Zoo and wildlife medical education: a European perspective

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Abstract

Europe has a long and distinguished history in veterinary science and education, and it was here that the first professional investigations of pathological conditions in zoo animals took place. However, despite an increasing number of veterinarians working with wildlife, education in zoological and wildlife medicine has only recently become part of formal veterinary training at the undergraduate level. Consequently, current educational opportunities in zoological and wildlife medicine vary widely throughout Europe, both in availability and in composition. The need to establish agreed standards in education across Europe and to foster the mobility of students and teaching staff are reflected by international agreements such as the Bologna Treaty and the ERASMUS-SOCRATES program. Europe is also home to a number of voluntary professional organizations, such as the European Wildlife Disease Association and the European Association of Zoo and Wildlife Veterinarians, that actively promote the inclusion of zoological and wildlife medicine in veterinary education. Zoo and wildlife medicine is currently a veterinary specialization in Europe, but educational opportunities are likely to increase in availability in the future.
Zoo and Wildlife Medical Education: A European Perspective

Kai Frölich ■ Susanne E. Grabitzky ■ Christian Walzer ■ Richard J. Delahay ■ Gerry M. Dorrestein ■ Jean-Michel Hatt

ABSTRACT
Europe has a long and distinguished history in veterinary science and education, and it was here that the first professional investigations of pathological conditions in zoo animals took place. However, despite an increasing number of veterinarians working with wildlife, education in zoological and wildlife medicine has only recently become part of formal veterinary training at the undergraduate level. Consequently, current educational opportunities in zoological and wildlife medicine vary widely throughout Europe, both in availability and in composition. The need to establish agreed standards in education across Europe and to foster the mobility of students and teaching staff are reflected by international agreements such as the Bologna Treaty and the ERASMUS–SOCRATES program. Europe is also home to a number of voluntary professional organizations, such as the European Wildlife Disease Association and the European Association of Zoo and Wildlife Veterinarians, that actively promote the inclusion of zoological and wildlife medicine in veterinary education. Zoo and wildlife medicine is currently a veterinary specialization in Europe, but educational opportunities are likely to increase in availability in the future.

INTRODUCTION
In 1865, the London Zoo became the first to employ someone to perform autopsies on deceased animals in order to determine the cause of death. Although Europe is the origin of the first scientifically managed zoological gardens, education in zoological and wildlife medicine has only recently become part of formal veterinary training at the undergraduate level. At the post-graduate level, the International Symposium on Diseases of Zoo and Wild Animals has been in existence since 1959, following its initiation by Professor Rudolph Ippen at the former Institute für Wirbeltierforschung, now the Institute of Zoo and Wildlife Research (IZW), in East Berlin.

Today, increasing numbers of veterinarians are working with non-domestic species, as illustrated by the growing number of European and national organizations dealing with zoo and wildlife veterinary medicine: for example, the European Association of Zoo and Wildlife Veterinarians (EAZWV); the British Veterinary Zoological Society (BVZS); the Swiss Association of Wildlife, Zoo Animal and Exotic Pet Medicine; and comparable organizations in France, Italy, the Czech Republic, and many other countries. The potential for these organizations to influence veterinary education is exemplified by the BVZS-initiated Zebra Foundation, which assists veterinary surgeons and students in gaining additional experience or qualifications in zoo and wild animal medicine.

The objective of the present article is to provide an overview of current opportunities in zoological and wildlife medicine at the undergraduate and post-graduate levels in Europe and to highlight recent relevant developments at universities and in European Union (EU) legislation. The number of countries to be considered in Europe precludes adequate recognition of all national training programs, and therefore our aim has been to focus on those operating at the international level.

TRAINING COURSES IN VARIOUS EUROPEAN COUNTRIES

Undergraduate Courses (see Table 1)
Despite the growing importance of non-domestic animals as patients in veterinary clinics, there has been a general reluctance to include a specific course in zoological medicine (as defined by Stoskopf et al.) in the veterinary undergraduate core curriculum, most probably because the core curriculum is already so congested. A study by Zwart investigated undergraduate training in zoological medicine at 27 European veterinary faculties. The study notes that although there is a growing interest in exotic animal medicine, diseases in exotic animals are usually taught separately, as elective courses. Belgium, the former Czechoslovakia, Germany, the Netherlands, and Switzerland, however, are recognized for their outstanding teaching programs on exotic pets and zoo animals. Intensive teaching programs in fish medicine are also identified in Norway and Spain.

Although Switzerland’s Zurich University may place greater importance on exotic animals than other European universities, graduates still appear to need additional training. In a survey of 131 graduates from that university between 1992 and 1997, respondents identified enhanced training in zoological medicine (40%) and diagnostic imaging (31%) as areas for future prioritization. The universities of Bern and Zurich are currently working on
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<th>Country</th>
<th>Graduate and Post-graduate Courses</th>
<th>Organizations, Institutions, and Meetings</th>
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<tbody>
<tr>
<td>Austria</td>
<td>University of Vienna: several lectures and courses concerning wildlife medicine</td>
<td>University of Vienna <a href="http://www.vu-wien.ac.at/128/fiwi.htm">http://www.vu-wien.ac.at/128/fiwi.htm</a></td>
</tr>
<tr>
<td>Belgium</td>
<td>None</td>
<td>Belgian Wildlife Disease Society (BWDS) <a href="http://wildlife.var.fgov.be/">http://wildlife.var.fgov.be/</a> November 26, 2005: First symposium of BWDS</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>University of Forestry, Sofia, Faculty of Veterinary Science Thracian University of Stara Zagora, Department of Game Pathology: several obligatory modules on game breeding and management, bird diseases, and pathology of aquatic organisms within the undergraduate curriculum; several elective modules including zoology of game, biology and ecology of predators, wildlife diseases. Post-graduate courses: Game biology and pathology; one course in the physiology and pathology of poultry and game birds</td>
<td>University of Forestry, Sofia <a href="http://www.ltu.bg/Pages/Main_file_ENG.html">http://www.ltu.bg/Pages/Main_file_ENG.html</a></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine, in cooperation with University of Veterinary Medicine Vienna, Austria: Summer school for Exotic Medicine and Surgery</td>
<td>University of Veterinary and Pharmaceutical Sciences Brno <a href="http://www.vfu.cz/default.php?lang=en">http://www.vfu.cz/default.php?lang=en</a></td>
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<tr>
<td>Denmark</td>
<td>None</td>
<td>National Environmental Research Institute <a href="http://www.dmu.dk/International">http://www.dmu.dk/International</a></td>
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<td>Estonia</td>
<td>Estonian Academy of Agriculture, Faculty of Veterinary Medicine, Tartu: obligatory two hours on wildlife diseases for undergraduates; elective 15-week advanced course on wildlife diseases</td>
<td>Estonian Academy of Agriculture, Faculty of Veterinary Medicine, Tartu <a href="http://www.eau.ee/">http://www.eau.ee/</a></td>
</tr>
<tr>
<td>Finland</td>
<td>None</td>
<td>Finnish Game and Fisheries Research Institute <a href="http://www.rktl.fi/english/">http://www.rktl.fi/english/</a> Yearly meetings (Game Days) that cover wildlife diseases among other game management subjects</td>
</tr>
<tr>
<td>Germany</td>
<td>Institute of Zoo and Wildlife Research (IZW), in cooperation with Free University Berlin: several lectures concerning clinical aspects of zoo and wildlife medicine, infectious and non-infectious diseases, reproductive medicine</td>
<td>IZW <a href="http://www.izw-berlin.de">http://www.izw-berlin.de</a> September 2005: First Berlin Summer School Free University Berlin &lt;www.fu-berlin.de&gt;</td>
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<td></td>
<td>IZW in cooperation with Humboldt University Berlin: lectures on clinical aspects in wildlife medicine; parasitological colloquium on ecology of endoparasites in birds of prey</td>
<td>Humboldt University Berlin &lt;www.hu-berlin.de&gt;</td>
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<tr>
<td></td>
<td>IZW: workshop in wildlife medicine in cooperation with Eekholdt wildlife park in Schleswig-Holstein</td>
<td>Eekholdt wildlife park <a href="http://www.wildpark-eekholt.de/">http://www.wildpark-eekholt.de/</a></td>
</tr>
<tr>
<td></td>
<td>Institut für Wildtierforschung Hannover: Wildbiologisches Praktikum (yearly)</td>
<td>Institut für Wildtierforschung Hannover &lt;www.tho-hannover.de/einricht/wildtier/&gt;</td>
</tr>
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<td></td>
<td>Faculty of Veterinary Medicine, University of Leipzig, Clinic for Birds and Reptiles: residency program in avian medicine</td>
<td>University of Leipzig <a href="http://www.vmf.uni-leipzig.de/">http://www.vmf.uni-leipzig.de/</a></td>
</tr>
<tr>
<td>Greece</td>
<td>Department of Clinical Science, Faculty of Veterinary Medicine, University of Thessaloniki: fifth-year course on exotics</td>
<td>University of Thessaloniki <a href="http://www.auth.gr/vet/">http://www.auth.gr/vet/</a> Volunteer Wildlife Rescue and rehabilitation Team of Students Hellenic Wildlife Hospital &lt;www.ekpaz.gr/index-en.html&gt;</td>
</tr>
<tr>
<td>Italy</td>
<td>Veterinary Faculty, University of Milan: One-year master’s degree in eco-pathology and management of wildlife</td>
<td>University of Milan <a href="http://www.unimi.it/">http://www.unimi.it/</a></td>
</tr>
<tr>
<td>Luxembourg</td>
<td>None</td>
<td>Administration des Eaux et Forets <a href="http://www.environnement.public.lu/functions/contact/index.php">http://www.environnement.public.lu/functions/contact/index.php</a></td>
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a combined program in zoological and wildlife medicine that will include 40 hours of coursework, to be taught at both locations. Of major importance in this program are housing and welfare issues, since a vast majority of diseases in exotic pets are directly attributable to improper housing and diet.9 Furthermore, an additional 20 hours of courses, including training in exotic pet medicine, are to be taught within the small-animal specialization track available to undergraduates. The students following this track will also be able to enroll in rotations at the division of Zoo Animals, Exotic Pets and Wildlife of the University of Zurich during their final year. An elective five-day course in zoo-animal medicine will be given at the Zurich zoo.

In Utrecht, in the Netherlands, pet birds and exotic animals have been part of the curriculum, especially in the small-animal track, for many years. Since 1995, these animals have been covered on an elective basis, including two weeks of anatomy and physiology of small mammals, pet birds, and ectothermic animals in the second year of the curriculum. In the third year, additional courses are given in nutrition, housing, and management. In the fourth year, a two-week combined clinical and pathology course is available on small mammals, pet birds, reptiles, and fish diseases. This course includes instruction in clinical examination, diagnosis, treatment, and post-mortem examination. In addition, an elective course on wildlife medicine, which covers a total of six weeks over a three-year period, is offered. With the reform of the curriculum in 2001, most of these activities are now fully integrated into the small-animal curriculum track. As a consequence, the identity of the zoo and wildlife elements has been reduced. In the final stage of their studies (in the rotation within the small-animal track), all students visit the Clinic for Avian and Exotic Animals and Avian and Exotic Animal Pathology section for two weeks each. How these activities will be incorporated into the bachelor/master reconstruction of the veterinary curriculum is not yet clear. Currently, it is not known whether the present concept will be appropriate for the future, although in general it follows the recommendations proposed by Kirkwood3 and by Stoskopf et al.2

In Berlin, Germany, students of the veterinary faculty of the Free University Berlin and the Humboldt University Berlin

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<tbody>
<tr>
<td>Romania</td>
<td>Facultatea de Medicina Veterinara Bucharest, Institutul Agronomic Dr Petru Groza: one elective course on wildlife diseases Institutul Agronomic Ion Inoescu de la Brad: Lecture on wildlife diseases during the undergraduate course</td>
<td>Facultatea de Medicina Veterinara Bucharest <a href="http://www.fmvb.ro">http://www.fmvb.ro</a></td>
</tr>
<tr>
<td>Slovenia</td>
<td>Veterinary Faculty, University of Ljubljana, Gerbiceva: Fifth-year module on diseases, health care, and breeding of game Institute for Health Care and Breeding of Wild Animals, Fish, and Bees, University of Ljubljana: PhD training opportunities in wildlife diseases</td>
<td>University of Ljubljana <a href="http://www.vf.uni-lj.si/veterina/e-index.htm">http://www.vf.uni-lj.si/veterina/e-index.htm</a></td>
</tr>
<tr>
<td>Spain</td>
<td>Universidad de Castilla–La Mancha: PhD in wildlife medicine (4 years); “master” in wildlife medicine (comparable to MSc; one year)</td>
<td>Universidad de Castilla–La Mancha &lt;www.uclm.es&gt;</td>
</tr>
<tr>
<td>Sweden</td>
<td>Faculty of Veterinary Medicine, Swedish University of Agricultural Sciences, Uppsala: guest lectures on diseases in wildlife within the veterinary study program; students are welcome to visit pathology labs as guests of the Wildlife Department. Special courses for veterinarians to obtain a license for game meat inspection.</td>
<td>Faculty of Veterinary Medicine, Swedish University of Agricultural Sciences, Uppsala <a href="http://www.slu.se/index_eng.cfm">http://www.slu.se/index_eng.cfm</a></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Vetsuisse Faculty: several lectures and courses on exotic pets, zoological and wildlife medicine</td>
<td>University of Berne <a href="http://www.unibe.ch">http://www.unibe.ch</a> University of Zurich <a href="http://www.unizh.ch">http://www.unizh.ch</a></td>
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have the opportunity to visit lectures and elective courses on wild and exotic animal physiology, pathology, diseases, and reproductive medicine. All lectures and courses are given in cooperation with the IZW.

In cooperation with the Eekholt wildlife park in northern Germany, members of the IZW offer a wildlife medicine course to students and graduates every other year. These courses cover handling, immobilization, nutrition, diseases, and biology of free-living and captive wild animals. Since 2000, international ultrasound and reproductive medicine hands-on workshops (“wet labs”) have been performed by the IZW in such countries as the Netherlands, Austria, Italy, Canada, the United States, India, and Thailand. The University of Hannover, also in Germany, also offers lectures on diseases of exotic and wild animals.

At the University of Vienna, Austria, undergraduate instruction in zoological medicine, physiology, and pathology has been provided on an elective basis for the past six years, including three separate modules dealing with pathology, physiology, and clinical medicine. Since 2005, however, zoo, wildlife, pet bird, and reptilian medicine have been taught as a separate study track. The previously elective lectures have been upgraded and integrated into this new track, and an additional series of lectures (e.g., nutrition, genetics, wildlife management) has also been added. In 2005, of a total of 187 available faculty positions within the veterinary school, 10 were dedicated to zoological medicine. Reorganization of the University of Vienna Veterinary School has also led to the establishment of several new research departments, including the Research Institute of Wildlife Ecology in Vienna. The research institute is an integral part of the veterinary university and offers numerous courses for students dealing with wildlife and game management, international project management, zoonoses, physiology and adaptive mechanisms of wildlife, telemetry, and geographic information systems. Further clinical training in zoo and wildlife medicine is carried out in cooperation with several zoos in Austria and Hungary. For example, memoranda of understanding (MoUs) exist with the Vienna, Herberstein, and Wels zoos.

Of the six universities with veterinary schools in the United Kingdom and Ireland, Edinburgh, Bristol, and Dublin have formal courses in exotic pet medicine for all veterinary undergraduates. Edinburgh and Bristol also provide limited teaching in zoo animal medicine. London University teaches exotic pet medicine in a three-month elective course, and at Glasgow University students attend an exotic pet clinic once a week.

In Greece, the faculty of veterinary medicine of the University of Thessaloniki offers a fifth-year course on exotics in the Department of Clinical Sciences.

The Bologna Treaty was established in 1999 to respond to growing internationalization in higher education and to improve the quality of education in Europe. The creation of a European area of higher education is considered key to promoting the mobility and employability of EU citizens. At a meeting in 2005, Armenia, Azerbaijan, Georgia, Moldova, and Ukraine were welcomed as new participants in the Bologna Treaty, bringing the current total of countries involved to more than 40. Implementation of a European higher education area and a European research area is intended to take place before 2010. Presently, the process is focused on three priorities: (1) the degree system, (2) quality assurance, and (3) the recognition of degrees and periods of study. Substantial progress has been made in these three priority areas, but it remains important to ensure consistency across all participating countries. This will require greater sharing of expertise to build capacity at both institutional and government levels. The Bologna Treaty is a commitment freely undertaken by each signatory country to reform its own higher education system.

Since 1985, student exchanges within the EU and between the EU and a limited number of other countries defined by the EU council commission (e.g., Norway and Switzerland), have been significantly boosted by the ERASMUS program. Study periods undertaken at partner institutions are recognized by the European Credit Transfer System (ECTS). The program also includes post-graduate student exchanges and a teaching staff mobility program. The Bologna Treaty is a further step toward the recognition of study-abroad periods, mutual transparency of widely differing systems of education, teaching staff mobility, and joint curriculum development.

Post-graduate Courses (see Table 1)

In the Netherlands in 1956, what was probably the first European zoo-animal diagnostic section was established at the veterinary faculty in Utrecht, and it almost immediately began providing elective possibilities for interested veterinarians. Currently, at Utrecht University, three opportunities exist for post-graduate training in avian and exotic animal medicine. A three-year residency program is offered in avian and exotic animal medicine section of the small-animal department. This leads to the opportunity to take the certification examination for the European College of Avian Medicine and Surgery (ECAMS). A 10-week internship is also offered in a clinical program for pet avian and exotic animals, although there is no training in zoo-animal medicine. The department of pathobiology offers a six-week course in diagnostic pathology of avian and exotic animals, which also includes zoo animals and wildlife. In 2005, a new opportunity for post-graduate training emerged in the Netherlands with the founding of the Dutch Research Institute for Avian and Exotic Animals (NOIVBD), which will offer adaptable programs for students and veterinarians in the very near future.

A yearly training course for veterinarians on wildlife diseases and the feeding and handling of free-living and captive wild animals is currently offered in Germany by the Deutscher Tierschutzbund. The course was given for the first time in 2002 and changes location every year.

In Austria and Switzerland, the respective national veterinary associations have zoo and wildlife subsections that provide several post-graduate training workshops and lectures for established practitioners. These lectures are also available to students. Furthermore, the Austrian association of small-animal practitioners also provides post-graduate training through various seminar and lecture series.
Opportunities for PhD Training and Jobs (see Table 1)
In Spain, the Universidad de Castilla–La Mancha offers a PhD in wildlife medicine and a one-year master’s-degree course. In Germany, the IZW offers several doctoral degree opportunities related to zoo and wildlife medicine. In Italy, doctoral courses and jobs are available at the Società Italiana di Ecopatologia della Fauna (SIEF) and at the Società Italiana dei medici Veterinari degli Animali (SIVAS), in cooperation with EAZWV. The veterinary faculty of the University of Milan offers a one-year master’s-degree course in eco-pathology and management of wildlife. In Austria, the University of Veterinary Medicine Vienna offers multiple doctoral opportunities in zoological medicine, supported by various departments, including the Research Institute of Wildlife Ecology. In Switzerland, training opportunities and research projects leading to a doctoral degree are offered at the veterinary faculties in Bern (focusing on zoo-animal pathology, wildlife, and fish) and Zurich (focusing on exotic pets and zoo-animal medicine).

Additionally, numerous zoos and wildlife parks in Europe offer jobs for zoo and wildlife veterinarians. An updated list of internships in zoos and similar institutions is provided on the EAZWV homepage.

INTERNATIONAL ORGANIZATIONS, INSTITUTIONS, AND MEETINGS
Associations (see Table 1)
The European Wildlife Disease Association (EWDA) is the European arm of the worldwide Wildlife Disease Association (WDA). The EWDA has its own Web site (see Table 1) and is committed to raising the profile of wildlife disease surveillance, research, and education. The organization provides opportunities for veterinary and biology students with an interest in wildlife diseases to meet with established professionals and present their own work through attendance at scientific meetings and workshops. The EWDA has a student representative dedicated to promoting the interests of students within the organization.

The EAZWV, established in 1996, is a nonprofit association with international membership that aims to promote the advancement of veterinary knowledge and skill in the field of zoo- and wild-animal medicine. Membership is open to any person or organization interested or involved in veterinary aspects of captive and free-living wild animals and wishing to promote the aims and objectives of the association. In order to support veterinary education, the EAZWV organizes a scientific congress every second year, alternating with the IZW (see below). Through an educational committee, it strives to improve zoological medicine education in the represented countries and to provide undergraduate and post-graduate educational opportunities in the members’ respective institutions. Presently, the association has more than 600 members in 48 countries or territories. The EAZWV is a collective member of the World Association of Wildlife Veterinarians, the World Association of Zoos and Aquariums, and the International Union for the Conservation of Nature. The association closely collaborates with the European Association of Zoos and Aquaria on veterinary legislative issues and on improving standards of animal welfare in Central and Eastern European zoos. The student group within the EAZWV is involved in the active exchange of information on educational opportunities in zoological medicine.

Institutions and Meetings (see Table 1)
Many meetings related to veterinary medicine in non-domestic animals take place in Europe. Often these are organized by national organizations involved in pet avian, exotic animal, zoo animal, and wildlife medicine.

At a European level, the EWDA has been organizing a scientific conference every two years for the last decade. These conferences have provided a forum for veterinarians and wildlife biologists to present research findings and discuss their work. In recent years a student group has formed, and in April 2005 the first successful EWDA student workshop was held in Annecy, France.

The IZW has a long history of organizing conferences for zoo and wildlife veterinarians. These were originally held annually, at a different European zoo each year. Since the foundation of the EAZWV, the International Symposium on Diseases of Zoo and Wild Animals has been held biannually, alternating with the conferences of the EAZWV. The International Symposium on Physiology, Behaviour and Conservation of Wildlife is a biannual meeting also organized by the IZW and held in Berlin.

In the area of avian medicine, there is a biannual meeting of the European branch of the Association of Avian Veterinarians (EAAV), the location of which changes each time. The conference is held in conjunction with a one-day scientific program of the ECAMS.

There have also been recent initiatives to provide international summer schools in the field of non-domestic animal medicine. Examples include the Berlin Summer School (organized by the IZW) and the international summer school on exotic animal medicine at the University of Veterinary and Pharmaceutical Sciences in Brno, Czech Republic.

Another form of meeting, increasing in popularity, is the Web-based electronic conference (e-conference). The EWDA recently held an e-conference on wildlife-related emerging diseases in Europe; contributions are published on the EWDA Web site.1

CERTIFICATES IN ZOO AND WILDLIFE MEDICINE IN EU COUNTRIES
Several countries in Europe offer specialization titles and national certificates in zoological medicine. However, against a background of increasing globalization, long-term recognition of these titles is questionable. Currently, the only European specialization in non-domestic animals relates to avian species and is represented by the ECAMS. At present, five residency programs are approved by this college:

- Faculty of Veterinary Medicine, Utrecht University, the Netherlands
- Faculty of Veterinary Medicine, University of Zurich, Switzerland
changes are the Trade Control and Expert System (TRACES) and the BALAI directive.

As of April 2004, the TRACES system has been in place to control the trade of animals within and into the European Community. TRACES is Internet based and requires customs declaration of animal transports to be carried out before the animal leaves, thus minimizing customs controls. The system also applies to zoo animals and will, when fully implemented, reduce travel time.

The BALAI directive is Annex (C) to EU Council Directive 92/65/EEC, laying down animal-health requirements governing internal trade and imports into the European Community of animals, semen, ova, and embryos. The present recommendations aim at contributing to a uniform interpretation and facilitating the exchange of animals between approved zoos easily and without major health risks. The recommendations are meant to provide some practical guidance to both veterinary authorities and zoo veterinarians throughout the European Union, Liechtenstein, Norway, and Switzerland. They define the status of an approved veterinarian (and deputy) in a zoo, the provision of an annual disease surveillance plan (focused mainly on the Office International des Epizooties List A diseases), and quarantine and isolation requirements.

CONCLUSIONS
Zoo and wildlife medicine is recognized as a veterinary specialization in Europe. It is likely that, in the future, further opportunities for education in zoo and wildlife medicine will arise for both undergraduates and veterinary graduates. In addition, it is becoming increasingly apparent that the investigation and management of diseases in free-living wildlife populations require multidisciplinary approaches. In this context, one major challenge for the content of veterinary education courses in the future is to include some appreciation of the importance of ecological processes in the dynamics and management of diseases in free-ranging wildlife.

Because of the large number and diversity of nation states in Europe, significant differences exist with respect to veterinary education at both undergraduate and post-graduate levels. Future developments within the European Union, such as the Bologna Treaty and the implementation of the BALAI directive, are likely to help reduce these differences and are therefore expected to have a positive effect on the role of zoo and wildlife medicine in veterinary education.

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NOTE
a EWDA <www.ewda.org.uk>.

REFERENCES


5 Grether B. Personal communication.


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