
Harmonization of animal health and welfare with animal production are central to Danish agriculture, and is being demanded increasingly by Danish society. Research undertaken in Cluster A focuses on the development of profitable animal husbandry systems, taking the health and welfare of livestock into account.

Research is currently needed to identify animal and herd health parameters; these might be clinical, ethological or biochemical and might require production data. There is also a need to develop more precise methods for measuring the health of animals kept under existing management systems. Extensive clinical and laboratory-based investigations are required for this. The relative importance of different animal production conditions also needs to be studied, for instance the effect of housing layout, climate and management factors.

Cluster B: Pathogenesis of diseases in production animals
Research in this core cluster is geared towards increasing our understanding of the origin and pathogenesis of infectious and non-infectious diseases, with the ultimate aim to control them. Progress in this field depends on the development of methods to identify and evaluate pathological factors. An in-depth knowledge of the immune system of the relevant production animals is necessary before prevention strategies can be developed and put into place. A better understanding of the relationship between production conditions - type of housing, climate, feeding and other management factors - and the adaptive and innate immune systems is needed. Eventually, methods for improving an animal's immunity to disease will be developed and consequently health status in production animals will be raised. At present there is a shortage of methods to characterise herd immunity.

Cluster C: Animal health economics
Animal health economics is a relatively new discipline in research. It explores methods and tools that decision-makers can use for the selection of disease control strategies. The discipline relies on input from the animal and veterinary sciences as well as from agricultural economics. Traditionally, animal scientists have regarded animal production as the conversion of input (feed) into a marketable product, such as milk or meat, etc. Economists take other input factors into account, including labour, buildings, machinery and management skills.

For many years veterinary science considered only the treatment of individual animals. In the last twenty years, however, epidemiology has become a more significant subject, and thus the incidence, prevalence and production losses caused by diseases have been studied more carefully, although many of the findings have yet to be used in an all-encompassing approach to animal production. The effects of diseases and economic output in a defined production system have rarely been calculated, and consequently changes in production systems have not been made.

Animal health economics at RAPH aims to develop methods by which disease control strategies can be designed for the herd rather than for individual animals

Some areas of research are particularly active at present and include the study of well-known production-related diseases, such as salmonellosis, paratuberculosis, porcine reproductive and respiratory syndrome and mastitis; other fields are the examination of traditional methods related to health status, particularly evaluation, surveillance, factors related to management and welfare assessments, and research into antibiotics and antimicrobial resistance, the definition of immunity in health and disease, the pathogenesis of viral diseases, and metabolic aspects of production.