

**SOCRATES THEMATIC NETWORK  
AQUACULTURE, FISHERIES AND AQUATIC RESOURCE MANAGEMENT 2008-11**

**LIFELONG LEARNING PROGRAMME  
ERASMUS  
Academic Network**

Report on **Comparative Quality of the PhD courses and need for standardisation**

**Project Acronym:** Aqua-tnet

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## Description

In the Aqua-tnet domains, PhD students are often facing similar problems such as statistical handling of data, but also handling of experimental animals. This task will compare the content of courses covering such scientific skills courses and formulate recommendations for best practice across the Aqua-tnet domain.

## Course contents

There are basically two aspects to courses dealing with experimental animal handling. First there is the fact that students need to acquire the practical skills for working with experimental animals and secondly there may be legal requirements concerning experiments with animals that require particular courses to be followed and successfully completed.

In Belgium, Norway, the United Kingdom, the Netherlands and a number of other European countries it is compulsory for a researcher who is responsible for the experimental handling of animals (mostly restricted to vertebrates) to have a legally approved certificate of his/her skills. In a number of countries this certificate can be acquired by following a specialised course in a Laboratory Animal Science (LAS) in addition to or as part of a relevant academic degree. In case of Belgium, Norway and the Netherlands, the status and structure of courses in these countries are clearly described. In addition, courses dealing with laboratory animals are also provided by other universities, but often in a more informal way. For instance, the University of Aberdeen provides a course for staff and postgraduate students to get a Home Office Personal Licence which involves animal handling, but this course is specifically organised as an MSc or PhD course. In Italy, for the moment, it is not compulsory for a researcher to have a specific certificate for doing animal experiments although his/her skills are evaluated by an Academic Ethical Commission including external members, as Authorities and Professional experts, before the experiments are allowed to proceed. In several universities (Universities of Insubria, Milano, Bologna, Torino) courses on Ethology and Animal Welfare (not specifically on fish) are organized for undergraduate and master students. Training on fish manipulation for MSc and PhD students are organized without a precise agenda (according to needs) at the universities of Bologna, Camerino, Insubria, Udine, Milano Statale, Roma Tor Vergata (Roma 2), Palermo, Torino.

We received more precise information on the following animal handling courses:

1. Ghent University, Belgium: Laboratory Animal Science I (D002122), <http://studiegids.ugent.be/2010/EN/FACULTY/D/MABA/DMBIOM/DMBIOM.html#>
2. Ghent University, Belgium: Laboratory Animal Science II (D000504), <http://studiegids.ugent.be/2010/EN/FACULTY/D/MABA/DMBIOM/DMBIOM.html#>
3. Wageningen University, the Netherlands: Laboratory Animal Science (YAS-30304), [https://ssc.wur.nl/wpage8/xpage.aspx?xml=vak\\_xml.iread?Vak:Vak%20id=92ZM2NB3DXCKTMQ9\\$On deenheid:Gidsjaar=2010\\$Oplprt:Oplprt=R&xsl=/bois/xsl/vak.xsl&css=gids.css&lang=usa&app=bois](https://ssc.wur.nl/wpage8/xpage.aspx?xml=vak_xml.iread?Vak:Vak%20id=92ZM2NB3DXCKTMQ9$On deenheid:Gidsjaar=2010$Oplprt:Oplprt=R&xsl=/bois/xsl/vak.xsl&css=gids.css&lang=usa&app=bois).
4. Norwegian University of Science and Technology, Norway: Laboratory Animal Science for Researchers (NEVR8003), <http://www.ntnu.edu/studies/courses/NEVR8003/2010>.
5. University of Insubria, Italy:

An overview of the above-mentioned courses can be found in the table underneath. Some of the more conspicuous similarities and differences will be addressed next.

## Similarities

- Courses are roughly of the same size (4 – 6 ECTS)
- Contents of the courses all cover a wide range of subjects including, physiology, health, care, handling, ethics, legislation etc.
- In all courses learning outcomes are assessed based on a written exam, although an active involvement in practicals and assignments is also required.

- The focus of all courses is on mammals, especially small rodents. The Wageningen course does cover a small section on fish. Only the Trondheim course has a substantial specific part on fish that can be selected by the student.

## Differences

- In Ghent and Wageningen courses are set up as MSc rather than as PhD courses, while in Trondheim the course is specifically intended for the doctoral phase.
- The LAS course I, provided by Ghent University does not suffice for the requirements for independent animal experimenters in Belgium. For that purpose the LAS course II has to be successfully completed. This latter course assumes that there already is hands-on experience in animal handling, otherwise the LAS course I has to be completed. In Norway and the Netherlands the legal prerequisites for successfully completing the LAS course and acquiring a status of independent experimenter are explicit.
- The extent of practical exercises explicitly aimed at handling of animals is more extensive in the Wageningen course than in the Ghent courses. The compulsory LAS II course of Ghent does not have any practical work regarding animal handling in it. These skills are assumed to be acquired in earlier stages of education (see above). It cannot be clearly deduced from the information on the portals how much practical skills training is involved in the Trondheim course, which appears mainly to involve demonstrations, discussions and assignments.
- The Wageningen course is given in Dutch only. The reason for this is lowering the 'threshold' for students in discussions on issues concerning laboratory animals. Since the course is aimed at meeting Dutch standards and Dutch legislation and therefore the majority of students is Dutch the choice for the Dutch language was made explicitly. This might hamper student mobility. In Ghent the LAS courses are offered both in Dutch and English. In Trondheim the course is offered in English.

## Recommendations on PhD student mobility in relation to animal experiments

From the acquired information, which was rather limited, we find that the prerequisites for a researcher to be legally allowed to take the responsibility for animal experiments is very much dependent on national legislation. The ways to meet these national legal requirements differ among countries and may involve compulsory courses in addition to general requirements on previous education, such as in Belgium, Norway, and the Netherlands. This situation may potentially hamper the mobility of students to do experimental work in other countries than their own, especially if courses are only offered in the national language, such as in the Netherlands. However, in practice the problems could be very limited, because PhD students will almost exclusively perform animal experiments under the supervision and responsibility of a supervisor that will have the required status as an animal experimenter. In this way the PhD student will be enabled to do the work without exactly meeting the specific national requirements of the host country. Therefore, from a legal perspective we do not foresee any large problems for student mobility. However, in order to ensure that PhD students are given the opportunity to comply to the national standards of the host country anyway, it would be advisable that all LAS courses would be taught in English too.

Concerning the quality of the courses and the practical skills they are teaching it is difficult to make general statements now, because of the lack of data provided. All in all, the quality of the compared courses and the subjects that they are covering appear to be largely similar, although it is not possible to compare all aspects in detail. In order to assess whether the existing courses meet the requirements of practical skills needed for handling experimental animals (which in the domain of AQUA-TNET are mostly aquatic animals, mainly fishes) the skills that each of these courses is teaching could be inventoried in detail, focusing on the organisms used, the type of work that students are doing (practical, theoretical or both), the time investment and the assessment (only a written exam, or also a direct assessment of practical skills). This inventory could then be compared with what PhD-supervisors in the field consider relevant skills for their students and possible gaps could be identified and filled up in newer versions of the courses. This requires consensus on the description of skills and how to assess them.

In summary our recommendations boil down to:

- All laboratory animal courses should be taught in English.
- Laboratory animal courses should explicitly incorporate aquatic organisms (at least fishes) in their subjects.
- There should be consensus on the description of practical skills and how to assess these.

Descriptor	Wageningen University (Laboratory Animal Science, YAS-30304)	Ghent University (Laboratory Animal Science I, D002122)	Ghent University (Laboratory Animal Science II, D000504)	Norwegian University of Science and Technology (Laboratory Animal Science for Researchers, NEVR8003)	University of Insubria, Course/Laboratory on Ethology and Animal Welfare
ECTS	4	5	5	6 <sup>1</sup>	5
Total study time	120 hours	150 hours	150 hours		125
Lecture (hours)	22 hours	30 hours	30 hours	35 hours	30
Practical (hours)	17 hours	10 hours	10 hours	21 hours	10
Group work and assignments				24 hours	25 hours
Other teaching methods			<b>Group discussion, debates</b>	<b>Tours with demonstrations</b>	<b>Tours with demonstrations</b>
Teaching language	Dutch (as to optimize the exchange of information, but more importantly thoughts and opinions, the course is given entirely in Dutch)	English	English	English	Italian with slides and comments in English
Prerequisite knowledge	<ul style="list-style-type: none"> <li>• knowledge on the basic subjects of biology up to 18.75 credits (= 500 study hours) including at least 7.5 credits on anatomy/zoology and 7.5 credits on physiology.</li> <li>• These terms of admission are in accordance with the formal requirements of the Dutch responsible authority.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Having insight in chemical and physiological processes as documented in the relevant courses of a bachelor program of the university scientific disciplines.</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Having successfully completed the courses Anatomy and Physiology of a bachelor program of the university, or having acquired the relevant ending objectives by other means.</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>a 3-year education on university or college level is a prerequisite in order for the participant to use the title "FELASA category C, Researcher" when the compulsory activities have been carried out.</b></li> <li>• <b>Recommended knowledge:</b> <ul style="list-style-type: none"> <li>○ Biomedical education on university or college level</li> <li>○ courses in statistics</li> </ul> </li> <li>• <b>knowledge of literature search on the internet and in the library.</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Having insight in biological and physiological processes as documented in the relevant courses of a bachelor program of the university scientific disciplines.</b></li> </ul>

<sup>1</sup> On the NTNU website the 6 credits are not translated into separate activities, but it mentions that there is a general part (3 days) and a selectable part (2 days). On the AQUA-TNET portal it is mentioned that there is.

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Goal of the course	<p>Dutch Law requires that animal experimentation is carried out by properly trained people. For researches this implies that, on top of a biological or biomedical university degree, a so-called Article 9 certificate is needed. The Laboratory Animal Science (LAS) Course given in Wageningen leads to such a certificate, when the course is fully attended (two to three weeks) and the exam is successfully completed. The LAS course entails scientific, ethical and practical aspects of animal experimentation. The main purpose of the course is to enhance a positive attitude towards animal needs and wellbeing.</p>	<ul style="list-style-type: none"> <li>to provide the student with basic knowledge concerning the use of laboratory animals.</li> </ul> <p>The student should learn to know about the specificities of different animal species, e.g. concerning morphology, physiology, requirements for housing and nutrition, etc. Furthermore, the students should acknowledge the advantages and disadvantages of animal use and the importance of optimising laboratory animal welfare.</p>	<ul style="list-style-type: none"> <li>to provide the student with enough knowledge concerning the use of laboratory animals</li> <li>to be able to function as responsible for animal experiments.</li> </ul> <p>This course is legally imposed by the government for professionals working with lab animals. The student should acknowledge the advantages and disadvantages of animal use and learn to optimize laboratory animal welfare, especially focusing on the 3 R's: Replacement, Reduction and Refinement of lab animal experiments. The student also acquires knowledge on legal implications and possible alternatives for laboratory animal use.</p>	<p>To use the title "FELASA category C, Researcher the student needs to meet the requirements of this course and the prerequisite knowledge</p>	<p>Students must know the basis of Ethology and of the methods for the study of animal behaviour and welfare; moreover, they must get aware of animal motivations and pulsions, plus must get knowledge of etical and legislative principles for animal transport, handling and farming.</p>
Lecture subjects	<ul style="list-style-type: none"> <li>Anatomy &amp; Physiology</li> <li>housing, nutrition and care</li> </ul>	<ul style="list-style-type: none"> <li>Morphology</li> <li>Physiology</li> <li>Reproduction</li> </ul>	<ul style="list-style-type: none"> <li>Ethics</li> <li>ethology and stress</li> <li>legislation</li> </ul>	<ul style="list-style-type: none"> <li>Legislation, ethics and views in society;</li> <li>the course of events in</li> </ul>	<p>Basic of animal behavior.</p> <ul style="list-style-type: none"> <li>Genes and environment.</li> <li>Defence, feeding and</li> </ul>

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	<ul style="list-style-type: none"> <li>• responsible animal handling</li> <li>• obtained some practical experience in the</li> <li>• collection of body fluids</li> <li>• experimental techniques (amongst others cannulation, insertion of catheters);</li> <li>• recognition of pain and discomfort</li> <li>• anaesthesia, analgesia and euthanasia</li> <li>• impact of environmental and procedural factors on experimental results;</li> <li>• hygienic measures and barrier systems;</li> <li>• impact of disease on the experimental approach</li> <li>• health monitoring;</li> <li>• safety aspects and occupational health</li> <li>• preparation and performance of animal experimental techniques and research;</li> <li>• optimisation of the use of laboratory animals;</li> <li>• good laboratory practice (GLP);</li> <li>• alternative techniques;</li> <li>• legislation concerning the use of laboratory animals;</li> <li>• ethical judgement of animal experiments.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Immunology</b></li> <li>• <b>Nutrition</b></li> <li>• <b>Diseases</b></li> <li>• <b>Pharmacology</b></li> <li>• <b>medical imaging</b></li> <li>• <b>anaesthesia.</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>ethical methods of euthanasia</b></li> <li>• <b>pain and analgesia</b></li> <li>• <b>animal models and alternatives</b></li> <li>• <b>extrapolation of experimental data to man</b></li> <li>• <b>interaction of diseases with animal experiments</b></li> <li>• <b>housing and environmental enrichment of lab animal cages</b></li> <li>• <b>sample size determination</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>animal experiments;</b></li> <li>• <b>biology of lab animals;</b></li> <li>• <b>the choice of species;</b></li> <li>• <b>genetic and environmental factors influencing animal experiments;</b></li> <li>• <b>health hazards;</b></li> <li>• <b>principles concerning the handling of animals, anaesthesia, analgesia and humane killing of lab animals;</b></li> <li>• <b>evaluation and quality control of animal experiments;</b></li> <li>• <b>reporting;</b></li> <li>• <b>alternatives to animals experiments;</b></li> <li>• <b>literature search.</b></li> </ul> <p><b>The course will contain of a general part (3 days) and selectable part (2 days) where the student can choose between mammal or fish.</b></p>	<p>reproductive behaviours. .</p> <p>Environmental pressures and animal welfare. . . Monitoring animal welfare.</p> <p>. Principles of etic and policies for animal transport, handling, farming and for the laboratory experiments.</p> <p>. Molecular approach for animal behaviour and welfare study</p> <p>. Laboratory methodologies</p> <p>. Animal slaughtering: te example of fish</p> <p>. Current EU and Italian legislation</p> <ul style="list-style-type: none"> <li>•</li> </ul>

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Practical subjects	<ul style="list-style-type: none"> <li>responsible animal handling</li> <li>oral administration of substances and the performance of various injection techniques</li> </ul>	<ul style="list-style-type: none"> <li><b>Handling</b></li> <li><b>experimental techniques used in laboratory animals</b></li> </ul> <p><b>These will be illustrated. Alternative methods (without the use of laboratory animals) are used as much as possible.</b></p>	<ul style="list-style-type: none"> <li><b>Statistics</b></li> <li><b>ethical evaluation of a laboratory animal protocol.</b></li> </ul>	See above: there is no mention of an explicit distinction between lecture, practical and assignment subjects.	. <b>Fish cases</b>
Learning outcomes	<ul style="list-style-type: none"> <li>The participant has a critical and analytical attitude towards the scientific knowledge underlying Laboratory Animal Science related activities.</li> <li>The participant demonstrates the ability to assess her/his scientifically based knowledge and skills.</li> <li>From a participant, who successfully passed the course, one can expect that he/she: <ul style="list-style-type: none"> <li>has knowledge of the major anatomical and physiological characteristics of the commonly used laboratory animal species, with respect to the choice of the proper animal model;</li> </ul> </li> </ul>	<p><b>The final attainment level is to have knowledge and insight in the specificities of laboratory animals, mainly the small rodents. The student is aware of the fact that a thorough knowledge of an animal species is required before using this animal in a specific experiment. The student furthermore understands the sociological relevance and implications of the use of animals in experiments.</b></p>	<p><b>The final attainment level is to have knowledge and insight in scientific, legal and ethical aspects of laboratory animal experiments. The responsible for these experiments understands the sociological relevance and implications of the use of animals in experiments and is able to design an animal experiment in a responsible way. He or she possesses knowledge concerning alternatives, will optimize the lab animal welfare and is able to interpret the results obtained in a critical and correct way.</b></p>	<p><b>After having completed the course, the researcher should:</b></p> <ul style="list-style-type: none"> <li><b>know the principles behind modern theory on animal experiments and welfare</b></li> <li><b>know the legislature regulating the use of lab animals in Norway</b></li> <li><b>know the potential health hazards related to animal experiments, and how to minimize these hazards</b></li> <li><b>understand the significance of the internal and external factors influencing a lab animal and which thereby may influence the outcome of the experiment</b></li> <li><b>know how to work in order to best possible</b></li> </ul>	Students must know the basis of Ethology and of the methods for the study of animal behaviour and welfare; moreover, they must get aware of animal motivations and pulsions, plus must get knowledge of etical and legislative principles for animal transport, handling and faringe.



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	<ul style="list-style-type: none"> <li>○ has knowledge of the requirements of laboratory animals with respect to housing, nutrition and care</li> <li>○ possesses the necessary knowledge for responsible animal handling and also obtained some practical experience in this respect</li> <li>○ obtained some practical experience in the oral administration of substances and the performance of various injection techniques</li> <li>○ has taken note of the different methods for the collection of body fluids</li> <li>○ has taken note of a number of other frequently used experimental techniques (amongst others cannulation, insertion of catheters);</li> <li>○ possesses the knowledge to recognise pain as well as discomfort in laboratory animals and to define humane</li> </ul>			<p><b>standardize these factors</b></p> <ul style="list-style-type: none"> <li>• know roughly how to monitor the health of lab animals</li> <li>• understand the most important principles for choosing methods for handling and treating lab animals</li> <li>• understand the principles behind anaesthesia, analgesia and humane killing of lab animals</li> <li>• understand the general principles for planning animal experiments, including quality control</li> <li>• know of the potential alternatives and supplements to animal experiments which exist</li> <li>• be able to evaluate a published article on animal experiments with emphasis on how the animals are described and used</li> <li>• know of and be able to use guidelines for good reporting of animal experiments</li> <li>• have insight into the</li> </ul>	

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	<p>endpoints</p> <ul style="list-style-type: none"> <li>○ has knowledge of the most important methods of anaesthesia, analgesia and euthanasia, which can be used in various laboratory animal species;</li> <li>○ has knowledge of the possible impact of environmental and procedural factors on experimental results;</li> <li>○ has knowledge of the importance of hygienic measures and barrier systems;</li> <li>○ has knowledge of the impact of diseases in laboratory animals on the experimental approach and knows about possible health monitoring;</li> <li>○ knows about safety aspects and occupational health when working with laboratory animals;</li> <li>○ knows about the specific demands that are necessary for a correct preparation and performance of animal experimental techniques and</li> </ul>			<p><b>most important factors which decide the running of a research department using lab animals</b></p> <ul style="list-style-type: none"> <li>• <b>have an attitude towards the lab animals which reflect "the three R's" with focus on animal protection and animal welfare (Replace, Reduce, Refine).</b></li> </ul>	

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	research; <ul style="list-style-type: none"> <li>○ knows the possibilities that statistics can offer to optimise the use of laboratory animals;</li> <li>○ knows the guidelines with respect to good laboratory practice (GLP);</li> <li>○ knows about the possibilities and limitations of alternative techniques;</li> <li>○ is familiar with legislation concerning the use of laboratory animals;</li> <li>○ knows about basic principles, which guide towards the ethical judgement of animal experiments.</li> </ul>				
Evaluation method	Written exam	Written exam	Written exam	Written exam	