

Harmonizing Veterinary Training and Qualifications in Laboratory Animal Medicine: A Global Perspective

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Introduction

Animal-based research and education are an increasingly international enterprise, as evidenced by the number and scope of international research collaborations and scientific meetings as well as the number of journals publishing articles from the international scientific community. A recent survey of pharmaceutical companies indicated that 45% of respondents planned to increase outsourcing spending in 2011 and another 29% planned to sustain their current levels (Contract Pharma 2010).

But the recent trend toward outsourcing or “offshoring” of animal research has evoked concern about appropriate animal welfare standards, personnel qualifications, and the quality of the data generated from animals used in countries with limited animal welfare oversight. Potentially compromised animal welfare is a significant concern in and of itself, but the use of such animals may also lead to inaccurate data, and ultimately jeopardize public and animal health. In addition, there is a widely held perception that companies or universities may conduct offshore research and testing merely

to avoid the stringent animal welfare requirements of their own countries.

Optimism is nonetheless evident as international partnerships provide greater access to resources and expertise. The potential for improving laboratory animal welfare in countries seeking to work with institutions in more developed countries is thus significant. In building these international interactions, there is a clear ethical imperative for the responsible and humane use of animals in research and education.

The Role of International Organizations

The World Organisation for Animal Health (OIE) affirmed in its Terrestrial Animal Health Code (OIE 2010, Chapter 7.8) that the oversight framework at institutions that use animals for research and education should include a veterinarian “with the necessary expertise to work with research animals, whose specific role is to provide advice on the care, use and welfare of such animals.” The veterinarian thus has a pivotal role in ensuring that a high-quality program of veterinary care is in place and that a high standard of animal welfare is sustained at the institution. To provide these assurances, the veterinarian must be knowledgeable about and competent in laboratory animal medicine.

The American College of Laboratory Animal Medicine (ACLAM) and the Association of American Veterinary Medical Colleges (AAVMC) have developed a suggested curriculum for laboratory animal medicine in North American veterinary schools (Turner et al. 2009); however, both organizations recognize that most veterinarians will obtain in-depth veterinary knowledge of laboratory animal medicine after graduation.

Around the world, there are widely disparate training opportunities for veterinarians who wish to work in the field of laboratory animal medicine. At one end of the spectrum is the specialty board certification offered by ACLAM and the European, Japanese, and Korean Colleges of Laboratory Animal Medicine (ECLAM, JCLAM, and KCLAM, respectively). These colleges collaborate on standards setting under an umbrella organization, the International Association of Colleges of Laboratory Animal Medicine (IACLAM). As indicated on its website (www.iaclam.org/lav.html), IACLAM defines laboratory animal veterinarians as “veterinary

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professionals who by virtue of interest, experience, and training have specialized in the care of laboratory animals. While basic veterinary education imparts some of these specialized skills and information necessary to care for laboratory animals, the diversity and complexity of the laboratory environment, and the species used within that environment, require additional experience and training.”

In many countries biomedical research is viewed as an economic driver, yet specialized training for veterinarians in laboratory animal medicine is not available. The OIE Terrestrial Animal Health Code sets a minimum standard for its 178 member countries and territories that “veterinarians working in an animal research environment have veterinary medical knowledge and experience in the species used, including the normal behaviour of the species, and they should understand research methodology.... Adequate veterinary care includes responsibility for promoting an animal’s health and welfare before, during and after research procedures and providing advice and guidance based on best practice. Veterinary care includes attention to the physical and behavioural status of the animal. The veterinarian should have authority and responsibility for making judgements concerning animal welfare. Veterinary advice and care should be available at all times” (http://web.oie.int/eng/normes/mcode/en_chapitre_1.7.8.htm).

The World Veterinary Association is developing minimum requirements for veterinary education (www.worldvet.org/docs/007_WVA_Policy_Global_Day_One_Compences_final.pdf). These criteria address the duration of the veterinary training program, the type of institution offering the training, subjects of instruction, educational facilities, staffing, clinical training, outcomes assessment, research, and continuing education. But these requirements are very general and do not prescribe the content of the curriculum for any of the veterinary specialties.

Variability in Guidance and Oversight

Zurlo and colleagues (2009) scanned global regulations to determine the extent to which they address veterinary qualifications and veterinary care programs for laboratory animals. They concluded that, in most cases, standards for veterinary care originate from professional organizations of laboratory animal medicine rather than from government requirements. Exceptions include the United States (the Animal Welfare Act), the United Kingdom (the Animals [Scientific Procedures] Act), provincial legislation in Canada (e.g., the Animals for Research Act of Ontario), and the 27 member states of the European Union (Directive 2010/63/EU).

- The authors noted that in the United States and Canada it is desirable, though not required, that the laboratory animal veterinarian achieve ACLAM certification.
- In the United Kingdom, the named veterinary surgeon in a research facility is required to have attended a training

course approved by the Royal College of Veterinary Surgeons during the individual’s first year in the position, and may also train in specialty courses planned according to guidelines of the Federation of European Laboratory Animal Science Associations (FELASA) or seek board certification by ECLAM.

- In Europe, the Directive requires that a designated veterinarian have “expertise in laboratory animal medicine.”
- Guidelines in India and Singapore state that the veterinarian should have training or experience in laboratory animal science or medicine, and Singapore also requires that the veterinarian be licensed by the country’s Agri-Food and Veterinary Authority.
- In Japan, there are no specific regulations for the qualifications of veterinarians to work with laboratory animals, but this gap is filled through the specialty board certification program offered by JCLAM.
- The *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* (NHMRC 2004) requires veterinarians to familiarize themselves with the biology and clinical characteristics of the species used.

The diversity of guidance offered around the world regarding the appropriate qualifications of the laboratory animal veterinarian, and thus the potential variability in the quality of the veterinary medical program at each institution, can result in tangible consequences for the animal and the research. These differences may have an impact on how animals are obtained, the provision of adequate veterinary care, the availability of appropriately qualified staff through institutional training programs directed by the veterinarian, provision of a suitable environment for animals (during transport and at the institution), assurance of an ethical review of proposed work and appropriate ongoing oversight of the animal program, and protection of the personnel involved in the animal program.

Evidence of this variability has been demonstrated by data made available from the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC International), a nonprofit accrediting body that evaluates and accredits animal care and use programs around the world. The veterinary care program elements that AAALAC International evaluates include animal procurement and transportation; quarantine, stabilization, and conditioning; surveillance, diagnosis, treatment, and control of disease; pain, analgesia, and anesthesia; surgery and postoperative care; and euthanasia. AAALAC recently reported that inadequacies in the program of veterinary care rank third highest in the Pacific Rim region at institutions applying for, or seeking to renew, their accreditation status (see Figure 1)—more than three times the occurrence in North America and Europe.

Shared concern about the need to harmonize veterinary qualifications in laboratory animal medicine prompted a collaborative effort by the OIE, IACLAM, and US National Research Council’s Institute for Laboratory Animal Research (ILAR) to address this issue, with the following goals:

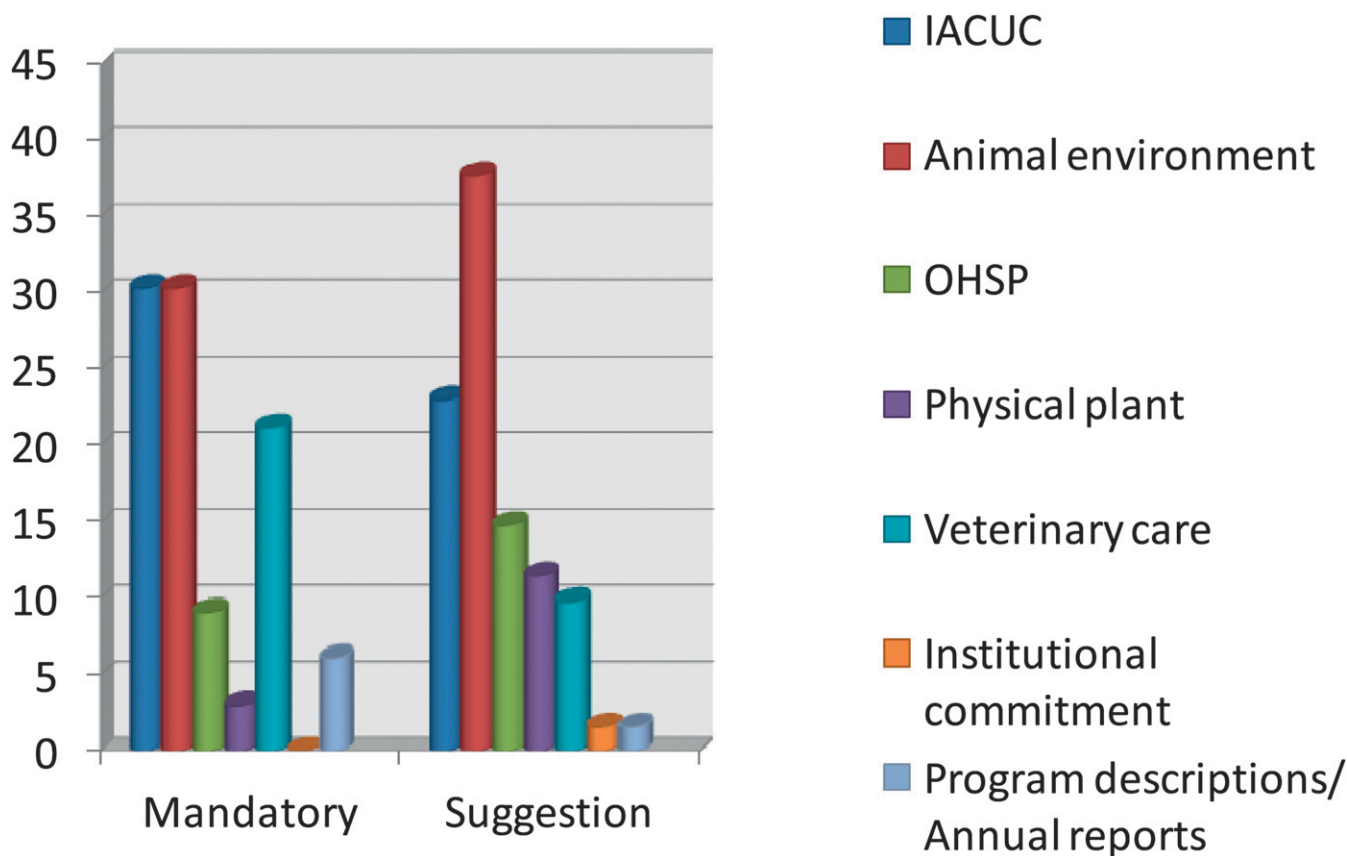


Figure 1 Percent of totals for mandatory deficiencies and suggestions for improvement for the period 2004–2009 in the Pacific Rim region. IACUC, institutional animal care and use committee; OHSP, occupational health and safety program. *Source:* AAALAC International.

- identify core knowledge and practical skills necessary for the laboratory animal veterinarian;
- articulate methods for delivering appropriate training to veterinarians who wish to practice laboratory animal medicine;
- determine the breadth and detail of information to be provided to trainees;
- identify potential methods for assessing competency after training;
- evaluate means of ensuring accessibility and translation of relevant information in laboratory animal medicine and science; and
- assess the value of and methods to provide continuing education.

Consultation with the Laboratory Animal Veterinary Medical Community

To assess the laboratory animal veterinary medical community's perspective on global harmonization of veterinary qualifications and training in laboratory animal medicine, focus group discussions were convened in association with three pivotal laboratory animal science meetings held in separate

geographic regions: the June 2010 FELASA meeting in Helsinki; the October 2010 meeting of the American Association for Laboratory Animal Science (AALAS) in Atlanta; and the November 2010 meeting of the Asian Federation of Laboratory Animal Science Associations in Taipei. A total of 106 individuals representing 27 countries participated in the three meetings. There was strong consensus among the participants that this topic was both timely and important.

Discussions were based on a model developed by Bolon and colleagues (2010), who proposed five key points for determining the knowledge and skills necessary to develop proficiency in toxicologic pathology. The adapted questions were as follows:

1. What roles do laboratory animal veterinarians serve?
2. What are the core knowledge and practical work-related skills required for proficiency in each laboratory animal medicine role?
3. What are acceptable educational approaches for imparting core knowledge in laboratory animal medicine?
4. What experiences are most suitable for instilling practical work-related skills in laboratory animal medicine?
5. How much training is required to attain proficiency in laboratory animal medicine?

Additional points about the role of the laboratory animal veterinarian were shared to stimulate the dialogue (Niemi 2011). Finally, the focus groups discussed what the laboratory animal veterinary community could do to assist countries with few or no trained laboratory animal veterinarians.

The Role of the Laboratory Animal Veterinarian: International Definitions

Several key documents regarding adequate veterinary care were provided to discussion group participants: the ACLAM position paper on adequate veterinary care (ACLAM 1996); the report of the joint working group of FELASA/ECLAM and the European Society of Laboratory Animal Veterinarians (ESLAV) on veterinary care for laboratory animals (Voipio et al. 2008); and recommendations published by the Canadian Council on Animal Care (CCAC): Appendix VI, Continuing Education (CE) for Consulting and Newly Hired Institutional Veterinarians Working in Science, and an excerpt from Section 7.2, Qualifications and Continuing Education for Veterinarians and Staff (CCAC 2008).

The ACLAM position paper notes that the complexity of the veterinary care program may vary depending on the number and species of animals used and types of research conducted at the institution. As the complexity increases, so too may the requisite number and training level of veterinarians necessary to deliver adequate veterinary care. ACLAM outlines the following primary responsibilities for the veterinarian:

- disease detection and surveillance, prevention, diagnosis, treatment, and resolution;
- guidance and monitoring in (1) handling and restraint of animals; (2) anesthetics, analgesics, and tranquilizers; and (3) methods of euthanasia;
- review and approval of all preoperative, surgical, and postoperative procedures;
- promotion and monitoring of animal well-being before, during, and after experimentation or testing; and
- involvement in the review and approval of all animal care and use at the institution.

Ancillary roles identified by ACLAM include providing training to staff in the care and use of laboratory animals, providing input to the occupational health and safety program, monitoring for zoonotic diseases, advising on standards of hygiene in the animal facility, and advising on and monitoring biohazard control policies and procedures.

The FELASA/ECLAM/ESLAV guidelines for the veterinary care of laboratory animals recognize the importance of postgraduate education for veterinarians who specialize in laboratory animal medicine based on the many competencies necessary to fulfill the veterinarian's multiple roles in this field. The guidelines acknowledge that there may be acceptable gradations of expertise in laboratory animal medicine, ranging from the availability of a skilled mentor for

veterinarians working in small institutions to specialty board certification from ECLAM. Regardless of the specific circumstances of employment, the guidelines identify the following key areas of responsibility: assessment of animal welfare, including behavioral evaluation; early recognition of signs of pain and distress, and their alleviation; prevention, diagnosis, and treatment of disease; verification that animals procured for research are derived from a licensed source or approved breeder; implementation of an appropriate health monitoring program; appropriate record keeping; involvement in the training and assessment of competence of those who conduct procedures that may affect animal welfare; review of anesthetic procedures; consultation with the researcher about proposed surgical procedures and adequate perioperative care; advice, training, and oversight of euthanasia procedures; and participation in the review of proposed research and implementation of the Three Rs—reduction, refinement, and replacement (Russell and Burch 1959).

More recently, the OIE Terrestrial Animal Health Code has been revised to describe the various responsibilities of the veterinarian. In addition to provision of an adequate program of veterinary care in a research environment, these responsibilities involve clinical duties, including preventive medicine, disease surveillance, diagnosis and management of disease, and management of controlled drugs; postmortem examinations; maintenance of veterinary medical records; and advice on zoonotic risks and notifiable diseases, surgery and postoperative care, analgesia, anesthesia, euthanasia, and humane endpoints.

There was consensus among the discussion participants that, over and above the roles and responsibilities described in these documents, the veterinarian served as a trainer in laboratory animal medicine and science for the institution and was key to ensuring sound management of the animal facility. They also noted that the veterinarian's input in protocol review was essential.

Core Competencies and Skills

The participants of the three focus groups generally agreed that the laboratory animal veterinarian should, at a minimum, have a sound understanding of the anatomy, physiology, pathology, and behavior of animals used in research and teaching; be able to make, understand, and respond appropriately to clinical observations and collect samples to aid in the diagnosis of problems observed; be able to recognize and mitigate animal pain and distress; be skilled in the diagnostic method and able to interpret diagnostic information, including evaluation of the available health history of the animal; be able to safely and humanely restrain animals; be able to administer anesthesia and analgesia, understanding the most safe and efficacious agents to use for various laboratory animal species; understand and implement aseptic technique for procedures, including surgery; and have basic surgical skills for common laboratory animals. The participating veterinary professionals also held the opinion that the laboratory

animal veterinarian should be knowledgeable in moral and ethical issues surrounding the use of animals in research, testing, and education; in the tenets of the Three Rs; and in the regulatory framework for animal use of the country in which they are working.

A few participants, including research scientists who rely on the support of laboratory animal veterinarians, stated that the veterinarian should be research “literate”—familiar with basic research methodology, with an appreciation of the scientific method and perhaps some experience in the basics of research (e.g., as a lead scientist or a collaborator). Other suggestions about desirable and useful skills and knowledge concerned occupational health and safety (e.g., allergies to animals and other potential hazards associated with working with animals); biosecurity practices to minimize the spread of disease in the research animal colonies; the biology of and medical care for nontraditional species; available types of caging and support equipment; the potential impact of various facility environmental factors on both animal well-being and experimental data; basic management/supervisory techniques; and interpersonal skills, to enable the veterinarian to work effectively with the diversity of individuals at an institution, from animal care staff to investigators to senior administrative officials.

Communication and networking among laboratory animal veterinarians on a global basis are essential. With the rise in international research collaborations and international transportation of research animals (e.g., genetically modified mice), the standard of veterinary care—and thus the health and welfare of research animals—is especially critical to the quality of the work and to ensuring an ethical approach to animal use. Global communication among veterinarians contributes to harmonization of skills, knowledge, and understanding in laboratory animal medicine and welfare.

Some online communication resources are available to support international communication. The listserv discussion group CompMed, hosted by AALAS, provides a venue for questions about laboratory animal medicine and science. At the time of this writing, there were approximately 3200 subscribers to CompMed from about 40 countries. IACLAM, too, serves an important role in facilitating communication among veterinarians from around the globe; according to its website (www.iaclam.org), IACLAM “provides a common platform at the global level for communication by, and representation of, these Colleges and their Diplomates.” A focal objective of IACLAM is the promotion and support of initiatives to train veterinarians in laboratory animal medicine in emerging new science provider countries (MacArthur Clark 2008). These and other modalities of dialogue among laboratory animal veterinarians should be exploited to further goals of harmonization of core competencies and skills.

Approaches to Delivering Training

It is imperative that veterinarians working with animals used in research, testing, or teaching receive adequate initial training

to meet the demands of their workplace and to engage in CE to stay current in their field of practice.

Formal and informal approaches for training veterinarians in laboratory animal medicine have been established based on veterinary care standards set forth by ACLAM and the Canadian Association for Laboratory Animal Medicine (CALAM; www.calam-acmal.org) (for a review, see Colby et al. 2007). For specialist training in laboratory animal medicine, ACLAM-recognized residency or graduate programs in laboratory animal medicine must provide a minimum of 200 hours of didactic training and 2000 hours of applied training in addition to some research training, culminating in a first-author hypothesis-driven scientific manuscript in biomedical research. The program must also cover all items set forth in ACLAM’s Role Delineation Document, which provides in-depth descriptions of the various roles of the laboratory animal veterinarian.

A similar approach is used in formal training programs in Europe that are recognized by ECLAM, using the FELASA Category D Standards and the ECLAM curriculum to determine program content (Nevalainen et al. 1999). Typical formal graduate and residency training programs in North America and Europe are 2 to 3 years long, but some programs that combine doctoral training may take up to 5 or 6 years.

Because some veterinarians may be unable or unwilling to return to full-time postgraduate studies (with the associated loss of income), alternative training strategies have recently been developed (Colby et al. 2007; Turner 2011). These strategies include combining a master’s program in laboratory animal science with a veterinary degree program (e.g., www.tufts.edu/vet/lam) or, in some countries, a postgraduate certificate program in laboratory animal medicine. The latter is an approved academic program of study and involves 160 hours online study and applied training in laboratory animal medicine at regional training sites. The program is meant to provide short and intensive entry-level training for licensed veterinarians in laboratory animal medicine. Regional training sites are assessed and accredited by the CCAC or AAALAC International.

A distance certificate program in laboratory animal medicine was launched in Canada in 2004, in the United States in 2008, and a Latin American program will be launched in Mexico next. In Canada, the program has been recognized by the CCAC and CALAM; the online course is mandatory for new Canadian veterinarians entering the field without formal training in laboratory animal medicine (CCAC 2008, Appendix VI).

In developing countries, opportunities for formal and informal training in laboratory animal medicine are more difficult to identify and are associated with local scientific activities or initiatives of the national laboratory animal science organization, if such an organization exists. But with the development of new electronic technologies, Internet access to online training programs may expand training opportunities in these countries. In addition, formal international mentoring programs in laboratory animal medicine have

recently been developed. ACLAM provides both informational resources and opportunities for veterinarians from around the world to be paired with North American laboratory animal veterinarians for formal career mentoring (www.aclam.org/career-outreach/mentoring), and CALAM maintains a similar mentoring program for Canadian veterinarians.

The Ladder Approach to Skill and Knowledge Development

A review of legal frameworks around the world for the use of animals in research, testing, and education reveals the tremendous variability in the degree to which the veterinarian is recognized as having a necessary role in such use. As Zurlo and colleagues (2009) noted, there is specific mention of required veterinary qualifications in the US Animal Welfare Act, UK Animal (Scientific Procedures) Act, and CCAC policy statement for Senior Administrators Responsible for Animal Care and Use Programs, Appendix VI regarding Continuing Education (CE) for Consulting and Newly Hired Institutional Veterinarians Working in Science. Other countries, however, are silent on the veterinarian's participation in the animal care and use program and/or recommended qualifications and experience.

Given this lack of consistency, the authors determined that a "ladder" approach to defining and implementing appropriate training and experience was a practical and logical method for ensuring the provision of adequate veterinary care and oversight in an animal use program. The premise of the ladder approach is that veterinarians providing clinical services and/or compliance oversight in any type of institution (e.g., academic, government, private sector) hold a license or comparable certificate of qualification to practice general veterinary medicine in the country or region in which they are employed and then go on to enhance this fundamental education through various levels of training/support.

Discussions among the focus groups buttressed the ladder strategy and led to the identification of four levels of support to ensure suitable veterinary qualification and experience: (1) a mentor (either on- or off-site); (2) on-the-job experience supplemented with relevant continuing education; (3) a certificate, residency, diploma, or degree program in laboratory animal medicine; and (4) specialty board certification. Intrinsic to selecting the training path best suited to the context of animal use is an understanding of the scope and scale of the program to be supported. Considerations should include the range of species in use at an institution; the types of research, production, testing, or educational programs that use animals; the program infrastructure (e.g., facility and equipment age, type, and condition; budget for equipment); regulatory requirements for oversight of the animals, research program, and facility; and availability of other specialists at the institution (e.g., occupational health professionals, radiation and biosafety officers, risk management personnel) who can contribute professional expertise.

The ladder approach to training is based on the size of the program the veterinarian supports and whether it requires a consulting veterinarian or a full-time, institutional position (Table 1).

Consulting Veterinarians

Consulting veterinarians are often private practitioners in large, small, or mixed animal medicine. Large animal practitioners work mostly with agricultural species, small animal practitioners with pet species (e.g., birds, reptiles, rabbits, ferrets, and other small mammal pets), and mixed animal practitioners with all common domestic animal species. These veterinarians typically dedicate a relatively small portion of their professional time to working with scientific institutions and their institutional animal care and use committee (or comparable oversight body).

Some consulting veterinarians are experienced laboratory animal medicine veterinarians who divide their time between several different institutions; they therefore do not need introductory training and education in their field but would benefit from more advanced continuing professional development (CPD) on topics most relevant to them. Frequently, though, consulting veterinarians work in small programs with a limited variety of species and a narrow focus of research type. Their initial education and training plan may include an online course in elements of laboratory animal medicine within their first year of employment, a formal short course in elements of laboratory animal science in the second year (e.g., the Charles River Short Course; www.criver.com), attendance at a conference or workshop specific to laboratory animal science of medicine at least once every 3 years, membership in a national or international professional laboratory animal medicine

Table 1 Correlation between laboratory animal program size and type of veterinarian needed

Program size	Type of veterinarian needed
Small program	Consulting (attending) veterinarian
Medium program	Multispecies consulting veterinarian <i>or</i> Newly hired institutional veterinarian(s) <i>or</i> Experienced institutional veterinarian(s)
Large program	Species-specific consulting veterinarians <i>or</i> Newly hired institutional veterinarians <i>or</i> Experienced institutional veterinarians

association, and a subscription to at least one journal in laboratory animal science.

For a consulting veterinarian in a medium-sized program, the initial education and training program could include those elements plus a practicum, such as participation in applied regional training courses in laboratory animal medicine or relevant wet labs in conjunction with laboratory animal science conferences at least once every 5 years.

Institutional Veterinarians

Institutional veterinarians are employed full-time by an institution and typically work with a range of common species of laboratory animals. For the newly hired institutional veterinarian in a medium or large program, the following initial education and training program is suggested: participation in a formal educational or certificate program in laboratory animal medicine within the first year of employment, participation in at least one relevant workshop or conference within the first 3 years, participation in a laboratory animal science short course or practicum within the first 4 years, membership in a national or international professional laboratory animal medicine association, and subscriptions to relevant journals.

Highly experienced or formally trained institutional veterinarians will not need to participate in introductory educational training programs but should be provided with opportunities for CPD at regular intervals to maintain their professional competence. They can achieve this through participation in relevant wet labs or annual conferences, membership in national or international professional laboratory animal medicine associations, and subscriptions to relevant journals.

Assessing Competency

Assessment of competency is considered a critical element of any form of veterinary education (Rhind et al. 2008) but it requires careful consideration of information sources and decision-making methods.

Assessments can be either formative (e.g., gauging competency at new skills acquisition or the ability to critically assess animal use protocols) or summative (e.g., gauging in-depth knowledge of regional or national regulatory guidelines through a final test or examination). Formal academic programs and well-designed training courses enable such assessments through the establishment of clear objectives and their translation into a carefully designed curriculum. Such programs typically include ongoing assessments to ensure adequate acquisition of skills and knowledge. Inadequacies, when identified, should result in remedial action to ensure competency is achieved.

For less formal types of CPD, a plan for expected outcomes is useful for ensuring the relevance of a particular training or educational opportunity. Increasingly, veterinary

licensing bodies in North America are expecting this type of foresight, planning, and reflection for CPD activities listed by veterinarians to meet jurisdictional requirements for annual licensure (e.g., www.cvo.org/uploadattachments/DefiningCPDCycle.pdf). For example, veterinarians may attend laboratory animal science conferences to learn the latest information about the prevention, diagnosis, and treatment of infectious diseases pertinent to the species and type of research at their institution, through oral and poster presentations as well as through networking with veterinary colleagues. The expected outcome would be a verifiable reduction in pathogens in the research animal colony evidenced by sentinel reports and necropsy results. Competency would be judged based on the success of disease eradication.

A veterinarian seeking to invest significant capital in a new facility cage washer might, for example, attend a laboratory animal science conference to gain knowledge—from formal presentations as well as vendor-provided literature—of new cage washer technology and to talk with vendors and professionals in the field about machine capacities, requirements, and issues related to various technologies. The expected outcome to justify conference participation may be the submission of a formal written purchasing plan that provides a sound rationale and cost accounting for the selection of a particular machine. Assessment of competency would be made by the employer based on the quality of the documentation and soundness of the plan.

Among the least formal sources of CPD is the Internet, where an overwhelming amount of information related to issues in laboratory animal science is freely available. Without clear objectives or an assessment plan, it can be difficult for a veterinarian without formal training in the subject to know which information is relevant and valuable. Even for experienced veterinarians, access to a mentor on a regular basis can assist with the identification of educational and training goals to enhance career development.

Ultimately, assessment of institutional veterinary competence will occur during periodic in-depth evaluations and reviews of the entire animal care and use program by external agencies such as AAALAC International, the CCAC, or the UK Home Office. In addition, interim assessments of veterinary competency should be conducted by animal ethics committees during regular reviews of their animal care and use program. Deficiencies, if identified, should result in the establishment of a professional mentoring and development plan to assist the veterinarian to achieve competency in the desired area(s).

Accessibility and Translation

Harmonization of laboratory animal veterinary qualifications depends in large part on the availability and accessibility of information (e.g., online or print versions of journal articles; books; sample animal care and use program documents, such as protocol review forms; videos or CDs; webinars; and conferences). But information that is available is

not always accessible—for example, it may not be available in the language of choice. Variability in access to relevant information and instructional tools impedes progress in elevating the knowledge and skills of laboratory animal veterinarians in developing countries and undermines progress in harmonizing standards of competency.

Limited fiscal resources at many institutions around the world have resulted in fewer journal subscriptions and text purchases and have fostered an increasing reliance on free or low-cost electronic sources. Needless to say, the validity of online information is uneven. It is very important to consider the source of the information. Several prestigious journals make articles freely available online several months after publication (e.g., the *ILAR Journal*, www.ilarjournal.com, and AALAS's *Journal of the American Association for Laboratory Animal Science* and *Comparative Medicine*, www.aalas.org/publications).

Some electronic tools, such as search engines like PubMed (www.ncbi.nlm.nih.gov/pubmed), direct inquirers to credible sources of information. However, PubMed does not include regulatory documents for various countries; international standards, guidelines, and codes of practice for laboratory animal science and medicine; laboratory animal welfare; or alternatives to animal experimentation. And, unfortunately, some journals on laboratory animal medicine and science, on alternatives, and on the Three Rs are not listed in PubMed.

One helpful source of information about animal laws is the Georgetown Law Library (www.ll.georgetown.edu/guides/InternationalAnimalLaw.cfm); but, although the website lists numerous links to country-specific regulations, these are typically general and do not specifically relate to animals used in research. AAALAC International provides links to more specific references on its website (www.aaalac.org/accreditation/resources.cfm), but the resources on both the AAALAC and Georgetown University websites are limited to English or English translations. Indeed, much of the relevant information, whether print or electronic, is written in English and thus the ability to read and fully understand the material may be limited by the reader's language skills. Translation programs available through the Internet may not be accurate for scientific or other technical terminology and may thus lead to the inadvertent dissemination of misinformation or contribute to misunderstanding.

For these reasons, an accurate and official translation of core laboratory animal medicine and science resources is critical to advancing knowledge and understanding worldwide. The 7th edition of the *Guide for the Care and Use of Laboratory Animals* (Guide; NRC 1996) illustrates the potential impact of translation of a core document. In addition to English, the *Guide* was made available in 11 other languages. Although critical assessment of the accuracy of each translation was variable, the resulting worldwide accessibility of this book contributed significantly to a philosophy of laboratory animal care and welfare. The 8th edition of the *Guide* was published in 2010, and numerous laboratory animal medicine and science organizations have assisted or indicated their intent to assist in translation efforts. For

example, the Japanese Association of Laboratory Animal Science (JALAS) arranged translation of the *Guide* into Japanese with the assistance of five translators who are knowledgeable in the field, including three diplomates of JCLAM; the translation was published in May 2011. This type of team effort by experts in the field elevates the quality of the translation, ensuring a higher degree of accuracy, and should be considered for other translations.

Technological limitations further hamper access to resources available on the Internet. File size (for example, video clips for certain types of training, such as behavior, surgical techniques, and common procedures such as blood sampling or injections are typically large files that may take too long to download, overwhelm a server, or require the purchase of additional software) and blocked sites can limit accessibility for individuals, depending on their location, equipment, and technical or financial resources. Thus, although the Internet is a powerful informational tool to mine, its limitations should be understood and addressed.

An important contributing factor to the harmonization of the skills and knowledge of laboratory animal veterinarians is the availability and accessibility of core reference documents. It would be useful to develop consensus about the resources that should be considered core references. A strategy should be developed to seek input from qualified veterinarians around the world to identify this key literature, followed by efforts to ensure the accessibility (e.g., through translation) and availability of this information. For example, a database of references, including legal and scientific documents, written in English and in other languages could be established and maintained by the OIE.

The need for enhancing access to this literature base to occur in a timely manner cannot be sufficiently underscored.

Recommendations

The Team Approach

To work effectively in a research institute, it is essential for the laboratory animal veterinarian to be part of one or several teams. The interpersonal skills that enable individuals to work well on teams may therefore be of great importance. The specific skills required of the veterinarian to be an effective team member will depend on the role of the team, and several teams may have overlapping roles in some institutions. The team roles of a minimally competent laboratory animal veterinarian are described below. Specialists in laboratory animal medicine perform at different levels in the various team environments and may independently direct many operations and activities, including research programs.

Animal Care Team

The veterinarian will work alongside paraprofessionals who may include those involved with animal care and husbandry, experimental support, surgical and nursing support, and

animal behavior observation. There may also be individuals who are more familiar with some of the unusual species encountered, whose expertise may be very valuable and to whom the veterinarian may defer. The role of the veterinarian may be primarily clinical, with others responsible for gathering diagnostic evidence and delivering treatment. The veterinarian may also be involved in the ongoing training of the animal care team. Excellent communication among team members is thus essential.

Research Team

The veterinarian may be a member of one or more research teams. The role in this case may be to provide advice on clinical matters such as anesthesia, analgesia, and perioperative care or in the conduct of specific animal procedures. However, often the role extends to advice on relevant models for the research, including genetics and health status, and experimental design and planning, including the determination of adequate numbers of animals. In this event, it is important for the veterinarian to become sufficiently familiar with the science to contribute effectively to project discussions. Negotiating skills may also be important to ensure that the enthusiasm of the research team is contained within legal and ethical boundaries.

Management Team

Depending on the job description, the veterinarian may have management responsibilities that will require both leadership of a team of staff and representation of that team at more senior levels. In addition to good managerial and leadership skills, the ability to conceptualize a vision for the team's role within the institute, and to develop and implement strategy, will be important.

Ethical Review Team

It is likely that the veterinarian will be a key player on the institutional animal care and use committee or comparable oversight body. In addition to clinical knowledge, valuable skills for this team will be the ability to advocate for moral and ethical issues, clarity of communication both in delivering views and listening attentively to others, and effective negotiation and conflict resolution. Veterinarians can also represent the institution, reassuring the public about the quality of the regulatory processes.

The laboratory animal veterinarian needs to purposefully develop these team skills, in addition to clinical and technical skills, as core proficiencies during training and development. This can be achieved partly through "on the job" training, although attendance at relevant courses and workshops is also very helpful. The importance of building effective networks of contacts cannot be overemphasized, and

seeking mentors or coaches who will support personal development and self-awareness should be a priority.

Finally, to be an effective team member, it is very important that the veterinarian have the necessary authority to make and implement appropriate decisions. The leadership of the institution needs to ensure that the veterinarian's position in the organizational structure makes such authority possible.

Conflict of Interest

The standing of laboratory animal veterinarians in their institutions is vital to the efficacy with which they are able to discharge their duties and responsibilities. A well-trained and highly competent laboratory animal veterinarian is a valuable resource for the research community at the institution and is typically well placed to ensure the right balance between animal welfare and quality science. The credibility of veterinarians in their institutions directly affects their ability to implement agreed-upon humane endpoints and to assist in identifying and using animal alternatives and refinements.

As noted in the *FELASA Guidelines for the Veterinary Care of Laboratory Animals* (Voipio et al. 2008, 7), "In some countries, the ultimate responsibility for decisions concerning experimental procedures on, and euthanasia of, animals rests with the veterinarian, but in others it remains with the researcher. This may lead to conflicts...." An example of this potential conflict is evident in two US regulations that apply to animal testing. The Food and Drug Administration's Good Laboratory Practice standards (21 CFR Part 58) state that the "study director has overall responsibility for the technical conduct of the study...and represents the single point of study control." Conversely, the U.S. Department of Agriculture Animal Welfare Regulations (9 CFR part 2) state that the attending veterinarian "has authority for activities involving animals"; that the "research facility shall assure that the attending veterinarian has appropriate authority to ensure provision of veterinary care"; and that the institution "shall establish programs of adequate veterinary care." The differences in the two official documents can lead to disparate perspectives on the status of an animal on study and contrasting decisions about necessary action to ensure the animal's well-being.

Conflicts can be especially challenging when the study director is also a veterinarian or has a position of high authority in the institution. Such conflicts are best addressed when the veterinarian has credibility and good standing in the institution and has negotiated, before the start of the study, a framework for the decisions and actions to be taken to address animal health and welfare. This approach requires veterinarians to be both knowledgeable and diplomatic, and to have confidence in their status and authority in their institutions.

Potential conflict can also arise in small institutions where individuals fulfill multiple roles. For example, the

veterinarian may also be the institutional official, or the IACUC chair, or the principal investigator, or some combination of these. It is important to avoid conflict of interest, whether perceived or real, by ensuring that independent professional veterinary advice is available as appropriate.

Finally, situations arise where economic pressures apply, for example, in relation to the success of an academic institution in obtaining grants or a contract research organization in gaining contracts. The veterinarian is often caught in the middle of efforts to weigh economic pressures against ethical considerations. The role of the laboratory animal veterinarian is best served when the individual is well qualified in the core competencies described above and has established an agreement with senior management for strategies to address potential conflicts.

Standards Development

An international intergovernmental approach to the drafting of, consultation on, and democratic adoption of international standards on animal welfare is relatively recent. The OIE assumed this role in 2001, as an important initiative in its third strategic plan for the period 2001–2005. An emphasis on animal welfare continued in the fourth (2006–2010) and fifth (2011–2015) strategic plans and animal welfare standard setting is now very much “core” OIE business.

The chapter on the Use of Animals in Research and Education, adopted by the World Assembly of Delegates at the May 2010 OIE General Session and now included in the Terrestrial Animal Health Code, is the first OIE standard relating to the welfare of animals used in research and education, as distinct from animals used for food production purposes. This draft emphasizes the critical role of appropriately trained veterinarians in both optimizing the welfare of the animals involved and contributing to quality scientific outcomes.

Continuing Professional Development

Continuing professional development can be defined as involvement in a range of activities to maintain and enhance performance in a given area of professional practice. Commitment to lifelong learning, reflective practice, and quality assurance activities are central to maintaining competence, enhancing performance, and ensuring that the public can expect high professional standards. The principles of CPD are applicable to all veterinarians but are particularly relevant to practitioners of laboratory animal medicine because of rapid advances and changes in research methodology, the extent of the relevant published literature, and the professional imperative to mitigate potential risks to animal welfare. The latter includes research in which the risk is ethically justified by potential benefits to science and animal health and welfare.

The days of James Herriot and the “omnicompetent” veterinarian are over and commitment to lifelong CPD is an essential professional obligation, particularly in specialist areas such as laboratory animal medicine.

Looking Forward

World Veterinary Year

World Veterinary Year 2011 affords an opportunity not only to reflect on the history of the veterinary profession over the last 250 years but also to consider current and future challenges, to ensure that societal expectations are met in the years and decades ahead. The importance of veterinary education adequately catering for specialist areas such as epidemiology, veterinary public health, and laboratory animal medicine was recognized at the first OIE Global Conference on Veterinary Education and the AVMA/AAVMC Joint International Education Symposium on Animal Welfare, both held in 2009 (see <http://jymonline.metapress.com/content/122153?sortorder=asc&Article+Category=Animal+Welfare+in+Education+and+Research>).

The use of animals in research and education will undoubtedly remain a sensitive and high-profile area, to which the veterinary profession makes a vital contribution in terms of both scientific input and animal health and welfare. It is most timely, therefore, that substantive discussion is addressing initiatives to harmonize global veterinary qualifications in laboratory animal medicine.

OIE

Potential OIE involvement in the area of laboratory animal welfare was first identified at the 2004 OIE Global Conference on Animal Welfare, followed by detailed discussion with international organizations such as ICLAS and IACLAM to identify a unique, added-value role for the OIE, as a large established intergovernmental organization with a policy commitment to science-based international standards. The discussions led to the establishment of the Chapter on the Use of Animals in Research and Education in the Terrestrial Animal Health Code.

The OIE has key strategic interests in the use of animals in research to advance and improve animal health and welfare and veterinary public health and, where applicable, to support disease diagnosis and regulatory testing. The OIE guiding principles for animal welfare include a commitment to the Three Rs.

The OIE has assumed a role in international leadership, coordination, and strategic planning in veterinary education, with international conferences in Paris in 2009 and Lyon in 2011. An ad hoc group has also been established to address future veterinary education needs. Consideration of training requirements in laboratory animal medicine and global harmonization of relevant veterinary qualifications is thus very timely and fully compatible with the OIE global mandate “to improve animal health, veterinary public health, and animal welfare worldwide.”

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