Tierärztliche Hochschule Hannover

Entwicklung eines europäischen Lernzielkataloges für Veterinärneurologie

INAUGURAL – DISSERTATION
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Meinen Eltern gewidmet

Auszüge aus der vorliegenden Arbeit wurden bereits als Kongressbeitrag veröffentlicht:

21. Jahrestagung der Fachgruppe „Innere Medizin und Klinische Labordiagnostik“ der DVG (München 2013):
Erstellung von Lernzielen in der Veterinärneurologie - Tiermedizinisches Grundstudium

25th Annual Symposium of the European Society and European College of Veterinary Neurology (Ghent 2012):
Results of a Survey Detailing the Required Job Competencies of Diplomates and the Learning Objectives for the European College of Veterinary Neurology

Inhaltsverzeichnis

1 Einleitung und Literaturübersicht

Lernziele und Blooms Taxonomie

Die Formulierung von Lernzielen spielt für Lernende, Lehrende sowie für die Curriculumsentwicklung eine wesentliche Rolle. Lernziele vermitteln eine definierte Leitlinie für Lernende, bieten Prüfungsinhalte und Möglichkeiten zur Lehrevaluation für Lehrende an (BOEKER et al. 2010). 1956 publizierte Bloom "*The Taxonomy of Educational Objectives: The Classification of Educational Goals"* (BLOOM 1984). Seitdem ist Blooms Taxonomie eine der meist zitierten Literaturquellen und eine der meist verwendeten pädagogischen Methoden geworden. Sein Werk wurde in 22 Sprachen übersetzt (KRATHWOHL 2002).

Blooms Taxonomie ist eine Klassifikation verschiedener Lernziele in drei Domänen (BLOOM 1984; CHURCHES 2009):

- Kognitive Lernziele beziehen sich auf Informationen, Wissen, intellektuelle Fertigkeiten und kritisches Denken. Sechs verschiedene Niveaus werden beschrieben.
- Psychomotorische Lernziele beziehen sich auf manuelle oder körperliche Tätigkeiten. Fünf Niveaus bestehen.
- Affektive Lernziele beziehen sich auf Einstellung, Emotion und Gefühl und werden in sechs Niveaus eingeteilt.

Im Jahre 2001 publizierten Lorin Anderson und David Krathwohl eine überarbeitete "Bloom Taxonomie" – *A Taxonomy for Learning, Teaching and Assessing: a Revision of Bloom's Taxonomy of Educational Objectives* (ANDERSON und KRATHWOHL 2001). Die Bloom Taxonomie und die überarbeitete Taxonomie von Lorin konzentrierten sich auf die kognitive Domäne. Bloom beschrieb hierin die sechs folgenden hierarchischen Niveaus (BLOOM 1984; SITTE 2001):

- Knowledge (Kenntnisse)
- Comprehension (Verstehen)

- Application (Anwendung)
- Analysis (Analyse)
- Synthesis (Synthese)
- Evaluation (Bewertung)

Die überarbeitete Bloom Taxonomie von Lorin Anderson (2001) verwendete Verben statt Nomina und stellte „Creating“ auf ein höheres Niveau (ANDERSON und KRATHWOHL 2001; ARBEITSSTELLE FÜR HOCHSCHULDIDAKTIK UNIVERSITÄT ZÜRICH 2010):

- Remembering (Erinnern)
- Understanding (Verstehen)
- Applying (Anwenden)
- Analyzing (Analysieren)
- Evaluating (Beurteilen)
- Creating (Schaffen)

Durch die Transformation von Nomina zu Verben wurde Blooms Taxonomie von einer eindimensionalen auf eine zweidimensionale Ebene gebracht. Eine Dimension identifiziert in der „Knowledge dimension“ das Wissen, welches gelernt werden soll. Die zweite Dimension ist die sogenannte „cognitive process dimension“, die den Prozess des Lernens beschreibt (KRATHWOHL 2002; FOREHAND 2010).

Die sechs Niveaus der Domänen sind charakterisiert durch ihre hierarchischen Strukturen. Demnach kann man ein Konzept nicht verstehen, wenn man es sich nicht merken kann. Und man kann Kenntnisse nur anwenden, wenn man sie verstanden hat. Dies ist ein ununterbrochener Zusammenhang von „Lower Order Thinking Skills (LOTS)“ zu „Higher Order Thinking Skills“ (CHURCHES 2009). Diese hierarchischen Strukturen sind nützlich für die Evaluation von Wissen und Fertigkeiten und wurden in vorliegender Studie durch die Verwendung der 4-Punkte Likert-Skala im Rahmen der Blooms Taxonomie angewandt.

Durch die zielorientierten und hierarchischen Strukturen definieren Lernziele welche Kenntnisse, Fertigkeiten und Einstellungen die Lernenden auf welchem Niveau erlangen sollen. Dies soll dem „SMART“-Prinzip folgen (UNIVERSITY OF NEW MEXICO SCHOOL OF MEDICINE 2005):

- „**S**pecific“ (spezifisch)
- „**M**easurable“ (messbar)
- „**A**ttainable“ (erreichbar)
- „**R**elevant“ und berufsbezogen
- „**T**argeted“ – zielgerichtet für die Lernenden und auf das zu erreichende Niveau

In vorliegender Studie sollten die Lernziele oder Kompetenzen für Studierende und Residents in Veterinärneurologie erfasst werden. Die Lernziele sollten der Zielgruppe der Lernenden (Studierende oder Postgraduierte) angepasst werden. Das entsprechende Niveau sollte definiert werden, um eine Optimierung der Ausbildungsqualität und der Curriculumsentwicklung zu ermöglichen.

Lernziele in der Humanmedizin

Die 90er Jahre wurden in der Humanmedizin als „The Decade of Brain“ bezeichnet. Viele neue Therapien zur Behandlung neurologischer Erkrankungen wurden ins Leben gerufen. Da vermutet wurde, dass die durchschnittliche Lebenserwartung der Bevölkerung ständig steigt, wurde die Wichtigkeit der Neurologie entdeckt (CHARLES et al. 1999). Im Jahre 1998 wurde ein Entwurf eines Kerncurriculums für Neurologie in den USA unter Mithilfe des Consortium of Neurology Clerkship Directors (CNCD) und des Undergraduate Education Subcommittee (UES) der American Academy of Neurology (AAN) vorbereitet, welcher im Jahre 2000 auf der CNCD Tagung revidiert und danach genehmigt wurde (GELB et al. 2002). Das Kerncurriculum definiert Prinzip und die minimalen Anforderungen für das neurologische Curriculum. Außerdem bietet die AAN auch einen Lernzielkatalog für die Lehre von Studierenden der Humanmedizin an (AMERICAN ACADEMY OF NEUROLOGY 2013).

Ähnlich wie für das Grundstudium wurden Kompetenzen für das postgraduale Training 1998 durch das Accreditation Council for Graduate Medical Education (ACGME) etabliert und 2002 durch sechs Kernkompetenzen ergänzt, die in allen Disziplinen von Residency-Trainingsprogrammen obligatorisch eingesetzt werden sollen (SWING 2007; BREADY 2011). Für eine Verbesserung der Ausbildungsqualität und eine bessere Weiterentwicklung von Spezialisten im Beruf in der Neurologie wurde 2006 eine Arbeitsgruppe der AAN eingesetzt, die Education Research Work Group (ERWG).

In Europa wurde die minimale Anforderung der Lernziele für die Humanmedizin und Tiermedizin in der European Union (EU) Direktive 2005/36 auf EU Ebene geregelt (EUROPEAN COMMISSION 2005).

Lernziele in der Tiermedizin

Im Jahre 1978 wurden Anordnungen (78/1026/EEC und 78/1027/EEC) vom EC (European Council) für die Anerkennung professioneller Qualifikationen publiziert. Im Jahre 1988 wurde die EAEVE (The European Association of Establishments for Veterinary Education) gegründet, um die Evaluation der Lehre, Promotion und zukünftige Entwicklung der Tiermedizin zu begleiten und zu diskutieren sowie die Anforderung der EU zu erfüllen (EUROPEAN ASSOCIATION OF ESTABLISHMENT FOR VETERINARY EDUCATION 2013).

Für eine schnelle Erfassung tierärztlicher Berufsbilder bzw. ein rasches Ansprechen auf neue Markterfordernisse wurde das Projekt VET2020 initialisiert und ein Bericht 2002 publiziert (DE CASTRO und ZUCCONI 2004). Die Anordnung 2005/36/EC vom Europäischen Parlament regelt die minimalen Anforderungen für Studierende. Viele tiermedizinische Ausbildungsstätten in der EU definieren Lernziele individuell. Ein detaillierter Lernzielkatalog der Veterinärneurologie in Europa ist noch nicht definiert.

Die Spezialisierung in der Tiermedizin wurde 1989 beim World Small Animal Veterinary Association (WSAVA) Kongress diskutiert und anschließend wurde die

European Association of Veterinary Specialisation (EAVS) 1990 begründet. Im Jahre 1992 akzeptierte das Advisory Committee on Veterinary Training (ACVT) das Dokument „Veterinary Specialisation in Europe“ für die Entwicklung einer transnationalen Organisation, die die Spezialisierung der Tiermedizin in Europa vorantreiben sollte. Im Jahre 1996 wurde das European Board of Veterinary Specialisation (EBVS) offiziell registriert (LUMEIJ und HERRTAGE 2006; ROMAGNOLI 2010) und funktioniert seither als Anerkennungs-, Registrations-, Promotions- und Überwachungsstelle für die verschiedenen Spezialisten-Colleges in Europa (EUROPEAN BOARD OF VETERINARY SPECIALISATION 2013).

Ein Kerncurriculum ist für das postgraduale Training in der Tiermedizin nicht vorhanden. Jedes College erstellt individuell einen eigenen Lernzielkatalog. Ein detaillierter Lernzielkatalog und eine ausführliche Untersuchung der berufsrelevanten Kompetenzen sollen in vorliegender Studie für die Veterinärneurologie erfasst werden.

Die Veterinärneurologie ist eine ständig wachsende Spezialdisziplin. Eine Fülle neuer Erkenntnisse wurde in den letzten Jahren in Europa und den USA gewonnen. Mit zunehmender Anzahl neurologischer Patienten in tierärztlichen Privatpraxen und Kliniken erwartet die Gesellschaft eine gute und professionelle Dienstleistung von veterinärneurologischen Spezialisten (PLATT und NATASHA 2004; PLATT und GAROSI 2012). Infolgedessen müssen bereits Studierende in der Lage sein, neurologische Symptome zu erkennen, bei neurologischen Notfällen eine Erstversorgung zu bewältigen und wenn notwendig Patienten an Spezialisten zu überweisen. Außerdem sollen Studierende durch die Grundausbildung motiviert werden, sich nach dem Studium weiter zu bilden oder zu spezialisieren (CARDINET 3RD et al. 1992; LEIBETSEDER 2004; RODRIGUEZ-MARTINEZ 2004).

Delphi-Methode

Um die Lernziele für Studierende sowie berufsrelevante Kompetenzen für Residents zu erfassen, wurde eine modifizierte Delphi-Methode verwendet. Die Delphi-Methode wurde in den 1950er Jahren initialisiert und Ende 1968 von einer amerikanischen Firma RAND-Corporation entwickelt (DALKEY et al. 1969). Die Delphi-Methode ist ein populäres Werkzeug, mit dem durch Teilnahme von Experten und durch mehrstufige Befragung Entwicklungen, zukünftige Ereignisse, Trends oder Meinungsbildungen erfasst werden können (OKOLI und PAWLOWSKI 2004). Die Delphi-Methode ist charakterisiert durch (1) Anonymisierung, (2) Iterationsverfahren und kontrollierte Feedbacks und (3) statistische Auswertung. Diese Eigenschaften sind für die Minimierung des „Halo Errors“ oder „Halo Effektes“ konzipiert (NISBETT und WILSON 1977). Eine freie Äußerung von subjektiven Meinungen, Kritiken oder Beurteilung von Experten kann gesammelt werden.

2 Material und Methode

Für die Sammlung der Meinungen von Experten in Veterinärneurologie wurde eine modifizierte zweistufige Delphi-Methode mit anschließender statistischer Auswertung verwendet.

Phase 1

Der Entwurf einer Sammlung von Lernzielen basierte auf Grundlage eines amerikanischen Fragebogens, welcher vom American College of Veterinary Internal Medicine (ACVIM) für die Untersuchung der Kompetenzen von Residents in Neurologie entwickelt worden war. Der Entwurf des Fragebogens wurde in der qualitativen Phase von der Curriculum-Arbeitsgruppe des European College of Veterinary Neurology (ECVN), die aus sieben Spezialisten* in Veterinärneurologie von verschiedenen Universitäten und Privatkliniken in Europa besteht, diskutiert, überprüft und bearbeitet. Der überarbeitete Entwurf umfasste 140 Lernziele (exklusive 5 Freitextfragen) in 8 Kategorien für Studierende und 149 Lernziele (exklusive 48 Freitextfragen) in 9 Kategorien für postgraduales Training. Die Kategorien wurden wie folgt definiert:

1. Anatomie und Physiologie
2. Pharmakologie und Toxikologie
3. Genetik und Molekularbiologie
4. Klinische Methodologie
5. Krankheitsmechanismen
6. Neuroanästhesie und Neurochirurgie
7. Neuroradiologie
8. Pathologie
9. Akademische Kompetenzen

Außerdem beinhaltete er 7 Richtig-/Falsch-Fragen und eine Freitext-Frage zur Fragestellung „Difference between ECVN Diplomates and Veterinary Practitioners“.

Phase 2

Die für die Bewertung gesammelten Lernzielvorschläge wurden in Form eines quantitativen Onlinefragebogens per Surveymonkey® an 341 Mitglieder der European Society of Veterinary Neurology (ESVN) und des ECVN verteilt. Insgesamt wurden 142 ESVN-Mitglieder, 72 Residents und 127 ECVN-Diplomates angeschrieben. Per Email bekam jedes Mitglied einen individuellen, anonymisierten Link, welcher für die Bewertung drei Monate lang frei geschaltet wurde. In den drei Monaten konnten die Teilnehmer jeder Zeit eine Pause einlegen und die Bewertung danach weiter durchführen, da der Fragebogen etwa 1,5 Stunden Zeit in Anspruch nahm, um ihn auszufüllen. Die Teilnehmer bewerteten die Lernziele mit Hilfe einer 4-stufigen Likert-Skala, die auf Klassifikation der Blooms Taxonomie basiert:

1. Nicht notwendig
2. Anfänger-Niveau
   - Theorie: Erkennen (Basiswissen, Begriffe kennen).
   - Praxis: Kenntnisse über theoretische Grundlagen.
3. Fortgeschrittenen-Niveau
   - Theorie: Interpretieren.
   - Praxis: Demonstration, Durchführung unter Anleitung.
4. Experten-Niveau
   - Theorie: intellektuell diskutieren können.
   - Praxis: routinemäßig und selbstständig durchführen können.

Zusätzlich beinhaltete die Likert-Skala auch die Option „Keine Vorstellung“. Diese letzten Antworten wurden jedoch nicht in die statistische Bewertung genommen.

Phase 3

Nach der Umfrage wurden statistische Berechnungen durchgeführt mit dem statistischen Programm SAS (Version 9.2). Das Signifikanzniveau betrug 0.05.

*Mitglieder der Curriculum-Arbeitsgruppe des ECVN sind H.A. Volk, J. Penderis, T.J. Anderson, S.Añor, A.L. Feliu-Pascual, V.M. Stein und A. Tipold.

3 Publikationen

3.1 Development of learning objectives for a veterinary neurology undergraduate curriculum based on experts' opinion of european specialists

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3.1.1 ABSTRACT

With an increasing need of neurology in first opinion practice, relevant learning objectives for veterinary neurology in aspects of knowledge, skills and attitudes for veterinary undergraduate students in Europe should be established. With help of experts of the European College of Veterinary Neurology (ECVN) and the European Society of Veterinary Neurology (ESVN) a questionnaire about veterinary neurologic learning objectives using a modified Delphi method was conducted. The first phase comprised the development of a draft job description and learning objectives by the ECVN curriculum-working group. In the second phase, a quantitative questionnaire (multiple choice, Likert scale and free text) about 140 learning objectives in 8 categories was sent to 341 ESVN and ECVN members and a return rate of 62% (n=213/341) was achieved. ECVN Diplomates and ESVN members considered 42 (30%) objectives as not necessary, 94 (67%) were graded at beginner level and 4 (3%) at advanced level. The following objectives were interpreted as most important day one skills: interpret laboratory tests, perform a neurological examination, and establish a neuroanatomical localization of the suspected lesion. In this survey the three most important diseases of the central nervous system were epilepsy, intervertebral disc disease and inflammatory diseases. The three most important diseases of the peripheral nervous system were polyradiculoneuritis, myasthenia gravis and toxic neuropathy.

Key words: veterinary education, curriculum, learning objectives, neurology, undergraduate, ECVN, ESVN, Europe

3.1.2 INTRODUCTION

In the 1950s Bloom published "*Taxonomy of educational objectives: the classification of educational goals*" (BLOOM 1984; CONKLIN 2005), which established learning objectives as one of the most important concepts in pedagogy. Clearly defined learning objectives, the assessment and evaluation become independent from the used instructional mode or the subjective opinions of the teachers (CARROLL 2001).

Learning objectives are the educational foundation of a competence-oriented curriculum, which indicate the expectation of teaching/learning and its assessment. The learning objectives define (A) WHO can (B) DO (C) WHAT (D) HOW MUCH or HOW GOOD (BOEKER et al. 2010). These abbreviations are symbols for an (A) AGENT (in this case a specifically addressed learner), who's specific (B) ACTION will be executed by a defined (D) PERFORMANCE LEVEL, in order to prove his learned knowledge, abilities or behavior of a given (C) CONTENT (BOEKER et al. 2010). In other words, learning objectives define specifically what knowledge, skills and attitudes learners should obtain. These should be "SMART": (UNIVERSITY OF NEW MEXICO SCHOOL OF MEDICINE 2005):

Specific
Measurable / Observable
Attainable for target audience within scheduled time and specified conditions
Relevant and result-oriented
Targeted to the learner and to the desired level of learning

In medical school, the professional training "would be extremely inefficient without a blueprint of knowledge, skills and attitudes transmitted by instructors and acquired by students. Without such a plan, a tight overlap between what is being taught, learned and examined could not be guaranteed" (BLOCH and BÜRGI 2002), R. Bloch expressed here the importance and the necessity of involvement of learning objectives being the core of any good curriculum. Essential objectives help undergraduates to gain confidence and to focus on their learning process.

As in veterinary medicine in human medicine, neurology is recognized as an independent specialty (PONTES 2001). During 1990s - "the Decade of the Brain", neurological disorders had gained national attention in the United States (CHARLES et al. 1999). It was predicted that neurologic problems will be increasingly important due to the increased life expectancy of people (CAPLAN and ADELMAN 1994). To ensure the quality of neurologic training for all physicians, a document of the core curriculum for neurology was initiated in October 1998, under the auspices of the

Consortium of Neurology Clerkship Directors (CNCD) and the Undergraduate Education Subcommittee (UES) of the American Academy of Neurology (AAN) (GELB et al. 2002).

Veterinary neurology is a flourishing specialization in Europe and the United States. Neurological diseases in veterinary practice are frequently seen and the knowledge in veterinary neurology has also dramatically increased over the last decades (PLATT and GAROSI 2012). Also the report from the Web of Knowledge by using following parameter “Topic=(dog) OR Title=(cat) AND Topic=(neuro)” showed that there was a significant increasing of published items over the last 15 years with almost 9000 publications. The growth of the veterinary neurology response also pet owners’ expectation that their animals receive professional care (PLATT and NATASHA 2004). A recent study from Royal Veterinary College found that 8,38% causes of death of UK dogs was neurological cranial including seizures (O’Neill et al. 2012), which reflects the need of neurology service in veterinary medicine. Consequently, undergraduate students have to be taught the respective basics of the discipline, to be able to recognize neurologic signs, to manage emergencies, to refer cases to specialists or for them to have the basics to start a specialist training themselves.

With the exception of single schools, Europe wide detailed learning objectives for veterinary neurology are not yet defined. Therefore, such objectives for veterinary neurology should be established. This can be achieved similar to the aforementioned example of the US undergraduate curriculum development using expert opinions of CNCD and AAN with the help of certified and recognized specialists in Veterinary Neurology (e.g. European Diplomates of the European College of Veterinary Neurology (ECVN)) and advanced practitioners with a special interest in Veterinary Neurology (European Society of Veterinary Neurology (ESVN) members). The detected learning objectives could be used to define the basic necessary knowledge, skills and attitudes for undergraduate students in veterinary neurology. Assembled in the curriculum they will build the basis for competency-based training and outcome-

based assessment and could motivate undergraduates for postgraduate specialist training in the discipline.

The aim of the current study was to develop learning objectives for undergraduates using information gained via a survey of ECVN and ESVN members. The international profile of the members helped to create learning objectives largely independent from cultural background. Experts helped to attenuate the balancing act between “as much knowledge as necessary” and “as little knowledge as possible”. In addition to the development of the learning objectives, the quality and level of these were defined. The current approach of curriculum development is not specific for Neurology and could also be used for other disciplines.

3.1.3 MATERIALS AND METHODS

A modified Delphi method was conducted for identifying relevant learning objectives. Draft of learning objectives was developed with the help of an ECVN curriculum-working group, and then the revised learning objectives were assessed by Experts (ECVN and ESVN members) and statistically analyzed.

Phase 1: Qualitative development of a draft of learning objectives with the help of an ECVN curriculum working group.
The draft was based on the structure and learning objectives recently created from the American College of Veterinary Internal Medicine (ACVIM) for evaluating the competencies of their residents in Neurology. The draft of learning objectives was reviewed and adapted by the ECVN curriculum working group consisting of seven ECVN Diplomates* from different Universities and private practices in Europe. The members of ECVN curriculum working group were asked for suggestions and comments to modify the initial draft. Following the review of the draft the initial learning objectives were comprehensively revised.

Phase 2: A quantitative questionnaire with revised learning objectives was distributed to ESVN (veterinarians specially interested in neurology, residents) and ECVN members (Diplomates).

In phase 1, a total of 140 learning objectives (Appendix 1) in 8 categories were developed (1. Anatomy and Physiology; 2. Pharmacology and Toxicology; 3. Genetics and Molecular Biology; 4. Clinical Methodology; 5. Disease Mechanisms; 6. Neuroanaesthesia and Neurosurgery; 7. Neuroradiology; 8. Pathology). In the category Clinical Methodology, the abilities of performance and interpretation were assessed, in Neuroanaesthesia / Neurosurgery and Neuroradiology the competencies were sub-categorised into theory and practice.

The developed quantitative questionnaire with all these learning objectives was distributed then to 341 ESVN and ECVN members using Surveymonkey® (an online-survey provider). Every member received a unique link by e-mail for the questionnaire, which was active for 3 months. The users could pause and continue the questionnaire at any time during the active period. With the involvement of human participants in this research project, all data of this study were used anonymously and treated confidentially according to the EU Data Protection Directive 95/46/EC. The clearance for this research project was given by the data protection officer of the University of Veterinary Medicine Hannover and followed the ethical regulations of the university.

The questionnaire was compounded of single/multiple choice questions for demographic data, Likert scale for learning objectives and free text for comments. Respondents were requested to indicate the importance of the competencies for undergraduates based on Bloom´s taxonomic classification (ANDERSON and KRATHWOHL 2001; FOREHAND 2010) using the following Likert scale:

1= Not Necessary

2= As Beginner - Theory knowledge: knowing terms

Practice Skills: knowledge of theory by practice

3= As Advanced - Theory: Being able to interpret

Practice Skills: perform under instruction by practice

4= As Expert - Theory: Being able to discuss intellectually

Practice Skills: perform independently

Additionally, an option “No Idea” was available, and responses of this option were excluded from statistic analysis.

Phase 3: Statistical evaluation using Fisher’s Exact Test.

All questions used the same Likert scale, which made the scale a defensible approximation to an interval scale. After consulting the statistician of institute of biometrics of University of Veterinary Medicine Hannover, Non-parametric Fisher’s Exact Test was used with statistic software SAS® with Version 9,2 under the assumption of unequal variances, two-tailed distributions and a significance level of 0.05. In addition, the responses were evaluated among the following groups to discover different opinions:

1. ESVN vs. ECVN
2. German-speaking vs. non-German-speaking countries
3. Surgery vs. no-surgery performed
4. Experience in Neurology: 0-5 Years vs. 6-10 Years vs. > 10 Years.

Moreover, the free text answers were summarized and qualitatively presented.

3.1.4 RESULTS

The Questionnaire was sent to 341 Experts with a return rate of 62% (n = 213/341), of which 77% (n = 164/213) submitted a completed questionnaire and was used for analysis.

The completed questionnaires were from 83 ESVN (incl. 46 Residents) and 81 ECVN-Diplomate members who mainly worked in the United Kingdom (44), Germany (30), Italy (23) and Spain (15). 45% of the experts worked in Academia, 44% in private specialty practice, 8% in both areas and 3% in industry or other organizations. Furthermore, 97% of the experts worked mainly with small animals.

Of 140 learning objectives (5 in free text questions excluded) 42 (30%) objectives were considered as not necessary for undergraduates, 94 (67%) should be achieved at beginners level, 4 (3%) at advanced level and none in an expert level (Appendix 1). The 42 disregarded objectives were in the area of electrodiagnostic tests (57%; n = 24/42), performing CSF puncture, most surgical techniques and advanced techniques in neuroradiology (Appendix 1).

The ten learning objectives with the highest mean rating (2.58-2.25, beginner to advanced level) were listed below (Table 1). They could be considered as day one skills for undergraduates in neurology. The first five competencies were transferable skills, and the last five were competencies associated with neuroanatomical localization, general clinical reasoning and with specific common disease presentation such as discopathy and seizures.

Table 1 – Rating of 10 most important learning objectives

Learning objectives	Mean rating
1. Interpret hematological, serum chemistry and urinalysis results	2.58
2. Understand organ function tests (liver, endocrine).	2.58
3. Interpret organ function tests (liver, endocrine).	2.56
4. Ability to interpret radiographs of the abdomen and thorax.	2.50
5. Ability to interpret radiographs of the axial and appendicular skeleton.	2.41
6. Neurolocalize a lesion based on the examination findings.	2.37
7. The understanding of CNS diseases according to the VITAMIN-D principal	2.37
8. The understanding of the diagnosis and treatment of disc disease in dogs and cats.	2.35
9. The understanding of the pathogenesis of disc disease in dogs and cats.	2.32
10. The understanding of the diagnosis and treatment of seizure.	2.29

In free text questions experts named the six most important antiepileptic drugs in veterinary neurology: Benzodiazepine, Phenobarbital, Potassium Bromide, Levetiracetam, Gabapentin and Zonisamide; the three most important immunosuppressive or antiinflammatory drugs were Glucocorticosteroids, Azathioprine and Cyclosporine; the ten most important chemotherapeutic drugs were considered to be from the groups Nitrosoureas, Cytosine arabinoside and Nitrogen mustards.

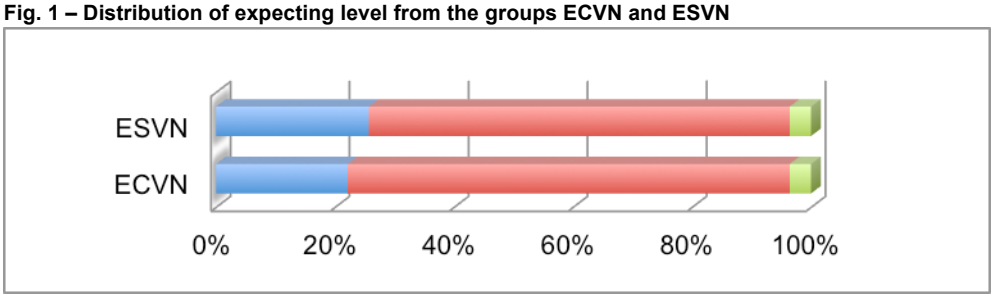
The three most important diseases of the central nervous system (CNS) experts had the opinion that an undergraduate student should know about, were epilepsy, intervertebral disc disease and inflammatory diseases of CNS; as the four most important diseases of the peripheral nervous system (PNS) were polyradiculoneuritis, myasthenia gravis, neurotoxins and inflammatory myopathy.

Evaluation of the learning objectives by ESVN or ECVN members.

From 164 completed questionnaires, 83 questionnaires of ESVN members (incl. 46 residents) and 81 of ECVN-Diplomates were included in the analysis. Interestingly, there was no difference between ESVN and ECVN members what they expected from an undergraduate (Fig. 1). From 140 learning objectives, significant difference

(P<0.05) was detected in only 8 learning objectives (Tab. 2), of which 6 learning objectives received higher rating from ECVN Diplomates.

Fig. 1 – Distribution of expecting level from the groups ECVN and ESVN



	ESVN	ECVN
Not Necessary	26% (n = 36)	22% (n = 31)
Beginner	71% (n = 99)	74% (n = 104)
Advanced	3% (n = 5)	4% (n = 5)

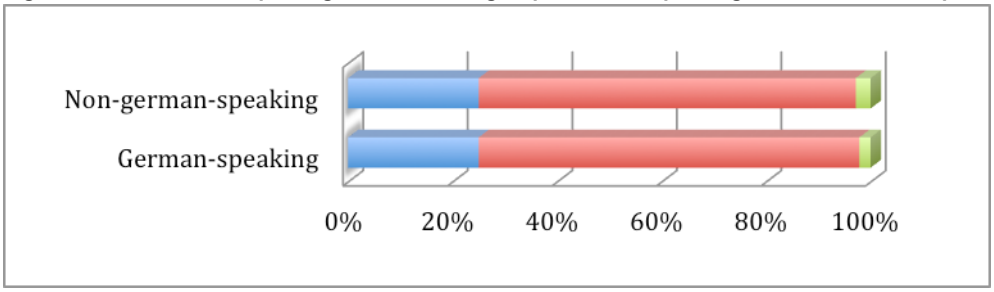
Table 2 – Rating of the importance of learning objectives comparing the ECVN and ESVN group; 8 learning objectives were rated significantly different.

Learning objectives	Mean ECVN	Mean ESVN	P-value
Anatomy and Physiology			
The microscopic anatomy of the nervous system	1.82	1.56	0.0145
The functional neuroanatomy of the central nervous system	2.25	2.04	0.0124
The functional neuroanatomy of the autonomic nervous system	2.09	1.89	0.0027
Clinical Methodology			
> Laboratory			
Interpret hematological, serum chemistry and urinalysis results	2.63	2.52	0.035
> CSF			
Perform cistern magna collection of CSF in the dog and cat	1.55	1.32	0.0398
> EMG			
Interpret EMG and nerve conduction testing in the dog and cat.	1.38	1.63	0.005
Neuroradiology			
> Practical			
Ability to interpret radiographs of the skull	2.08	2.28	0.0328
Pathology			
Understand hematological cytological interpretation	2.38	2.13	0.027
- Values in filled cells have a higher mean rating.			

Evaluation of the learning objectives by experts, who work in German-speaking or in non-German-speaking countries.

38 experts were working in German-speaking countries, 126 experts in non-German-speaking countries. In this comparison, the expectation from both groups was almost identical (Fig. 2). Only 3 learning objectives were graded significantly different (Table 3).

Fig. 2 – Distribution of expecting level from the groups German-speaking and Non-German-speaking



	German-speaking	Non-German-speaking
Not Necessary	25% (n = 35)	25% (n = 35)
Beginner	73% (n = 102)	72% (n = 101)
Advanced	2% (n = 3)	3% (n = 4)

Table 3 – Rating of the importance of learning objectives comparing the German-speaking and Non-German-speaking countries groups; these members rated 3 learning objectives significantly different.

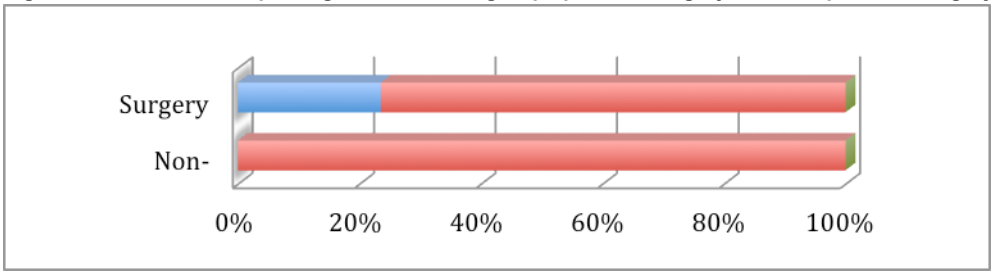
	Mean rating German-speaking	Mean rating Non-German-Sp.	P-value
Anatomy and Physiology			
4. The functional neuroanatomy of the peripheral nervous system	2,05	2,14	0,0278
Pharmacology and Toxicology			
6. Therapeutic index in relation to drug efficacy and safety	2,08	1,93	0,0431
Neuroradiology			
1. Understand CT scanning technique	1.84	1,78	0,0381

- Values in filled cells have a higher mean rating.

Evaluation of the learning objectives by experts, who do perform or do not perform neurosurgery.

This evaluation was only done in the category neuroanaesthesia / neurosurgery with 17 (4 theoretical and 13 practical skills) learning objectives. The group of experts not performing surgery expected all 17 learning objectives to reach beginner's level; in contrast, experts performing-surgery rated 4 skills as not necessary (Fig. 3). Though no significant difference was detected between the two groups, experts not performing surgery had higher expectations.

Fig. 3 – Distribution of expecting level from the groups perform surgery and Non-perform-Surgery

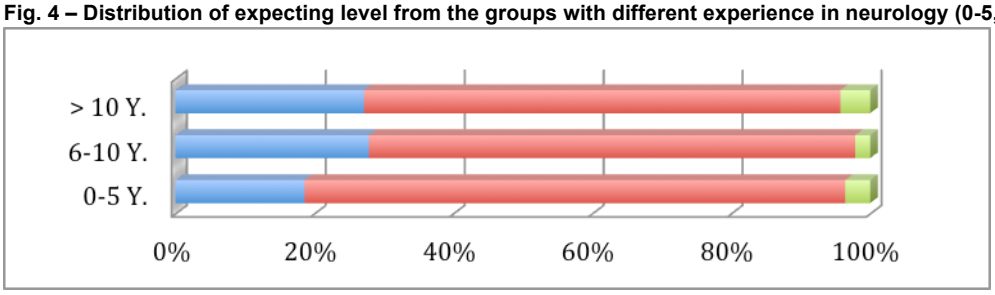


	Surgery	Non-perform-surgery
Not Necessary	24% (n = 4)	0% (n = 0)
Beginner	76% (n = 13)	100% (n = 17)
Advanced	0% (n = 0)	0% (n = 0)

Evaluation of the learning objectives by Experts, who have experience in veterinary neurology for 0-5, 6-10 or >10 Years.

When comparing groups of different experience levels, the members of the 0-5 years' group expected more learning objectives to reach beginner's level than the group with 6-10 years of experience or >10 years (Fig. 4). Significant difference was detected by comparing different groups (Tab. 5, Tab. 6, Tab. 7). Moreover, the group with 0-5 years experience expected 6 learning objectives of 24 in the category of electrodiagnostics to reach beginner's level, while the other 2 groups regarded all as not necessary.

Fig. 4 – Distribution of expecting level from the groups with different experience in neurology (0-5, 6-10 and >10 years)



	0-5 Y.	6-10 Y.	>10 Y.
Not Necessary	19% (n = 26)	28% (n = 39)	27% (n = 38)
Beginner	78% (n = 109)	70% (n = 98)	69% (n = 96)
Advanced	3% (n = 5)	2% (n = 3)	4% (n = 6)

Table 5: 13 Learning objectives with significant difference between the groups with different experience in neurology (0-5, 6-10 years)

	Mean 0-5	Mean 6-10	P-value
Clinical Methodology			
> EEG			
Perform EEG testing in the dog and cat	1.43	1.16	0.0371
Interpret EEG testing in the dog and cat	1.48	1.17	0.0273
> EMG			
Perform EMG and nerve conduction testing in the dog and cat	1.48	1.19	0.0329
Perform F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.44	1.13	0.0254
Interpret F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.56	1.2	0.0154
Interpret EMG and nerve conduction testing in the horse.	1.53	1.28	0.0224
Interpret single fiber EMG testing in the dog and cat.	1.31	1.1	0.0207
> OPHTAMOLOGIC ELECTRO. TESTING			
Perform ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat.	1.46	1.1	0.0155
Disease Mechanisms			
> Micturition Disorders			
Micturition disorders of dogs and cats. The understanding of the pathogenesis	2.19	1.95	0.0377
Neuroanaesthesia & Neurosurgery			
> Practical			
Brain biopsy	1.69	1.38	0.0252
Fracture repair	1.7	1.4	0.0223
Muscle biopsy	1.79	1.6	0.0298
Nerve biopsy	1.64	1.48	0.012
- Values in filled cells have a higher mean rating.			

Table 6: 5 Learning objectives with significant difference between the groups with different experience in neurology (6-10 and >10 years)

	Mean 6-10	Mean >10	P-value
Pharmacology and Toxicology			
> Chemotherapeutic drugs			
The mechanism of chemotherapeutic drugs for nervous system neoplasia / inflammation	1.65	1.88	0.028
Disease Mechanisms			
> Seizure			
Seizure disorders in ruminants / food animals. The understanding of the pathogenesis	1.91	1.64	0.003
> Disc Disease			
Disc disease in dogs and cats. The understanding of the pathogenesis	2.17	2.44	0.0487
Neuroradiology			
Understand CT scanning technique	1.69	1.84	0.0415
Understand MRI scanning technique	1.57	1.79	0.0283
- Values in filled cells have a higher mean rating.			

Table 7: 18 Learning objectives with significant difference between the groups with different experience in neurology (0-5 and >10 years)

	Mean 0-5	Mean >10	P-value
Anatomy and Physiology			
The microscopic anatomy of the nervous system	1.55	1.8	0.031
The functional neuroanatomy of the autonomic nervous system	1.87	2.17	0.0326
Pharmacology and Toxicology			
> pharmacodynamic and Pharmacokinetic			
The autonomic nervous system receptors and neurotransmitters	1.72	1.97	0.04
Clinical Methodology			
> EEG			
Perform EEG testing in the dog and cat	1.43	1.19	0.0121
Interpret EEG testing in the dog and cat	1.48	1.22	0.0124
> EMG			
Perform F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.44	1.16	0.0066
Interpret F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.56	1.23	0.0033
Interpret EMG and nerve conduction testing in the horse.	1.53	1.27	0.0062
> OPHTAMOLOGIC ELECTRO. TESTING			
Perform ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat.	1.46	1.13	0.0036
Disease Mechanisms			
> Seizure			
Seizure disorders in horses. The understanding of the pathogenesis	1.9	1.75	0.0255
Seizure disorders in ruminants / food animals. The understanding of the pathogenesis	1.75	1.64	0.0389
> Micturition Disorders			
Micturition disorders of horses. The understanding of the pathogenesis	1.82	1.56	0.0156
The understanding of the diagnosis and treatment	1.88	1.56	0.0263
Micturition disorders of ruminants / food animals. The understanding of the pathogenesis	1.79	1.49	0.0336
The understanding of the diagnosis and treatment	1.85	1.48	0.0073
Neuroanaesthesia & Neurosurgery			
> Practical			
Brain biopsy	1.69	1.36	0.0125
Nerve biopsy	1.64	1.49	0.0111
Neuroradiology			
> Theory			
Understand CT scanning technique	1.85	1.84	0.0108

- Values in filled cells have higher mean rating.

3.1.5 DISCUSSION

The goal of this study was to determine a catalog of learning objectives for veterinary neurology undergraduate curricula in a European framework. A modified Delphi method was conducted in 2 steps to combine qualitative and quantitative methods. Experts from areas of teaching, research and practice were involved in the first phase to develop a draft of learning objectives (ECVN curriculum working group). The learning objectives were discussed and revised in detail. In the second phase, a quantitative questionnaire with revised learning objectives was assessed by ESVN and ECVN members. A total of 144 learning objectives were included in a questionnaire. The high return rate of 62% with an overall response rate of 77%

demonstrated the interest of experts on the development and improvement of neurology teaching.

Only for 4 (3%) of the 140 learning objectives the ESVN/ECVN group felt undergraduates should reach an advanced level. These objectives were all listed in the categories laboratory and radiology and were non-neurology specific. The undergraduates should be able to understand and interpret the result of hematology, serum chemistry, urinalysis and organ function test and radiographs of the abdomen and thorax. The ten learning objectives (Tab. 1) with highest mean rating could be considered as the neurology day one skills for undergraduates, which include also five general transferable skills.

Undergraduates were expected to reach beginner level of understanding (knowing terms by theory or knowledge and comprehension of theory by practice) for 67% (94/140) of the analyzed learning objectives. These objectives would be ranked relatively low in the cognitive domain of Bloom's Taxonomy. In addition, 30% (42/140) of the learning objectives in the categories of electrodiagnostic tests, CSF puncture, bone marrow aspiration, biopsy, advanced neurosurgical skills and neuroradiological techniques are considered as not necessary for undergraduate students. Based on our findings undergraduates should have basic understanding in most of the analyzed objectives, however, they should be motivated for deepening their knowledge and skill sets. Achieving these objectives at the end of an undergraduate degree can only be the beginning of a lifelong independent learning journey.

ECVN and ESVN members ranked all learning objectives similarly. ECVN members gave, however, higher mean ratings than ESVN members in eight of the learning objectives. The different working environment may explain this phenomenon; part of the ESVN member group are veterinarians, who are especially interested in neurology, however, neurology cases are not their primary and only caseload. In

contrast, ECVN Diplomates are mainly working in Academia, hospitals of universities or referral clinics and therefore their routine caseload is neurology based.

To evaluate, if a defined group of European countries have different opinions than other countries, German-speaking countries were evaluated separately and compared with the others. There were only three learning objectives showing significant differences between both groups. The international community of ESVN and ECVN and their regular meetings may contribute to this uniform result. Furthermore, the mission of the EAEVE (European Association of Establishment for Veterinary Education) is to ensure a comparable quality of veterinary medical education across the member states of the European Union (EUROPEAN ASSOCIATION OF ESTABLISHMENT FOR VETERINARY EDUCATION, 2013), which may also be an explanation for this phenomenon.

Experts who perform surgery did agree that four of the seventeen objectives in the category neuroanaesthesia / neurosurgery were not necessary. On the other hand experts who don't perform surgery expected all learning objectives to reach beginner's level (knowing terms or knowledge of theory by practice). Even if this difference was not significant, it shows a tendency that experts in surgery will have less high expectation than medical neurologists. Neurosurgery is a specific area in surgery. For undergraduates an advanced or expert level should not be considered necessary. However, they should know terms by theory and understand the knowledge of theory by practice via e.g. lectures, seminars, eLearning or skills lab. Miller describes the assessment of clinical skills as a pyramid and suggests that the undergraduates should reach the second level "Know How", which means the undergraduate should "Know" and/or "Know How" a the certain clinical procedure is performed, but it is not yet necessary to reach the "Show How" level (MILLER 1990 Fundamental knowledge for surgery can be acquired passively by lectures and the active learning takes usually place during clinical rotations (SCHWARTZ et al. 1992). In skills labs various simulators provide hands-on training representing alternative possibilities for different psychomotor objectives (SCALESE and ISSENBERG 2005).

The interesting and surprising finding in this comparison was that the young generation (group with experience 0-5 years) expected more learning objectives to reach beginner's level and gave also higher mean rating than the elder generation. In addition, the young generation also showed higher interest in electrodiagnostic tests and considered them more important than the elder generation. In the 24 learning objectives of electrodiagnostic tests the young generation group expected undergraduates to reach beginner level in 6 (25%) learning objectives, while the 2 other groups regarded all of them as not necessary.

Transferring in Practice

Because veterinary neurology is very closely associated with different disciplines, an implementation of the learning objectives in the current curricula with an increasing interdisciplinary cooperation would be preferable. With the help of inter-institutional support and expertise from different fields, a meaningful interdisciplinary cooperation provides valuable teaching and learning synergies (WATERMAN et al. 2011).

Additionally, elective courses could also be offered. Moreover, E-learning is an ideal supplement to classroom education. An example is the platform CASUS providing various interactive neurology themes for veterinary undergraduates, which is regarded as an efficient teaching method (BÖRCHERS et al. 2010; KOCH et al. 2010). Using such tools, the most important diseases can be provided for self-studies.

Challenges and Limitations

With the result of this pilot study, we expect that veterinary neurology, as a niche discipline, is not only providing the orientation for training of undergraduates in veterinary neurology, but might also be a role model for the development of European learning objectives in other specific areas in veterinary medicine.

The learning objectives of the current study include only cognitive and psychomotor skills. The affective domain was not included. However, besides professional

knowledge and skills, attitude and communication are also requirements for “being a good doctor”, which is defined in Good Medical Practice as “competent, keep their knowledge and skills up to date, establish and maintain good relationships with patients and colleagues, are honest and trustworthy, and act with integrity” (GENERAL MEDICAL COUNCIL 2009).

The affective domain includes values, attitudes and behaviours describing how we interact with others, how we act in the society, how veterinarians care for patients or pet owners, communicate with pet owners and how they demonstrate their morality in particular situations. Moreover, students’ motivation in learning is also one of the elements of the affective domain (BEARD et al. 2007; SHEPHARD 2008). For an integrated development of learning objectives, the affective elements should also be supplemented in the future, but can be achieved together with other specialties.

3.1.6 CONCLUSION

With the help of this catalog of learning objectives it is possible to modernize and improve the quality of teaching, curriculum development, competency-based training and outcome-based assessment in veterinary neurology in undergraduate studies in Europe. A comprehensive and effective curriculum is a valuable tool and investment in such a curriculum with one-off development and continual correction can result in enormous benefits for undergraduates and lecturers in terms of time, effectiveness and competency.

*Members of ECVN curriculum working group included H.A. Volk, J. Penderis, T.J. Anderson, S.Añor, A.L. Feliu-Pascual, V.M. Stein und A. Tipold. We acknowledge very much the work of this group and of the active ESVN and ECVN members filling in the questionnaire.

3.1.7 REFERENCES

ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION (2011):
ACGME – Glossary of Terms. ACGME, Chicago, S. 4 – 5
[Internet: URL:
http://acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/ab_ACGMEglossary.pdf]

ANDERSON, L. W., and D. R. KRATHWOHL (2001):
A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
4.Ed., Publisher Longman, New York

BEARD, C., S. CLEGG and K. SMITH (2007):
Acknowledging the Affective in Higher Education.
British Educational Research Journal 33(2), 235 – 252
Doi:10.1080/01411920701208415

BLAHA, T. (2012):
What about the VetCEE.
The EBVS Newsletter, (5), 9 – 10
[Internet: URL: http://www.ebvs.org/news]

BLOCH, R., and H. BÜRGI (2002):
The Swiss Catalogue of Learning Objectives.
Medical Teacher 24(2), 144-150. Doi:10.1080/01421590220120759

BLOOM, B. S. (1984):
Taxonomy of Educational Objectives: The Classification of Educational Goals.
Handbook 1: Cognitive Domain.
2.Ed., Publisher Addison Wesley, Boston

BOEKER, M., F. BALZER and S. SCHULZ (2010):
Konzeption einer Ontologie Medizinischer Lernziele
In: 14. Workshop der gmds-Arbeitsgruppe „Computerunterstützte Lehr- und Lernsysteme in der Medizin (CBT)" und des GMA-Ausschusses „Neue Medien".
Witten, Germany, 16 – 17. April 2010.
doi: 10.3205/10cbt35

BÖRCHER, M., A. TIPOLD, C. PFARRER, M. R. FISCHER and J. P. EHLERS (2010):
Akzeptanz von fallbasiertem, interaktivem eLearning in der Tiermedizin am Beispiel des CASUS-Systems.
Tierärztliche Praxis Kleintiere, 38(April), 379 – 388

BROWN, J. P., J. D. SILVERMAN (1999):
The Current and Future Market for Veterinarians and Veterinary Medical Services in the United States - Executive summary.
J. Am. Vet. Med. Assoc. 215(2), 161 - 183

BURNS, G. A., K. L. RUBY, R. M. DEBOWES, S. J. SEAMAN, and J. K. BRANNAN (2006):
Teaching non-technical (professional) Competence in a Veterinary School Curriculum.
J. Vet. Med. Edu. 33(2), 301 – 308

CAPLAN, L. R., and L. ADELMAN (1994):
Neurologic Education.
The Western Journal of Medicine 161(3), 319 – 322

CARROLL, R. G. (2001):
Design and evaluation of a national set of learning objectives: the medical physiology learning objectives project.
Adv. Physiol. Edu. 25(2), 2 - 7

CATE, T. J. TEN and J. C. J. M. DE HAES (2000):
Summative assessment of medical students in the affective domain.
Medical Teacher 22(1), 40 – 43

CHARLES, P.D., B. SCHEROKMAN and R. F. JÓZEFOWICZ (1999):
How much neurology should a medical student learn? a position statement of the AAN Undergraduate Education Subcommittee.
Journal of the Association of American Medical Colleges, 74(1), 23–26

CONKLIN, J. (2005):
Book Reviews: A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
Educational Horizons 83(3), 154 – 159

DALKEY, N. C., B. B. BROWN and S. COCHRAN (1969):
The Delphi method.
Publisher Rand Corporation, California

EUROPEAN ASSOCIATON OF ESTABLISHMENT FOR VETERINARY EDUCATION (2013):
The Association: Foundation, Mission and Objectives.
[Internet: URL: http://www.eaeve.org/about-eaeve/history-and-aims.html]

FOREHAND, M. (2010):
Bloom's Taxonomy - Emerging Perspectives on Learning, Teaching and Technology.
[Internet: URL: http://projects.coe.uga.edu/epltt]

GELB, D. J., C. H. GUNDERSON, K. A. HENRY, H. S. KIRSHNER and R. F. JÓZEFOWICZ (2002):
The Neurology Clerkship Core Curriculum.
Neurology, 58(6), 849–852

GENERAL MEDICAL COUNCIL (2009):
Good Medical Practice. Publisher General Medical Council, Great Britain
[Internet: URL: http://www.gmc-uk.org/guidance]

KOCH, M., M. R. FISCHER, M. VANDEVELDE, A. TIPOLD and J. P. EHLERS (2010):
Erfahrungen aus Entwicklung und Einsatz eines Interdisziplinären Blended-Learning-Wahlpflicht- fachs an Zwei Tiermedizinischen Hochschulen Einleitung.
Zeitschrift für Hochschulentwicklung, 5(1), 88–107

LIOYD, J. W. (2002):
Developing a Curriculum to Improve the Skills, Knowledge, Aptitudes, and Attitudes of Veterinary Students.
Journal of the American Veterinary Medical Association, 220(7), 976–977

MILLER, G. E. (1990):
The Assessment of Clinical Skills/Competence/Performance.
Journal of the Association of American Medical Colleges, 65(9 Suppl), S63–67

OKOLI, C., and S. D. PAWLOWSKI (2004):
The Delphi Method as a Research Tool: an Example, Design Considerations and Applications.
Information & Management, 42(1), 15–29

O'Neill, D.G., D. B. Church, P.D. McGreevy, P.C. Thomson and D.C. Brodbelt (2012)
Longevity of UK Dog Breeds.
In: Society for Veterinary Epidemiology and Preventive Medicine – 2012 Annual Conference.
Glasgow, Scottland, 28 – 30. March 2012

OVERBAUGH, R. C. and L. SCHULZ (2013):
Bloom's Taxonomy.
[Internet: URL: http://ww2.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm]

PALMER, K. T., C. C. HARLING, J. HARRISON, E. B. MACDONALD and D. C. SNASHALL (2002):
Good Medical Practice: Guidance for Occupational Physicians.
Occupational Medicine (Oxford, England), 52(6), 341–352

PLATT, S and L. GAROSI (2012):
Small Animal Neurological Emergencies.
1.Ed., Publisher Manson, London

PLATT, S., and O. NATASHA (2004):
BSAVA Manual of Canine and Feline Neurology.
3.Ed., John Wiley & Sons, New York

PONTES, C. (2001):
EFNS Task Force on Postgraduate Neurological Training Survey of the Current Situation of Postgraduate Neurological Training in Europe.
European Journal of Neurology, 8, 381–384

ROMAGNOLI, S. (2010):
The European System of Veterinary Specialization.
Journal of Veterinary Medical Education, 37(4), 334–339

SCALESE, R. J. and S. B. ISSENBERG (2005):
Effective Use of Simulations for the Teaching and Acquisition of Veterinary Professional and Clinical Skills.
Journal of Veterinary Medical Education, 32(4), 461–467

SCHWARTZ, R. W., M. B. DONNELLY, B. YOUNG, P. P. NASH, F. M. WITTE and W. O. GRIFFEN JR. (1992):
Undergraduate Surgical Education for the Twenty-First Century.
Annals of Surgery, 216(6), 639–647

SHEPHARD, K. (2008):
Higher Education for Sustainability: Seeking Affective Learning Outcomes.
International Journal of Sustainability in Higher Education, 9(1), 87–98

TINGA, C. E., C. L. ADAMS, B. N. BONNETT and C. S. RIBBLE (2001):
Perspectives in Professional Education of a veterinary college.
Journal of the American Veterinary Medical Association, 219(7), 924–931

UNIVERSITY OF NEW MEXICO SCHOOL OF MEDICINE (2005):
Effective Use of Performance Objectives for Learning and Assessment.
[Internet: URL:
http://ccoe.umdnj.edu/forms/EffectiveUseofLearningObjectives.pdf]

WATERMAN, E., N. HARTMANN, D. HARDY-COX, M. MACLEOD, C. PORR, L. ROHR and P. MEZO (2011):
Interdisciplinary Cooperation in Teaching and Learning at Memorial University.
[Internet: URL:
http://www.delts.mun.ca/faculty/teachinglearning/ACR_Intdisc_Coop_Report.pdf]

3.2 Learning Objectives for Residents and the Required Job Competencies of Diplomates of the European College of Veterinary Neurology

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3.2.1 ABSTRACT

Background: Specialization in veterinary medicine in Europe is organized by different Colleges of the European Board of Veterinary Specialization. To revise the current learning objectives and to update the curriculum for Residents of the European College of Veterinary Neurology (ECVN) the following study was designed. **Aims:** To define the current job competencies of Diploma holders in Veterinary Neurology and to describe the required level of knowledge and of competencies required for Residency training. **Methods:** With the help of the ECVN and the European Society of Veterinary Neurology (ESVN) a modified Delphi study, including a qualitative search of objectives and quantitative ranking with 149 Likert scale questions and 48 free text questions in 9 categories was conducted in a survey. In addition, opinions of different groups were subjected to statistical analysis and the result compared. **Results:** A return rate of 62% (n=213/341) was reached from 341 experts. 75% of all competencies were expected to reach expert level, 24% advanced level and 1% beginner level (e.g. applying radiation therapy technique). Moreover, 11 most important job competencies, 6 frequently seen diseases of central and peripheral nervous system and frequently used immunosuppressive, antiepileptic and chemotherapeutic drugs were extracted from free text questions. **Conclusion:** Using this survey the curriculum of the ECVN can be adapted to actually needed job competencies. The majority of these competencies are expected to reach expert level to meet the job requirement of European specialists. Besides knowledge and clinical skills, Residents and Diplomates are expected to reach high standard in teaching and communication.

Key words: veterinary education, curriculum, learning objectives, neurology, postgraduate, Diplomate, Resident, ECVN, ESVN, Europe

3.2.2 INTRODUCTION

Learning Objectives and Bloom's Taxonomy

Learning objectives define what a learner has to know, to understand, to operate or to behave during the learning process and are also called "intended learning outcomes" or "course-specific goals" (ANDERSON and KRATHWOHL 2001; EUROPEAN CENTRE FOR THE DEVELOPMENT OF VOCATIONAL TRAINING 2010; HARDEN 2002; UNIVERSITY OF GUELPH 2013). Bloom et al. published in 1956 the *Taxonomy of Educational Objectives: The Classification of Educational Goals* (BLOOM 1984). Bloom's taxonomy is a classification of the different objectives in the following 3 domains (BLOOM 1984; CHURCHES 2009; CONKLIN 2005):

- "*The Cognitive domain – processing information, knowledge and mental skills*
- *The Psychomotor domain – manipulative, manual or physical skills*
- *The Affective domain – attitudes and feelings*"

Later in 2001, Lorin Anderson, a former student of Bloom revised and updated Bloom's Taxonomy with David Krafthwohl and published *Bloom's Revised Taxonomy* (ANDERSON and KRATHWOHL). which replaced verbs by using nouns to describe the 6 levels of the cognitive domain. Bloom's taxonomy is additionally characterized by its hierarchical structure and different levels. Each level is followed by a higher level. A learner is only able to "apply" (using the knowledge), when he can at first "remember" (memorize the terms, basic concepts or facts) and "understand" (organize, explain or summarize the knowledge) (FOREHAND 2010). This hierarchical structure is useful for determining the extent of knowledge and skills for a specific group of learners.

The aim of the current study was to describe the level of learning objectives and competencies required for residency training and to define the job competencies currently perceived to be important for diploma holders in veterinary neurology. Webster's New World College Dictionary defines competence as "*condition or quality of being competent*" and competent as "*well qualified, capable, fit*." Clavien et al. described in the annual meeting of the Society for Surgery of the Alimentary Tract (SSAT) in 2004: "*The business and industrial community recognizes that high-quality*

products and services are essential to compete in our global economy; Accordingly, the public has expectations that providers of services, including mechanics, hairdressers, lawyers and physicians, will be competent" (CLAVIEN et al. 2005). The same principle can be adapted for the postgraduate education in veterinary neurology; one of the functions of the European College of Veterinary Neurology (ECVN) is to conduct examinations for veterinarians to get the ECVN Diploma and herewith certifying quality and competent services to the public and their animals (EUROPEAN COLLEGE OF VETERINARY NEUROLOGY 2012).

Competence based specialization training in human medicine

Since the late 1990s, competencies for residents in different disciplines of human medicine were discussed and until today competencies and methods of assessment are developed. In 1998, the Accreditation Council for Graduate Medical Education (ACGME) began to develop core competencies for graduate medical education. In 2002, six general competency domains were demanded to be implemented into the residency training programs (SWING 2007; BREADY 2011). In the *Program Requirements for Graduate Medical Education in Neurology* of the ACGME is stated that the purpose of the education program is to assure each resident's development of skills, knowledge and attitudes (ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION 2009). Core curricula for residencies in neurology should be developed and in 2006, the American Academy of Neurology (AAN) implemented the Education Research Work Group (ERWG) to improve the education in neurology and to promote career development for educators in neurology (AMERICAN ACADEMY OF NEUROLOGY 2003; STERN and RODMYRE 2006). In 2005, a European core curriculum for neurology was presented (PONTES 2005) and a questionnaire-based survey on neurology curricula was conducted from 2006 to 2009 to improve patient care in neurology in Europe (STRUHAL et al. 2011).

Specialization training in veterinary medicine

The specialization in veterinary medicine was developed in the late 1980s; 26 veterinarians met at the World Small Animal Veterinary Association (WSAVA)

congress in Harrogate, England in 1989 and discussed the specialization of veterinarians. In 1990, the European Association of Veterinary Specialisation (EAVS) was founded and in 1991 the document *Veterinary Specialisation in Europe* and a liaison committee were implemented (LUMEIJ and HERRTAGE 2006). In 1992, the Advisory Committee on Veterinary Training (ACVT) accepted the report and the recommendation from the liaison committee for the development of the transnational organization of veterinary specialization in Europe. An interim Board of Veterinary Specialisation was founded until 1996 the European Board of Veterinary Specialisation (EBVS) was officially registered (LUMEIJ and HERRTAGE 2006; ROMAGNOLI 2010). The EBVS should recognize new specialty colleges and monitor their quality, register European veterinary specialists and promote specialist service in the public. In 1991, five European Colleges existed and the number increased to 23 in 2012 (EUROPEAN BOARD OF VETERINARY SPECIALISATION 2013).

In contrast to human medicine no general core competencies in veterinary specialization training were developed. Instead, every college individually set up general learning objectives. Under the hypothesis of high standards of knowledge and skills reached by residents in veterinary neurology, the aim of this pilot study was to create a catalog of learning objectives for postgraduate training of veterinary neurology in Europe.

A modified Delphi method with 2 evaluation phases was applied for the collection of objective opinions. The Delphi method has three important features: (1) Anonymous response, (2) Iteration and controlled feedback, (3) Statistical group response. These characteristics prevent personal biases, group pressure (DALKEY et al. 1969) and minimize the “halo error” or “halo effect” (NISBETT and WILSON 1977) that makes the free expression of objective opinions, critics or judgments possible. Based on these characteristics, the opinions from experts could be collected and objective decisions were expected.

3.2.3 MATERIALS AND METHODS

The opinions of experts in the field of veterinary neurology were collected using a modified Delphi method, which consisted of qualitative and quantitative evaluation phases with subsequent statistical evaluation. The ECVN curriculum-working group initialized a draft of competencies, which were revised and evaluated by Experts from the European Society of Veterinary Neurology (ESVN) and the ECVN.

PHASE 1: Initializing of competencies

In this first qualitative phase the initial draft of competencies was based on a questionnaire created by the American College of Veterinary Internal Medicine (ACVIM) to assess competencies for their residents in neurology. The draft of competencies was reviewed by the ECVN curriculum working group consisting of seven veterinary neurologists* from various universities and private practices in Europe. The initial draft was modified and revised according to the comments and suggestions from the curriculum-working group.

The revised competencies consisted of 149 4-point Likert scale questions and 48 free text questions in 9 categories (Appendix 2):

1. Anatomy and Physiology
2. Pharmacology and Toxicology
3. Genetics and Molecular Biology
4. Clinical Methodology
5. Disease Mechanisms
6. Neuroanaesthesia and Neurosurgery
7. Neuroradiology
8. Pathology
9. Competencies in Academia

Moreover, 7 true-false questions and 1 free text question were developed to evaluate a potential “difference between ECVN diplomates and advanced practitioners” (Appendix 3). Additionally, 11 single and multiple-choice demographic questions were created.

PHASE 2: Evaluation of a quantitative questionnaire with revised competencies by ESVN and ECVN members

In the quantitative second phase the revised competencies were put into an online survey – (Surveymonkey®) and distributed to 341 ESVN and ECVN members (142 ESVN members, 72 residents and 127 ECVN Diplomates).

Every participant received a unique link by e-mail, which was active for a 3 months period. During this period the users could pause and continue the questionnaire at any time. About 1.5 hours were needed to finish the complete questionnaire. The learning objectives and the 4-point Likert scale in our study were based on the cognitive and psychomotor domain of Bloom's taxonomy classification. The participants were asked to evaluate the competencies by using the following 4-point Likert scale:

1= Not Necessary
2= As Beginner - Theoretical knowledge: knowing terms
Practical Skills: knowledge of theory by practice
3= As Advanced - Theoretical knowledge: Being able to interpret
Practical Skills: perform under instruction by practice
4= As Expert - Theoretical knowledge: Being able to discuss intellectually
Practical Skills: perform independently

Additionally, an option "No Idea" was available, and responses of this option were excluded from further statistical analysis. The same Likert scale was used for all questions of the competencies, which made the scale a defensible approximation to an interval scale.

With the involvement of human participants in this research project, all data of this study were used anonymously and in a confidential way according to the EU Data Protection Directive 95/46/EC. The data protection officer of the first author's university approved the study. The study was performed under the ethical regulations of the university.

PHASE 3: Statistical evaluation using Fisher's Exact Test

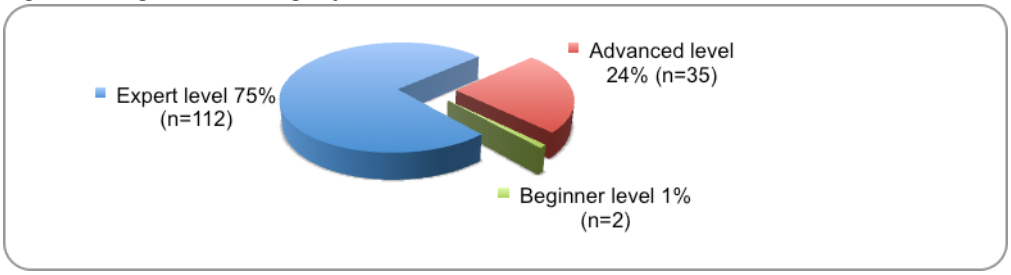
After 3 months the online survey was closed for further analysis. The non-parametric Fisher's Exact Test was used with the statistic software SAS® (Version 9.2) under the assumption of unequal variances, two-tailed distributions and a significance level of 0.05.

3.2.4 RESULTS

A return rate of 62% (n=213/341) was achieved from 341 experts, of which 77% (164/213) of experts (83 ESVN members and 81 ECVN Diplomates) completed the questionnaire. The experts worked mainly in the United Kingdom (27%, n = 44), Germany (18%, n = 30), Italy (14%, n = 23) and Spain (9%, n = 15); 45% worked in Academia, 44% in private specialty practice, 8% in both areas and 3% in industry or other organizations. Moreover, 97% of experts are mainly involved in small animal medicine.

Generally, none of the listed competencies was considered as "not necessary", 75% (n = 112/149) of competencies were expected to reach expert level, 24% (n = 35/149) advanced level and 1% (n = 2/149) beginner level (Fig. 1) (Appendix 2).

Fig. 1 – Rating of the learning objectives



In addition, the 11 most important job competencies graded at expert level could be extracted (Tab. 1). "Clinical examination" and "Disease Mechanisms" were emphasized.

Table 1: Rating of 11 most important job competencies

Competencies	Mean rating
Anatomy and Physiology	
The gross neuroanatomic structures of the cat and dog brain and spinal cord	3.98
Clinical Methodology	
Neurolocalize a lesion based on the examination findings	3.99
Understand the risk factors and contraindications of CSF collection and methods to ameliorate these risks	3.99
Perform cistern magna collection of CSF in the dog and cat	3.98
Perform lumbar collection of CSF in the dog and cat	3.97
Disease mechanisms	
The understanding of CNS diseases according to the VITAMIN-D principal	3.98
The understanding of PNS diseases according to the VITAMIN-D principal	3.99
Seizure disorders of dogs and cats. The understanding of the pathogenesis	3.97
The understanding of the diagnosis and treatment of seizure disorders of dogs and cats	4
Disc disease in dogs and cats. The understanding of the pathogenesis	3.99
The understanding of the diagnosis and treatment of disc diseases in dog and cats	4

100% (n = 7/7) of the competencies in “Genetics and molecular biology”, 46% (n = 11/24) of “Electrodiagnostic tests” and 71% (n = 5/7) of “Neuroradiology” were expected only to reach an advanced level (Appendix 2).

Experts highlighted 2 (1%) competencies and expected them to reach beginner level: „perform urinary tract electrodiagnostic testing in the dog and cat“ and „Apply radiation therapy technique” (Appendix 2).

The six most important/most frequently seen diseases of the central nervous system (CNS) were extracted from free text questions and included epilepsy, intervertebral disk disease (IVDD), granulomatous meningoencephalitis (GME), hydrocephalus, fibrocartilaginous embolus (FCE) and steroid-responsive meningitis-arteritis (SRMA); the six most important diseases of the peripheral nervous system (PNS) included polyradiculoneuritis, polyneuropathy, myasthenia gravis, myositis, botulism and brachial plexus avulsion.

Moreover, the three most frequently used immunosuppressive or anti-inflammatory drugs in veterinary neurology were glucocorticosteroids, azathioprine and cyclosporine; the six most frequently used antiepileptic drugs were benzodiazepine, phenobarbital, potassium bromide, levetiracetam, gabapentin and zonisamide; the ten most frequently used chemotherapeutic drugs included nitrosoureas, cytoarabinosin and nitrogen mustards.

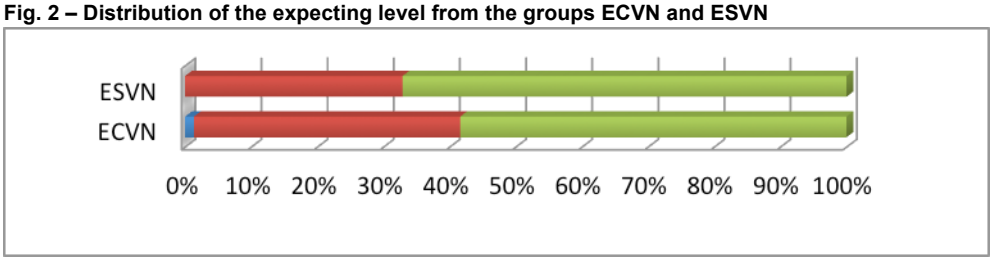
Comparisons between opinions of the following different groups were investigated:

1. ECVN Diplomates and ESVN experts (Residents included)
2. Diplomates in academia and Diplomates in private specialty practice.
3. Experts performing neurosurgery and not performing neurosurgery
4. Experience in neurology of 0-5, 6-10 and >10 Years

Comparison between ECVN Diplomates and ESVN experts

Though 59% (n=87/149) of the competencies were expected from both groups to reach expert level, a slight difference between ECVN and ESVN was found; ESVN members demanded 8% (n=13) more competencies to reach expert level than ECVN Diplomates (Fig. 2). In 22 competencies (Tab. 2) a significant different expectation was found between ECVN and ESVN. 12 (55%) of these competencies were electrodiagnostic tests and 8 (36%) subjects of neuroradiology.

Fig. 2 – Distribution of the expecting level from the groups ECVN and ESVN



	ESVN	ECVN
Beginner	0% (n = 0)	1% (n = 2)
Advanced	33% (n = 49)	40% (n = 60)
Expert	67% (n = 100)	59% (n = 87)

Table 2: Rating the importance of competencies by comparing the groups ESVN and ECVN members; these members rated 22 learning objectives significantly different.

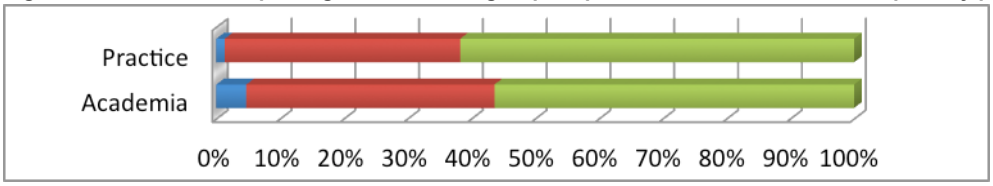
	Mean ECVN	Mean ESVN	P-value
Genetics and Molecular Biology			
The principles of errors of cellular metabolism	3,01	3,26	0,0143
Clinical Methodology			
> EEG			
Perform EEG testing in the dog and cat	2,91	3,42	3,34E-04
Interpret EEG testing in the dog and cat	2,96	3,45	7,85E-05
> EMG			
Perform EMG and nerve conduction testing in the horse.	3	3,35	0,0224
Perform single fiber EMG testing in the dog and cat.	2,58	3,15	0,001
Interpret single fiber EMG testing in the dog and cat.	2,93	3,35	0,0183
> SSEP			
Perform somatosensory evoked potential testing in the dog and cat	2,85	3,39	3,77E-04
Interpret somatosensory evoked potential testing in the dog and cat	3,08	3,55	5,79E-04
> OEA			
Perform otoacoustic emission testing in the dog and cat	2,53	3,07	0,0017
Interpret otoacoustic emission testing in the dog and cat	2,73	3,25	0,0043
> VEP			
Perform visual evoked potential testing in the dog and cat	2,48	2,95	0,009
Interpret visual evoked potential testing in the dog and cat	2,67	3,12	0,0092
> urinary tract electro. Testing			
Perform urinary tract electrodiagnostic testing in the dog and cat	2,25	2,63	0,0282
Neuroradiology			
> Theory			
Understand CT scanning technique	3,65	3,67	0,0386
Understand CT physics	3,1	3,15	0,0488
Understand MRI scanning technique	3,64	3,6	0,0011
Understand MRI physics	3,03	3,25	0,0047
Understand nervous system ultrasound technique	2.96	3.23	0.0368
> Practical			
Ability to perform myelography in the horse	2,63	3,12	0,0036
Apply radiation therapy technique	2,16	2,56	0,0339
Academia Competencies			
In laboratorium	2,94	3,27	0,023
In epidemiology	2,87	3,24	0,0204

- Values in filled cells have higher mean rating.

Comparison between Diplomates in academia and in specialty practice

In 56% (n=84/149) of the competencies both groups agreed on reaching expert level (Fig. 3). A slight difference in the opinion of these two groups was detected. 6% more job competencies were expected from Diplomates in specialty practice to reach expert level. In contrast, seven competencies were considered only to reach beginner's level by the group working in academia. In four competencies significant differences between the two groups were found (Tab. 3).

Fig. 3 – Distribution of expecting level from the groups Diplomates in academia and in specialty practice



	Practice	Academia
Beginner	1% (n = 2)	5% (n = 7)
Advanced	37% (n = 55)	39% (n = 58)
Expert	62% (n = 92)	56% (n = 84)

Tab. 3: Rating the importance of competencies by comparing the groups Diplomates in academia and in specialty practice; these members rated 3 learning objectives significantly different.

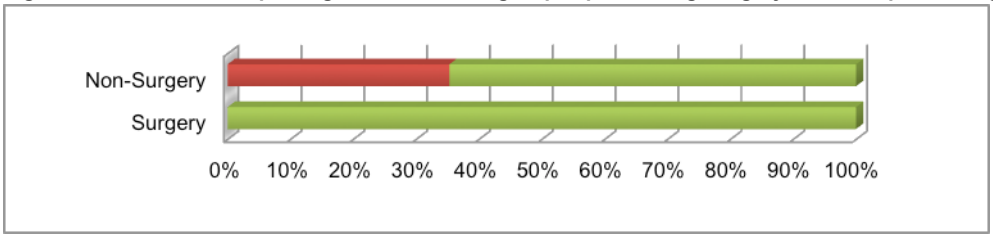
Learning objectives	Diplomates in Academia	Diplomates in Practice	P-value
Clinical Methodology			
Interpret urinary tract electrodiagnostic testing in the dog and cat	2,4	2,71	0,0085
Neuroanaesthesia & Neurosurgery			
Atlantoaxial subluxation fixation techniques	3,17	3,56	0,0236
Pathology			
Understand basic PNS pathological interpretation	3,48	3,77	0,0394
Understand microscopic pathological features of specific small animal diseases	3,47	3,6	0,0114

- Values in filled cells have higher mean rating.

Comparison between experts performing neurosurgery and not-performing neurosurgery

The comparisons between these two groups were limited to the 17 job competencies included in the categories “Neuroanaesthesia and Neurosurgery”. Experts performing neurosurgery expected from residents to reach an expert level in all job competencies in the categories “Neuroanaesthesia and Neurosurgery”. In contrast, experts not performing neurosurgery considered only 65% (n = 11/17) of these objectives to reach expert level (Fig. 4). Ten competencies showed significant differences between both groups, 9 of these received higher mean ratings from experts who were performing neurosurgery (Tab. 4).

Fig. 4 – Distribution of expecting levels from the groups "performing Surgery" and Not-performing" Surgery



	Non-surgery	Surgery
Beginner	0% (n = 0)	0% (n = 0)
Advanced	35% (n = 6)	0% (n = 0)
Expert	65% (n = 11)	100% (n = 17)

Table 4: In 10 competencies significant differences were detected between the groups "performing Surgery" and "Not-performing Surgery"

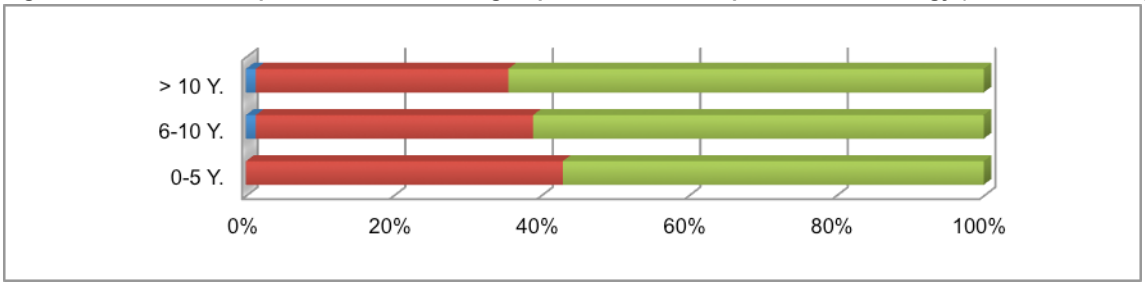
	Mean Non-Surgery	Mean Surgery	P-value
Neuroanaesthesia & Neurosurgery			
> Theory			
Understand fluid therapy for a neurological patient	3,91	3,73	0.0241
> Practical			
Ventral slot	3.67	3.89	0.0014
Thoracolumbar hemilaminectomy	3.7	3.93	1.58E-04
Dorsal laminectomy of cervical spine	3.59	3.79	0.0212
Fenestration	3.65	3.9	2.86E-05
Ventriculo-peritoneal shunt	3.22	3.51	0.0306
Craniotomy / Craniectomy	3.3	3.62	0.01
Fracture repair	3.22	3.53	0.0133
Dorsal laminectomy of lumbosacral spine	3.52	3.8	0.0018
Atlantoaxial subluxation fixation techniques	3.26	3.57	0.0331

- Values in filled cells have higher mean rating.

Comparison according to the experience in neurology of 0-5, 6-10 and >10 years

For all three groups a similar pattern in the distribution of the expected levels was found. However, the experts with more than ten years of experience in neurology expected more competencies to reach expert level than the other two groups (Fig. 5). Significant differences were found in 11 learning objectives between groups with 0-5 and 6-10 years experience (Tab. 5), 9 learning objectives between groups with 6-10 and >10 years experience (Tab. 6), and 16 between groups with 0-5 and >10 years experience (Tab. 7).

Fig. 5 – Distribution of expected levels from the groups with different experience in neurology (0-5, 6-10 and >10 years)



	0-5 Y.	6-10 Y.	> 10 Y.
Beginner	0% (n = 0)	1% (n = 2)	1% (n = 2)
Advanced	43% (n = 64)	38% (n = 56)	34% (n = 51)
Expert	57% (n = 85)	61% (n = 91)	65% (n = 96)

Table 5: 11 competencies with significant difference between the groups with different experience in neurology (0-5, 6-10 years)

	Mean 0-5	Mean 6-10	P-value
Pharmacology and Toxicology			
> pharmacodynamic and Pharmacokinetic			
The major neurotransmitters and their receptors of the central and peripheral nervous system	3.79	3.74	0.0269
Genetics and Molecular Biology			
How to investigate a breed related disorder for an underlying genetic mutation	3.21	3.33	0.0384
Clinical Methodology			
> EEG			
Perform EEG testing in the dog and cat	3.38	3.05	0.0128
Interpret EEG testing in the dog and cat	3.4	3.09	0.0063
> EMG			
Perform single fiber EMG testing in the dog and cat.	3.14	2.6	0.0041
Neuroradiology			
Understand nervous system ultrasound technique	2.96	3.1	0.0484
Pathology			
Exhibit competence in CSF cytological interpretation in small animals	3.64	3.88	0.0188
Exhibit competence in CSF sample examination (protein content, cell counting)	3.53	3.88	0.0273
Understand microscopic pathological features of specific horse diseases	3.15	3.18	0.0262
Academia Competencies			
In teaching for undergraduates	3.55	3.88	0.0126
In teaching for postgraduates	3.53	3.85	0.0092

- Values in filled cells have higher mean rating.

Table 6: 9 competencies with significant difference between the groups with different experience in neurology (6-10 and >10 years)

	Mean 6-10	Mean >10	P-value
Genetics and Molecular Biology			
The difference between transcription versus translation	2.81	3.13	0.0439
The genome organization and chromosome structure	2.81	3.11	0.0405
The inheritance patterns and types of mutations	3.07	3.42	0.022
The principles of common molecular genetic tools (laboratory methods; SNPs, microsatellite mapping, candidate genes)	2.65	3.08	0.0146
Clinical Methodology			

> Bone marrow aspiration & core biopsy			
Interpret results of bone marrow aspirate and or core biopsy	2.74	2.97	0.0242
Neuroanaesthesia & Neurosurgery			
Understand anesthesia of the neurological patient	3.52	3.74	0.0023
Neuroradiology			
Understand CT scanning technique	3.62	3.77	0.0154
Pathology			
Understand Infectious disease testing techniques (PCR / Western blot / Serology)	3.05	3.4	0.0248
Academia Competencies			
In statistics	2.87	3.11	0.0306
- Values in filled cells have higher mean rating.			

Table 7: 16 competencies with significant difference between the groups with different experience in neurology (0-5 and >10 years)

	Mean 0-5	Mean >10	P-value
Pharmacology and Toxicology			
> Pharmacodynamic and Pharmacokinetic			
The difference between pharmacokinetics and pharmacodynamic qualities of drugs and the parameters used to quantify these qualities	3.28	3.52	0.0361
> Chemotherapeutic drugs			
The pharmacokinetics of chemotherapeutic drugs for nervous system neoplasia / Inflammation	3.35	3.52	0.0328
Clinical Methodology			
> CSF			
Interpret laboratory results of CSF	3.91	4	0.0424
> EEG			
Perform EEG testing in the dog and cat	3.38	3.07	0.0459
Interpret EEG testing in the dog and cat	3.4	3.12	0.0187
> Urinary tract electro. Testing			
Interpret urinary tract electrodiagnostic testing in the dog and cat	2.81	2.79	0.0345
Disease Mechanisms			
> Disc Disease			
Disc disease in horses. The understanding of the pathogenesis	3.43	3.29	0.0342
> Micturition Disorders			
Micturition disorders of ruminants / food animals. The understanding of the pathogenesis	3.21	2.97	0.0377
Neuroanaesthesia & Neurosurgery			
Understand peri-operative antibiotic recommendations	3.68	3.87	0.0461
Ventral slot	3.9	3.73	0.036
Neuroradiology			
Understand CT scanning technique	3.55	3.77	0.0019
Understand nuclear medicine technique	2.73	2.95	0.0386
Ability to interpret radiographs of the skull	3.7	3.89	0.0032
Pathology			
Exhibit competence in CSF cytological interpretation in small animals	3.64	3.89	0.0345
Exhibit competence in CSF sample examination (protein content, cell counting)	3.53	3.68	0.0134
Understand Infectious disease testing techniques (PCR / Western blot / Serology)	3.11	3.4	0.0052
- Values in filled cells have higher mean rating.			

Difference between Diplomates and advanced practitioners

Experts expect that Diplomates have a detailed understanding of veterinary neurology in a clinical setting, an advanced level in research as well as competencies in teaching, while advanced practitioners were not expected to prove competencies in teaching and research.

3.2.5 DISCUSSION

Although the whole questionnaire included 149 4-point Likert scale questions and 49 questions in free text form and about 90 minutes were needed to complete it, the response rate was still satisfactory with a 62% return rate and a 77% overall response rate. Experts in veterinary neurology seem to have a genuine interest in teaching matters.

In contrast to “learning objectives for undergraduate studies in veterinary neurology” (LIN et al. 2013, manuscript submitted), where undergraduates were expected to reach beginner level in 71% of learning objectives and 26% of learning objectives were considered as “not necessary”, residents and Diploma holders of the ECVN were expected to reach experts level in 75% of competencies and none of them was regarded as “not necessary”. Neurology education for undergraduates requires a minimum body of clinical neurology knowledge and skills, without considering their eventual career path (GELB et al. 2002). For Specialist postgradual training, the requirements of knowledge and skills are expected on a much higher level as shown in the current study.

Surprisingly, in the current study a different opinion was detected between Diplomates working in academia and Diplomates working in private specialty practice. Experts working in private specialty practice expected in all learning objectives, which show significance, higher mean rating than experts in academia. Similar observations occurred also by comparison between ESVN and ECVN members. Experts of the ESVN expected in 21 of 22 significant learning objectives also higher mean rating than ECVN Diplomates.

This phenomenon might be explained by the different focus of these groups. Diplomates in academia have a multitude of tasks and have to find a balance between teaching, research and service. Besides working on clinical cases they constantly have to deal with undergraduate and postgraduate students and have to foster research. In most clinics of Universities several specialists treat single animals in fruitful collaboration. In contrast, Diplomates in private specialty practice focus more on expanding their competencies to manage a bigger variety of patients independently. This difference in the job description may explain the slightly higher expectation in clinical knowledge and skills.

Surprisingly, the learning objectives in the field of “electrodiagnostic tests” received controversial results. In total only 35 competencies were expected to reach an advanced level and 11 (31%) of these competencies were in the electrodiagnostic tests category (Appendix 1). Moreover, 12 of 22 (55%) learning objectives, which showed significant differences between ESVN and ECVN experts, were also in the electrodiagnostic tests category. According to this result the college has to discuss the depth of education and outcome evaluation in this specific field of neurology.

Besides the requirement of reaching the highest standard in the field of clinical neurology and research, ECVN Residents and ECVN Diplomates are expected to possess teaching competencies. These competencies may distinguish the job specification of Diplomates and advanced practitioners. Veterinary Continuous Education in Europe (VetCEE) assigned a role for Diplomates as trainers in postgraduate education of veterinarians in whole Europe (BLAHA 2012). The competencies of teaching should therefore also be part of a residency training, as the neurologist William A. Pulsinelli expressed “Residents are encouraged to teach the teacher and thereby enrich everyone’s education” (HEALTH SCIENCE CENTER UNIVERSITY OF TENNESSEE 2013).

In the current study the six most important disease processes of the CNS and PNS were defined. Also the three most frequently used immunosuppressive, antiepileptic and chemotherapeutic drugs were extracted from free text questions. Knowledge about such diseases and drugs may be considered as part of content of the examination (EUROPEAN COLLEGE OF VETERINARY NEUROLOGY 2009).

Using the Delphi-method made it possible to collect objectively the opinion of learners (residents; “learner-centered”) and trainers (Diplomates; “teacher-centered”), which can be used for curriculum adaption. The learner-centered focus includes frequently the need, skills and interests of the learner, which is often accompanied by a problem-based approach providing active learning and high motivation (NORMAN and SPOHRER 1996). The opinions of residents from the questionnaire should be therefore considered in the design of resident training.

A limitation of the current study is the limited consideration of affective elements, one of the three domains of educational objectives in Bloom’s taxonomy (BLOOM 1984). In the field of medicine, communication skills, dealing with ethical matters and interprofessional relations are important (ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION 2009). Such professional attitudes have received increasing attention in the recent years, while traditionally only little attention in medical education was perceived (CATE and DE HAES 2000). For a better and safe practice, “The Good Medical Practice” (GMP) from the General Medical Council of United Kingdom has set certain standards expected of all doctors (PALMER et al. 2002; GENERAL MEDICAL COUNCIL 2009). Also the glossary of terms from ACGME defines that “competencies” are not only confined to specific knowledge and skills, but should also include behavior and attitudes in graduate medical education (ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION 2011). In the future, the affective elements in veterinary postgraduate education should be also investigated and assessed, but could be part of a general training provided by all specialty colleges.

3.2.6 CONCLUSION

The results of our study confirmed the hypothesis that the majority of competencies are expected to reach expert level for ECVN residents and ECVN Diplomates to meet their job requirements. In addition to advancing scientifically knowledge and clinical skills, they are also expected 1) to have completed a well-structured training program of adequate length under direct supervision, 2) to be active in advanced teaching and 3) to be able to interact and communicate in a professional manner with a variety of stakeholders, including other experts and the public. The taxonomic catalog of learning objectives in the current study could be used by the ECVN to adapt their postgraduate curriculum. Moreover, regarding the continually developing of veterinary specialism, a periodic reevaluation of competencies should be conducted to guarantee the up to date status of the curriculum.

*Members of ECVN curriculum working group included H.A. Volk, J. Penderis, T.J. Anderson, S. Añor, A.L. Feliu-Pascual, V.M. Stein and A. Tipold. The work of ESVN and ECVN members is highly acknowledged.

3.2.7 REFERENCES

ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION (2009):
ACGME Program Requirements for Graduate Medical Education in Neurology. ACGME, Chicago, S. 24 – 26
[Internet: URL: http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/180_neurology_07012010.pdf]

ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION (2011):
ACGME – Glossary of Terms. ACGME, Chicago, S. 7 – 8
[Internet: URL: http://acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/ab_ACGMEglossary.pdf]

AMERICAN ACADEMY OF NEUROLOGY (2003):
Graduate Education Subcommittee Residency Core Curriculum.

American Academy of Neurology, Chicago, S. 3 – 9
[Internet: URL: http://www.aan.com/globals/axon/assets/2748.pdf]

ANDERSON, L. W., and D. R. KRATHWOHL (2001):
A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
4.Ed., Publisher Longman, New York

BLAHA, T. (2012):
What about the VetCEE.
The EBVS Newsletter, (5), 9 – 10
[Internet: URL: http://www.ebvs.org/news]

BLOOM, B. S. (1984):
Taxonomy of Educational Objectives: The Classification of Educational Goals.
Handbook 1: Cognitive Domain.
2.Ed., Publisher Addison Wesley, Boston

BREADY, L. L. (2011):
The Graduate Medical Education Community's Responsibility for Producing a Fully Trained Physician.
In D. PHILIBERT and D. AMIS (Eds.): The ACGME 2011 Duty Hour Standard - Enhancing Quality of Care, Supervision and Resident Professional Development.
Publisher Accreditation Council for Graduate Medical Education, S. 81 – 85

CATE, T. J. TEN and J. C. J. M. DE HAES (2000):
Summative Assessment of Medical Students in the Affective Domain.
Medical Teacher 22(1), 40 – 43

EUROPEAN CENTRE FOR THE DEVELOPMENT OF VOCATIONAL TRAINING (2010):
Learning Outcomes Approaches in VET Curricula.
Publisher Publications Office of the European Union, Luxembourg
[Internet: URL: http://www.cedefop.europa.eu/EN/Files/5506_en.pdf]

CHURCHES, A. (2009):
Bloom's Digital Taxonomy.
[Internet: URL: http://edorigami.wikispaces.com/Bloom's+Digital+Taxonomy]

CLAVIEN, P.-A., D. L. NAHRWOLD, N. J. SOPER and B. L. BASS (2005):
Physician Competency? Teaching Old Dogs New Tricks.
Journal of Gastrointestinal Surgery, 9(5), 625–32

DALKEY, N. C., B. B. BROWN and S. COCHRAN (1969):
The Delphi method.
Publisher Rand Corporation, California

EUROPEAN BOARD OF VETERINARY SPECIALISATION (2013):
College of EBVS.
[Internet: URL: http://www.ebvs.org/index.php/colleges2]

EUROPEAN COLLEGE OF VETERINARY NEUROLOGY (2009):
Guidelines for Admission to the Certification Examination of the European College of Veterinary Neurology.
[Internet: URL: http://www.ecvn.org/ecvn/education/residency/training/TrainingGuidelines.pdf]

EUROPEAN COLLEGE OF VETERINARY NEUROLOGY (2012):
Constitution of ECVN.
[Internet: URL: http://www.ecvn.org/ecvn/constitution.pdf]

FOREHAND, M. (2010):
Bloom's Taxonomy - Emerging Perspectives on Learning, Teaching and Technology.
[Internet: URL: http://projects.coe.uga.edu/epltt]

GELB, D. J., C. H. GUNDERSON, K. A. HENRY, H. S. KIRSHNER and R. F. JÓZEFOWICZ (2002):
The Neurology Clerkship Core Curriculum.
Neurology, 58(6), 849–852

GENERAL MEDICAL COUNCIL (2009):
Good Medical Practice.
Publisher General Medical Council, Great Britain
[Internet: URL: http://www.gmc-uk.org/guidance]

HARDEN, R. M. (2002):
Learning Outcomes and Instructional Objectives: Is There a Difference?
Medical teacher, 24(2), 151–155

UNIVERSITY OF GUELPH (2013):
Learning Objectives.
[Internet: URL: http://www.uoguelph.ca/tss/resources/index.cfm]

LIN, Y.-W., H. VOLK, J. PENDERIS, A. TIPOLD and J. P. EHLERS (2013):
Undergraduate studies: defining learning objectives for veterinary neurology with the help of experts of the European Specialist College (ECVN/ESVN).
Journal of Veterinary Medical Education. (manuscript submitted)

LUMEIJ, J. T. and M. E. HERRTAGE (2006):
Veterinary Specialization in Europe.
Journal of Veterinary Medical Education, 33(2), 176–179

NISBETT, R. E. and T. D. WILSON (1977):
The Halo Effect: Evidence for Unconscious Alteration of Judgments.
Journal of Personality and Social Psychology, 35(4), 250–256

NORMAN, D. A. and J. C. SPOHRER (1996):
Learner-centered education.
Communications of the ACM, 39(4), 24–27

PALMER, K. T., C. C. HARLING, J. HARRISON, E. B. MACDONALD and D. C. SNASHALL (2002):
Good Medical Practice: Guidance for Occupational Physicians.
Occupational Medicine (Oxford, England), 52(6), 341–352

PONTES, C. (2005): Recommended Core Curriculum for a Specialist Training Program in Neurology.
European Journal of Neurology, 12(10), 743–746

ROMAGNOLI, S. (2010):
The European System of Veterinary Specialization.
Journal of Veterinary Medical Education, 37(4), 334–339

STERN, B. J. and S. K. RODMYRE (2006):
The imperative for neurology educational research.
Neurology, 67(8), 1521–1521

STRUHAL, W., J. SELLNER, V. LISNIC, L. VÉCSEI, E. MÜLLER and W. GRISOLD (2011):
Neurology residency training in Europe--the current situation.
European journal of neurology, 18(4), e36 – e40

SWING, S. R. (2007):
The ACGME outcome project: retrospective and prospective.
Medical teacher, 29(7), 648–654

HEALTH SCIENCE CENTER OF THE UNIVERSITY OF TENNESSEE (2013):
Residency Training Program Overview.
[Internet: URL: http://www.uthsc.edu/neurology/education_training.php]

4 Übergreifende Diskussion

Obwohl etwa 1,5 Stunden benötigt wurden, um den Fragebogen komplett auszufüllen, erreichte die Rücklaufquote 62% (n=213/341). Diese hohe Rücklaufquote weist auf Interesse und Wertschätzung der Experten für Lernziele und Entwicklung eines Curriculums in der Veterinärneurologie hin. Besonders für Diplomates ist das Lehren eine verpflichtende Aufgabe (ROMAGNOLI 2010; BLAHA 2012).

Bei der Auswertung demographischer Daten der vorliegenden Studie wurde erfasst, dass 97% der Experten in Veterinärneurologie vorwiegend in der Kleintiermedizin arbeiten. In den 1980er Jahren wurde in den USA beschrieben, dass sich Tiermediziner immer mehr auf kleine Haustiere anstatt auf landwirtschaftliche Nutztiere konzentrieren. Verschiedene Analysen wurden durchgeführt, um auf diese Veränderungen und Herausforderungen in der zukünftigen Tiermedizin reagieren zu können (BROWN und SILVERMAN 1999; LLOYD 2002; BURNS et al. 2006).

In vorliegender Studie wurden die Lernziele zunächst für Studierende erfasst. Einige werden als „nicht notwendig“ angesehen, viele erhielten die Kennzeichnung „Anfänger-Niveau“. Nur für 3% der Lernziele wurde ein Fortgeschrittenen-Niveau bei Studierenden erwartet. Diese Lernziele waren alle in den Kategorien „Labor“ und „Radiologie“ enthalten. Die zehn Lernziele mit den höchsten Noten könnten als „Day-One-Skills“ identifiziert werden, sind also Lernziele bzw. Kompetenzen, die Studierende zum Zeitpunkt des Studiumabschlusses können bzw. besitzen sollten: Interpretation von Blut- und Harnbefunden, Verstehen und Interpretation von Funktionstests (Leber, Endokrinologie), Beurteilung von Röntgenbildern (Thorax, Abdomen, Wirbelsäule, Extremitäten), Neurolokalisation, Interpretation der Befunde der neurologischen Untersuchung, Verstehen von Erkrankungen des Nervensystems nach dem VETAMIN D Schema, Verstehen der Diagnostik, Therapie und

Pathogenese von Bandscheibenerkrankungen bei Hund und Katze, Verstehen der Diagnostik und Behandlung von Krampfanfällen.

In 71% der Lernziele wird von Studierenden ein Anfängerniveau erwartet. Dabei sollen Studierende Grundlagen in der Theorie erkennen können. Ihre Kenntnisse und Fertigkeiten werden in der späteren postgradualen Spezialisierungsphase vertieft. Die Motivation hierfür muss jedoch im Grundstudium gelegt werden. Für die Ausbildung der Residents in Veterinärneurologie werden daher Kenntnisse und Fertigkeiten nur in 1% im Anfängerniveau und in 24% im Fortgeschrittenen-Niveau erwartet. Der Rest der Lernziele hat die Klassifizierung „Experten-Niveau“ erhalten. Residents müssen als Spezialisten in der Veterinärneurologie in den meisten Kompetenzen den höchsten Standard erreichen, um den Diplomate-Grad erlangen zu können.

Außerdem zeigten sich beim Vergleich zwischen Grundstudium und postgradualem Training besonders große Erwartungsunterschiede in der Kategorie „Klinische Methodologie“, vorwiegend in der „Elektrodiagnostik“, „Neuroanästhesie“, „Neurochirurgie“ und „Neuroradiologie (CT / MRT)“. Der große Niveauunterschied weist darauf hin, dass die Ausbildung für Studierende in klinischen neurologischen Kenntnissen und Fertigkeiten minimale Anforderungen stellt, ohne ihre zukünftige Karriere zu berücksichtigen (GELB et al. 2002). Das Berufsbild eines Tierarztes / einer Tierärztin ist so vielfältig, dass eine intensive Ausbildung in die postgraduale Phase fallen muss. Die großen Erwartungsunterschiede beziehen sich meist auf Fertigkeiten, die durch Wahlpflichtkurse ergänzt werden könnten, um bereits im Grundstudium Interesse für diese Spezialdisziplin zu wecken. E-Learning ist eine ideale Ergänzungsmöglichkeit zum Unterricht. So bietet zum Beispiel die Plattform TiHo-CASUS verschiedene interaktive Themen in der Veterinärneurologie an und wird als effiziente Lehrmethode betrachtet (BÖRCHERS et al. 2010; KOCH et al. 2010). Außerdem bieten Skills Lab eine alternative Möglichkeit für die Lernenden zum Üben klinischer Fertigkeiten an (SCALESE und ISSENBERG 2005).

Für das Grundstudium wurden die Ergebnisse, die in deutschsprachigen und nicht-deutschsprachigen Ländern erhalten wurden, verglichen, um feststellen zu können, ob eine kleine Gruppe europäischer Länder eine andere Meinung hat, als der gesamte europäische Raum. Die Ergebnisse zeigten signifikante Unterschiede nur in drei Lernzielen. Die Tätigkeit der EAEVE könnte diese Gleichförmigkeit erklären. Die Aufgabe der EAEVE ist es, die Qualität der veterinärmedizinischen Ausbildung aller Mitgliedsstaaten der Europäischen Union sicherzustellen (EUROPEAN ASSOCIATION OF ESTABLISHMENT FOR VETERINARY EDUCATION 2013).

Mittels Freitextantworten wurden auch die drei wichtigsten Erkrankungen des zentralen Nervensystems (1. Epilepsie, 2. Diskopathie, 3. Entzündungen) sowie die vier wichtigsten Erkrankungen des peripheren Nervensystems / der Muskulatur (1. Polyradikuloneuritis, 2. Myasthenia Gravis, 3. Intoxikation, 4. Polymyositis) ermittelt.

Die Ergebnisse der Umfrage zeigten weiterhin, dass von Residents und Diplomates erwartet wird, Lehrkompetenzen zu besitzen. Lehrkompetenzen sind wichtige Bestandteile der Berufskompetenzen von Diplomates. Die Gruppe „Veterinary Continuous Education in Europe“ (VetCEE) definiert Diplomates als Trainer / Lehrer in der postgradualen Ausbildung der Tiermedizin in Europa (BLAHA 2012). Die Lehrkompetenzen sollen daher auch im Training von Residents, den zukünftigen Diplomates, enthalten sein. Außer fachlichen Erkenntnissen und Fertigkeiten auf Expertenniveau und Besitz von Lehrkompetenzen wird Folgendes im postgradualen Training erwartet: ein gut aufgebautes Trainingsprogramm in angemessener Zeit unter Aufsicht und eine professionelle Interaktion und Kommunikation mit anderen Experten auf hohem Niveau.

Die Limitation der vorliegenden Studie ist die Nichtberücksichtigung von affektiven Lernzielen, die eine der drei Domänen in Blooms Taxonomie sind. Die Lernziele der Studie umfassten nur kognitive und psychomotorische Lernziele. In der Medizin beinhaltet die affektive Domäne Kommunikationsfähigkeit, Umgehen mit ethischen Themen und interdisziplinäre Beziehungen, welche in den letzten Jahren mehr

Aufmerksamkeit erhielten (CATE und DE HAES 2000). Eine Studie von Carol E. Tinga et al. (2001) zeigte, dass die meisten Studierenden sich inkompetent fühlen, schlechte Nachrichten mitzuteilen, mit anspruchsvollen Besitzern zu sprechen, oder mit Fragen der Euthanasie umzugehen (TINGA 2001). Neben medizinischen Kenntnissen und Fertigkeiten ist eine gute Einstellung für einen Mediziner / Tiermediziner wichtig. Die sogenannte „Good Medical Practice“ wurde vom Rat des Vereinigten Königreichs publiziert, um einen guten Mediziner zu definieren (PALMER et al. 2002; GENERAL MEDICAL COUNCIL 2009). Auch im Glossarium von ACGME wird definiert, dass die Kompetenzen in der medizinischen Ausbildung nicht nur Kenntnisse und Fertigkeiten enthalten sollen, sondern auch Verhalten und Einstellung wesentlich sind (ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION 2011).

Veterinärneurologie ist eine Spezialdisziplin mit ständigem Wachstum und eng mit Innerer Medizin, Chirurgie, Bildgebung und Labordiagnostik assoziiert. Eine Entwicklung des Curriculums in der Veterinärneurologie ist notwendig und könnte in der Zukunft als Beispiel für andere Spezialdisziplinen in der Curriculumentwicklung genutzt werden. Eine interinstitutionelle Kooperation kann wertvolle Synergien für „Lernen und Lehren“ liefern (WATERMAN et al. 2011). Die vorliegende Untersuchung ermöglicht, einen europaweit abgestimmten Lernzielkatalog „Veterinärneurologie“ vorzulegen und kann auch als Pilotprojekt für andere Disziplinen gesehen werden.

5 Zusammenfassung

Lin, Yu-Wei:
Entwicklung eines Europäischen Lernzielkataloges für Veterinärneurologie

Mit zunehmendem Bedarf und steigenden Qualitätsanforderungen in der „Veterinärneurologie“ ist es erforderlich, Lernziele für diese Spezialdisziplin für das Grundstudium und die postgraduale Ausbildung zu untersuchen und damit eine Verbesserung der Curriculumsentwicklung zu ermöglichen. Entsprechend der Blooms Taxonomie werden Lernziele als kognitiv, psychomotorisch und affektiv klassifiziert, sie folgen hierarchisch strukturierten Unterteilungen. Lernziele vermitteln eine klar definierte und zielorientierte Leitlinie für Lernende und sind bedeutsam für Prüfungen, Lehrevaluation und Curriculumsentwicklung.

In vorliegender Studie sollten die Lernziele in Veterinärneurologie für das Grundstudium und die postgraduale Resident-Ausbildung quantitativ und qualitativ untersucht werden, um einen Lernzielkatalog zu entwickeln. Berufskompetenzen der Diplomates des European College of Veterinary Neurology (ECVN) wurden erfasst.

Eine Befragung zu den Lernzielen wurde mit einer modifizierten Delphi-Methode und mit Hilfe von europäischen Experten der European Society of Veterinary Neurology (ESVN) und des ECVN durchgeführt. Die erste Phase umfasste die qualitative Entwicklung eines Fragebogens durch die Curriculum-Arbeitsgruppe des ECVN. Dieser beinhaltete 140 Lernziele (exklusive 5 Freitextfragen) in 8 Kategorien für Studierende und 149 Lernziele (exklusive 48 Freitextfragen) in 9 Kategorien für die postgraduale Ausbildung. In der zweiten Phase wurde ein quantitativer Onlinefragebogen mit 4-stufiger Likert-Skala an 341 Mitglieder von ESVN und ECVN versandt und für eine 3 Monate dauernde Bewertungszeit aktiviert. In der dritten Phase wurde die Bögen ausgewertet und statistische Berechungen mit SAS® angeschlossen.

Eine Rücklaufquote von 62% (n=213/341) wurde erreicht. Für das Grundstudium wurden 26% der Lernziele als „nicht notwendig“, 71% im Anfängerniveau und nur 3% im fortgeschrittenen Niveau erwartet. Im Gegensatz dazu wurden für das postgraduale Training 75% der Lernziele auf Expertenniveau, 24% im fortgeschrittenen Niveau und nur 1% im Anfängerniveau erwartet. 10 Day-One-Skills für Studierende wurden identifiziert: Interpretation von Blut- und Harnbefunden, Verstehen und Interpretation von Funktionstests (Leber, Endokrinologie), Beurteilung von Röntgen (Thorax, Abdomen, Wirbelsäule, Extremitäten), Neurolokalisation, Interpretation der Befunde der neurologischen Untersuchung, Verstehen von Erkrankungen des Nervensystems nach dem VETAMIN D Schema, Verstehen der Diagnostik, Therapie und Pathogenese von Bandscheibenerkrankungen bei Hund und Katze, Verstehen der Diagnostik und Behandlung von Krampfanfällen. Außerdem wurden mittels Freitextantworten die drei wichtigsten Erkrankungen des zentralen Nervensystems (Epilepsie, Diskopathie und Entzündung), sowie die vier wichtigsten Erkrankungen des peripheren Nervensystems/der Muskulatur (Polyradikuloneuritis, Myasthenia Gravis, Intoxikation, Myositis) identifiziert.

Mit Hilfe des Lernzielkatalogs besteht die Realisierbarkeit einer Modernisierung und Verbesserung der Qualität von Lernen, Lehren und einer Curriculumsentwicklung in der Veterinärneurologie in Europa. Die Ergebnisse dieser Studie können als Orientierung für das Grundstudium und das postgraduale Training genutzt werden und als Beispiel für die Entwicklung europäischer Lernzielkataloge in anderen Spezialdisziplinen der Tiermedizin dienen.

6 Summary

Lin, Yu-Wei:

Development of a European Catalog of Learning Objectives for Veterinary Neurology

Because of the growing field of veterinary neurology a need exists to define learning objectives for undergraduate and postgraduate training in this discipline to improve the development of a curriculum and the quality of teaching. Learning objectives are according to Bloom's taxonomy classified as cognitive, psychomotor and affective and have a hierarchical structure. Learning objectives should be clearly defined and give a guideline for students. They are significant for evaluation of teaching and the development of a curriculum.

In the current study learning objectives should be examined quantitatively and qualitatively for undergraduate and postgraduate training and job competencies of Diplomates of the European College of Veterinary Neurology (ECVN) should be defined. Based on these results, the substantial learning objectives and the level to be reached could be defined and for the first time a catalog of learning objectives for veterinary neurology in a European framework for different educational levels could be established.

With the help of specialists of the European Society of Veterinary Neurology (ESVN) and the ECVN a questionnaire using a modified Delphi-method was developed and evaluated. In the first phase a qualitative questionnaire was developed by the curriculum working group of the ECVN including 140 learning objectives (exclusive 5 free text questions) in 8 categories for undergraduates and 149 learning objectives (exclusive 48 free text questions) in 9 categories for postgraduate training. In the second phase, a quantitative online questionnaire with a 4-point Likert scale was send to 341 members of ESVN and ECVN and activated for 3 months for evaluation. In the third phase, statistics were calculated using SAS®.

The return rate was 62% (n=213/314). For undergraduate education only 26% of the learning objectives were considered as “not necessary”, 71% to reach beginner’s level and only 3% to reach advanced level. In contrast, 75% of learning objectives were expected to reach expert’s level, 24% to reach advanced level and only 1% to reach beginner’s level in the postgraduate training. In addition, 10 Day-One-Skills for undergraduates were identified: interpretation of laboratory tests (hematology, blood chemistry and urinalysis), understanding and interpretation of organ function tests (liver, endocrinology), interpretation of radiographs of the abdomen, thorax, axial and appendicular skeleton, neurolocalization, interpretation of neurological examination, understanding of nervous system disorders according to the VITAMIN-D system, understanding of diagnosis, treatment and pathogenesis of disc disease, understanding of diagnosis and treatment of seizures in dogs and cats. Moreover, the three most important diseases of the central nervous system were defined (seizures, discopathy and inflammation) and the four most important diseases of the peripheral nervous system/muscles (polyradiculoneuritis, myasthenia gravis, intoxication, myositis).

With the help of the catalog of learning objectives of the current study it is possible to modernize and improve the quality of learning, teaching and the development of a curriculum in veterinary neurology in Europe. The development of this catalog is not only providing orientation for veterinary neurology training of undergraduates and postgraduates, but might also be a role model for the development of European learning objectives in other specific areas in veterinary medicine.

7 Literaturverzeichnis

ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION (2009):
ACGME Program Requirements for Graduate Medical Education in Neurology. ACGME, Chicago, S. 24 – 26
[Internet: URL: http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/180_neurology_07012010.pdf]

ACCREDITATION COUNCIL FOR GRADUATE MEDICAL EDUCATION (2011):
ACGME – Glossary of Terms. ACGME, Chicago, S. 4 – 5, 7 - 8
[Internet: URL: http://acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/ab_ACGMEglossary.pdf]

AMERICAN ACADEMY OF NEUROLOGY (2003):
Graduate Education Subcommittee Residency Core Curriculum. American Academy of Neurology, Chicago, S. 3 – 9
[Internet: URL: http://www.aan.com/globals/axon/assets/2748.pdf]

AMERICAN ACADEMY OF NEUROLOGY (2013):
Core Curricula Resources.
[Internet: URL: http://www.aan.com/go/about/sections/curricula]

ANDERSON, L. W., und D. R. KRATHWOHL (2001):
A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
4.Ed., Publisher Longman, New York

BEARD, C., S. CLEGG und K. SMITH (2007):
Acknowledging the Affective in Higher Education.
British Educational Research Journal 33(2), 235 – 252
Doi:10.1080/01411920701208415

BLAHA, T. (2012):
What about the VetCEE.
The EBVS Newsletter, (5), 9 – 10
[Internet: URL: http://www.ebvs.org/news]

BLOCH, R., und H. BÜRGI (2002):
The Swiss Catalogue of Learning Objectives.
Medical Teacher 24(2), 144-150. Doi:10.1080/01421590220120759

BLOOM, B. S. (1984):
Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook 1: Cognitive Domain.
2.Ed., Publisher Addison Wesley, Boston

BOEKER, M., F. BALZER und S. SCHULZ (2010):
Konzeption einer Ontologie Medizinischer Lernziele
In: 14. Workshop der gmds-Arbeitsgruppe „Computerunterstützte Lehr- und Lernsysteme in der Medizin (CBT)“ und des GMA-Ausschusses „Neue Medien“. Witten, 16 – 17. April 2010.
doi: 10.3205/10cbt35

BÖRCHER, M., A. TIPOLD, C. PFARRER, M. R. FISCHER and J. P. EHLERS (2010):
Akzeptanz von fallbasiertem, interaktivem eLearning in der Tiermedizin am Beispiel des CASUS-Systems.
Tierärztliche Praxis Kleintiere, 38(April), 379 – 388

BREADY, L. L. (2011):
The Graduate Medical Education Community’s Responsibility for Producing a Fully Trained Physician.
In D. PHILIBERT and D. AMIS (Eds.): The ACGME 2011 Duty Hour Standard - Enhancing Quality of Care, Supervision and Resident Professional Development.
Publisher Accreditation Council for Graduate Medical Education, S. 81 – 85

BROWN, J. P., J. D. SILVERMAN (1999):
The Current and Future Market for Veterinarians and Veterinary Medical Services in the United States - Executive summary.
J. Am. Vet. Med. Assoc. 215(2), 161 - 183

BURNS, G. A., K. L. RUBY, R. M. DEBOWES, S. J. SEAMAN, und J. K. BRANNAN (2006):
Teaching non-technical (professional) Competence in a Veterinary School Curriculum.
J. Vet. Med. Edu. 33(2), 301 – 308

CAPLAN, L. R., und L. ADELMAN (1994):
Neurologic Education.
The Western Journal of Medicine 161(3), 319 – 322

CARDINET 3RD, G. H., I. M. GOURLEY, R. H. BON DURANT, L. D. COWGILL, A. A. STANNARD, R. H. MCCAPES, B. P. SMITH und E. A. RHODE (1992):
Changing Dimensions of Veterinary Medical Education in Pursuit of Diversity and Flexibility in Service to Society.
J. Am. Vet. Med. Assoc. 201(10), 1530-1539

CARROLL, R. G. (2001):
Design and evaluation of a national set of learning objectives: the medical physiology learning objectives project.
Adv. Physiol. Edu. 25(2), 2 - 7

CATE, T. J. TEN und J. C. J. M. DE HAES (2000):
Summative assessment of medical students in the affective domain.
Medical Teacher 22(1), 40 – 43

CHARLES, P.D., B. SCHEROKMAN und R. F. JÓZEFOWICZ (1999):
How much neurology should a medical student learn? a position statement of the AAN Undergraduate Education Subcommittee.
Journal of the Association of American Medical Colleges, 74(1), 23–26

CHURCHES, A. (2009):
Bloom's Digital Taxonomy.
[Internet: URL: http://edorigami.wikispaces.com/Bloom's+Digital+Taxonomy]

CLAVIEN, P.-A., D. L. NAHRWOLD, N. J. SOPER und B. L. BASS (2005):
Physician Competency? Teaching Old Dogs New Tricks.
Journal of Gastrointestinal Surgery 9(5), 625–32

CONKLIN, J. (2005):
Book Reviews: A Taxonomy for Learning, Teaching, und Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
Educational Horizons 83(3), 154 – 159

DALKEY, N. C., B. B. BROWN und S. COCHRAN (1969):
The Delphi method.
Publisher Rand Corporation, California

DE CASTRO, P. und S. ZUCCONI (2004):
Development of European Educational Strategies: Design of Veterinarian Profiles Identified by Market Needs for the Year 2020.
Veterinary Research Communication 28 (September), 13-28

EUROPEAN ASSOCIATON OF ESTABLISHMENT FOR VETERINARY EDUCATION (2013):
The Association: Foundation, Mission and Objectives.
[Internet: URL: http://www.eaeve.org/about-eaeve/history-and-aims.html]

EUROPEAN BOARD OF VETERINARY SPECIALISATION (2013):
College of EBVS.
[Internet: URL: http://www.ebvs.org/index.php/colleges2]

EUROPEAN CENTRE FOR THE DEVELOPMENT OF VOCATIONAL TRAINING (2010):
Learning Outcomes Approaches in VET Curricula.
Publisher Publications Office of the European Union, Luxembourg
[Internet: URL: http://www.cedefop.europa.eu/EN/Files/5506_en.pdf]

EUROPEAN COLLEGE OF VETERINARY NEUROLOGY (2009):
Guidelines for Admission to the Certification Examination of the European College of Veterinary Neurology.
[Internet: URL:
http://www.ecvn.org/ecvn/education/residency/training/TrainingGuidelines.pdf]

EUROPEAN COLLEGE OF VETERINARY NEUROLOGY (2012):
Constitution of ECVN.
[Internet: URL: http://www.ecvn.org/ecvn/constitution.pdf]

EUROPEAN COMMISSION (2005):
Detective 2005/36/EC of the European Parliament and the Council of 7 September 2005 on the recognition of professional qualifications

FOREHAND, M. (2010):
Bloom's Taxonomy - Emerging Perspectives on Learning, Teaching and Technology.
[Internet: URL: http://projects.coe.uga.edu/epltt]

GELB, D. J., C. H. GUNDERSON, K. A. HENRY, H. S. KIRSHNER und R. F. JÓZEFOWICZ (2002):
The Neurology Clerkship Core Curriculum.
Neurology, 58(6), 849–852

GENERAL MEDICAL COUNCIL (2009):
Good Medical Practice. Publisher General Medical Council, Great Britain
[Internet: URL: http://www.gmc-uk.org/guidance]

HARDEN, R. M. (2002):
Learning Outcomes and Instructional Objectives: Is There a Difference?
Medical teacher, 24(2), 151–155

HEALTH SCIENCE CENTER OF THE UNIVERSITY OF TENNESSEE (2013):
Residency Training Program Overview
[Internet: URL: http://www.uthsc.edu/neurology/education_training.php]

KOCH, M., M. R. FISCHER, M. VANDEVELDE, A. TIPOLD und J. P. EHLERS (2010):
Erfahrungen aus Entwicklung und Einsatz eines Interdisziplinären Blended-Learning-Wahlpflicht- fachs an Zwei Tiermedizinischen Hochschulen Einleitung.
Zeitschrift für Hochschulentwicklung, 5(1), 88–107

LEIBETSEDER, J. (2004):
Education of Veterinarians in Europe: The Basis for Recent Change
Journal of Veterinary Medical Education 31(3), 207-211

LIN, Y.-W., H. VOLK, J. PENDERIS, A. TIPOLD und J. P. EHLERS (2013):
Undergraduate studies: defining learning objectives for veterinary neurology with the help of experts of the European Specialist College (ECVN/ESVN).
Journal of Veterinary Medical Education. (manuscript submitted)

LLOYD, J. W. (2002):
Developing a Curriculum to Improve the Skills, Knowledge, Aptitudes, and Attitudes of Veterinary Students.
Journal of the American Veterinary Medical Association, 220(7), 976–977

LUMEIJ, J. T. und M. E. HERRTAGE (2006):
Veterinary Specialization in Europe.
Journal of Veterinary Medical Education, 33(2), 176–179

MILLER, G. E. (1990):
The Assessment of Clinical Skills/Competence/Performance.
Journal of the Association of American Medical Colleges, 65(9 Suppl), S63–67

NISBETT, R. E. und T. D. WILSON (1977):
The Halo Effect: Evidence for Unconscious Alteration of Judgments.
Journal of Personality and Social Psychology, 35(4), 250–256

NORMAN, D. A. und J. C. SPOHRER (1996):
Learner-centered education.
Communications of the ACM, 39(4), 24–27

OKOLI, C., und S. D. PAWLOWSKI (2004):
The Delphi Method as a Research Tool: an Example, Design Considerations and Applications.
Information & Management, 42(1), 15–29

O'Neill, D.G., D. B. Church, P.D. McGreevy, P.C. Thomson and D.C. Brodbelt (2012)
Longevity of UK Dog Breeds.
In: Society for Veterinary Epidemiology and Preventive Medicine – 2012 Annual Conference.
Glasgow, Scottland, 28 – 30. March 2012

OVERBAUGH, R. C. und L. SCHULZ (2013):
Bloom's Taxonomy.
[Internet: URL: http://ww2.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm]

PALMER, K. T., C. C. HARLING, J. HARRISON, E. B. MACDONALD und D. C. SNASHALL (2002):

Good Medical Practice: Guidance for Occupational Physicians.
Occupational Medicine (Oxford, England), 52(6), 341–352

PLATT, S und L. GAROSI (2012):
Small Animal Neurological Emergencies.
1.Ed., Publisher Manson, London

PLATT, S., und O. NATASHA (2004):
BSAVA Manual of Canine and Feline Neurology.
3.Ed., John Wiley & Sons, New York

PONTES, C. (2001):
EFNS Task Force on Postgraduate Neurological Training Survey of the Current Situation of Postgraduate Neurological Training in Europe.
European Journal of Neurology, 8, 381–384

PONTES, C. (2005):
Recommended Core Curriculum for a Specialist Training Program in Neurology.
European Journal of Neurology, 12(10), 743–746

RODRIGUEZ-MARTINEZ, H. (2004):
Reflections upon the Trend of Education and Research in Small Animal Reproduction in Europe.
Journal of Veterinary Medical Education 31(1), 38-44

ROMAGNOLI, S. (2010):
The European System of Veterinary Specialization.
Journal of Veterinary Medical Education, 37(4), 334–339

SCALESE, R. J. und S. B. ISSENBERG (2005):
Effective Use of Simulations for the Teaching and Acquisition of Veterinary Professional and Clinical Skills.
Journal of Veterinary Medical Education, 32(4), 461–467

SCHWARTZ, R. W., M. B. DONNELLY, B. YOUNG, P. P. NASH, F. M. WITTE und W. O. GRIFFEN JR. (1992):
Undergraduate Surgical Education for the Twenty-First Century.
Annals of Surgery, 216(6), 639–647

SHEPHARD, K. (2008):
Higher Education for Sustainability: Seeking Affective Learning Outcomes.
International Journal of Sustainability in Higher Education, 9(1), 87–98

STERN, B. J. und S. K. RODMYRE (2006):
The imperative for neurology educational research.
Neurology, 67(8), 1521–1521

STRUHAL, W., J. SELLNER, V. LISNIC, L. VÉCSEI, E. MÜLLER und W. GRISOLD (2011):
Neurology residency training in Europe--the current situation.
European journal of neurology, 18(4), e36 – e40

SWING, S. R. (2007):
The ACGME outcome project: retrospective and prospective.
Medical teacher, 29(7), 648–654

TINGA, C. E., C. L. ADAMS, B. N. BONNETT und C. S. RIBBLE (2001):
Perspectives in Professional Education of a veterinary college.
Journal of the American Veterinary Medical Association, 219(7), 924–931

UNIVERSITY OF GUELPH (2013):
Learning Objectives.
[Internet: URL: http://www.uoguelph.ca/tss/resources/index.cfm]

UNIVERSITY OF NEW MEXICO SCHOOL OF MEDICINE (2005):
Effective Use of Performance Objectives for Learning and Assessment.
[Internet: URL:
http://ccoe.umdnj.edu/forms/EffectiveUseofLearningObjectives.pdf]

UNIVERSITÄT ZÜRICH (2010):
Taxonomie-Matrix zur Analyse und Selbstevaluation von Hochschullehre (TAMAS)
Publisher Arbeitsstelle für Hochschuldidaktik AfH
[Internet: URL:
http://www.hochschuldidaktik.uzh.ch/hochschuldidaktikaz/DU_Tamas_def.pdf]

WATERMAN, E., N. HARTMANN, D. HARDY-COX, M. MACLEOD, C. PORR, L. ROHR und P. MEZO (2011):
Interdisciplinary Cooperation in Teaching and Learning at Memorial University.
[Internet: URL:
http://www.delts.mun.ca/faculty/teachinglearning/ACR_Intdisc_Coop_Report.pdf]

8 Abkürzungsverzeichnis

AAN	American Academy of Neurology
ACGME	Accreditation Council for Graduate Medical Education
ACVIM	American College of Veterinary Internal Medicine
ACVT	Advisory Committee on Veterinary Training
BAER	Brainstem Auditory Evoked Potential Testing
CNCD	Consortium of Neurology Clerkship Directors
CNS	Central Nervous System
CSF	Cerebrospinal Fluid
EAEVE	The European Association of Establishments for Veterinary Education
EAVS	European Association of Veterinary Specialisation
EBVS	European Board of Veterinary Specialisation
EC	European Council
ECVN	European College of Veterinary Neurology
EEG	Electroencephalography
EMG	Electromyography
ERG	Electroretinography
ERWG	Education Research Work Group
ESVN	European Society of Veterinary Neurology
EU	European Union
FCE	Fibrocartilaginous Embolus
GME	Granulomatous Meningoencephalitis
IVDD	Intervertebral Disc Disease
OEA	Otoacoustic Emission Testing
PNS	Peripheral Nervous System
SRMA	Steroid-Responsive Meningitis-Arteritis
SSAT	Society for Surgery of the Alimentary Tract
SSEP	Somatosensory Evoked Potential Testing

UES	Undergraduate Education Subcommittee
VEP	Visual Evoked Potential Testing
VetCEE	Veterinary Continuous Education in Europe
WSAVA	World Small Animal Veterinary Association

9 Anhang

9.1 Learning objectives with mean values and level distribution for undergraduate

	Level			
Learning Objectives	**N**	**B**	**A**	**E**
N = Not Necessary (blue) (1 - 1.44) B = Beginner Level (green) (1.45 - 2.44) A = Advanced Level (orange) (2.45-3.44) E = Expert Level (red) (3.45 - 4)				
Anatomy and Physiology				
1. The gross neuroanatomic structures of the cat and dog brain and spinal cord		2.19		
2. The microscopic anatomy of the nervous system		1.69		
3. The functional neuroanatomy of the central nervous system		2.15		
4. The functional neuroanatomy of the peripheral nervous system		2.12		
5. The functional neuroanatomy of the autonomic nervous system		1.99		
6. The basic principles of neurophysiology in regards to membrane potentials, action potential generation, ion channel conductance and synaptic neurotransmission in the central and peripheral nervous system		1.92		
7. The principles of cerebrospinal fluid dynamics and intracranial pressure		1.97		
Pharmacology and Toxicology				
> pharmacodynamic and Pharmacokinetic				
1. The autonomic nervous system receptors and neurotransmitters		1.84		
2. The major neurotransmitters and their receptors of the central and peripheral nervous system		1.85		
3. The mechanisms of drug- delivery through the blood-brain barrier		1.88		
4. The basic principles of drug absorption, metabolism and clearance		2.07		
5. The difference between pharmacokinetics and pharmacodynamic qualities of drugs and the parameters used to quantify these qualities		1.78		
6. Therapeutic index in relation to drug efficacy and safety		1.97		
> Pain				
7. The principles of pain activation pathways		2.1		
8. The mechanism of action of pain therapy		2.19		
> Neurotoxin				
9. The major classes of neurotoxins and the effect on the nervous system		2.03		
> Antiepileptic drugs				
10. The mechanism of the major classes of anti-epileptic drugs		2.07		
11. The pharmacokinetics of anti- epileptic drugs		1.99		
12. The side-effect profiles of anti-epileptic drugs		2.21		
> Immunosuppression				
13. The mechanism of immunosuppressive drugs for CNS inflammatory disease		1.94		
14. The pharmacokinetics of immunosuppressive drugs for CNS inflammatory disease		1.78		
15. The side-effect profiles of the immunosuppressive drugs for CNS inflammatory disease		2.13		
> Chemotherapeutic drugs				
16. The mechanism of chemotherapeutic drugs for nervous system neoplasia / inflammation		1.75		
17. The pharmacokinetics of chemotherapeutic drugs for nervous system neoplasia / Inflammation		1.65		
18. The side-effects profiles of chemotherapeutic drugs for nervous system neoplasia / inflammation		1.88		
Genetics and Molecular Biology				
1. The structure of DNA and a gene		2.08		

2. The difference between transcription versus translation		2.08		
3. The genome organization and chromosome structure		2.01		
4. The inheritance patterns and types of mutations		1.96		
5. The principles of common molecular genetic tools (laboratory methods; SNPs, microsatellite mapping, candidate genes)		1.65		
6. The principles of errors of cellular metabolism		1.79		
7. How to investigate a breed related disorder for an underlying genetic mutation		1.67		
Clinical Methodology				
> Neurologic Examination				
1. Perform a neurologic examination of all species		2.24		
2. Neurolocalize a lesion based on the examination findings		2.37		
> Laboratory				
3. Interpret hematological, serum chemistry and urinalysis results			2.58	
4. Understand organ function tests (liver, endocrine)			2.58	
5. Interpret organ function tests (liver, endocrine)			2.56	
> CSF				
6. Understand the risk factors and contraindications of CSF collection and methods to ameliorate these risks.		2.16		
7. Perform cistern magna collection of CSF in the dog and cat	1.44			
8. Perform lumbar collection of CSF in the dog and cat		1.47		
9. Perform lumbar CSF collection in the horse / ruminant / food animal	1.4			
10. Interpret laboratory results of CSF		1.87		
> EEG				
11. Perform EEG testing in the dog and cat	1.18			
12. Interpret EEG testing in the dog and cat	1.21			
> EMG				
13. Perform EMG and nerve conduction testing in the dog and cat	1.23			
14. Interpret EMG and nerve conduction testing in the dog and cat.	1.35			
15. Perform F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.16			
16. Interpret F-waves, Repetitive stimulation and H-wave testing in the dog and cat.	1.25			
17. Perform EMG and nerve conduction testing in the horse.	1.18			
18. Interpret EMG and nerve conduction testing in the horse.	1.28			
19. Perform EMG and nerve conduction testing in the ruminant / food animal .	1.17			
20. Interpret EMG and nerve conduction testing in the ruminant / food animal	1.25			
21. Perform single fiber EMG testing in the dog and cat.	1.14			
22. Interpret single fiber EMG testing in the dog and cat.	1.2			
> SSEP (SOMATOSENSORY EVOKED POTENTIAL TESTING)				
23. Perform somatosensory evoked potential testing in the dog and cat	1.14			
24. Interpret somatosensory evoked potential testing in the dog and cat	1.18			
> BAER (AUDIOTORY EVOKED POTENTIAL TESTING)				
25. Perform brainstem auditory evoked potential testing in the dog and cat	1.26			
26. Interpret brainstem auditory evoked potential testing in the dog and cat	1.39			
> OEA (OTOACOUSTIC EMISSION TESTING)				
27. Perform otoacoustic emission testing in the dog and cat	1.1			
28. Interpret otoacoustic emission testing in the dog and cat	1.17			
> VEP (VISUAL EVOKED POTENTIAL TESTING)				
29. Perform visual evoked potential testing in the dog and cat	1.09			
30. Interpret visual evoked potential testing in the dog and cat	1.15			
> URINARY TRACT ELECTRO. TESTING				
31. Perform urinary tract electrodiagnostic testing in the dog and cat	1.08			
32. Interpret urinary tract electrodiagnostic testing in the dog and cat	1.14			
> OPHTAMOLOGIC ELECTRO. TESTING				

33. Perform ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat.	1.14			
34. Interpret ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat	1.25			
> BONE MARROW ASPIRATION & CORE BIOPSY				
35. Perform a bone marrow aspirate and or core biopsy		1.54		
36. Interpret results of bone marrow aspirate and or core biopsy		1.57		
Disease Mechanisms				
> CNS				
1. The understanding of CNS diseases according to the VITAMIN-D principal		2.37		
* Please list the 3 most important diseases of CNS that a undergraduate should know.				
> PNS				
4. The understanding of PNS diseases according to the VITAMIN-D principal		2.13		
* Please list the 3 most important diseases of PNS that a undergraduate should know.				
> Seizure				
7. Seizure disorders of dogs and cats. The understanding of the pathogenesis		2.12		
7.1 The understanding of the diagnosis and treatment		2.29		
8. Seizure disorders in horses. The understanding of the pathogenesis		1.8		
8.1 The understanding of the diagnosis and treatment		1.93		
9. Seizure disorders in ruminants / food animals. The understanding of the pathogenesis		1.68		
9.1 The understanding of the diagnosis and treatment		1.76		
> Disc Disease				
10. Disc disease in dogs and cats. The understanding of the pathogenesis		2.32		
10.1 The understanding of the diagnosis and treatment		2.35		
11. Disc disease in horses. The understanding of the pathogenesis		1.74		
11.1 The understanding of the diagnosis and treatment		1.74		
> Micturition Disorders				
12. Micturition disorders of dogs and cats. The understanding of the pathogenesis		2.09		
12.1 The understanding of the diagnosis and treatment		2.11		
13. Micturition disorders of horses. The understanding of the pathogenesis		1.68		
13.1 The understanding of the diagnosis and treatment		1.71		
14. Micturition disorders of ruminants / food animals. The understanding of the pathogenesis		1.61		
14.1 The understanding of the diagnosis and treatment		1.63		
Neuroanaesthesia & Neurosurgery				
> Theory				
1. Understand anesthesia of the neurological patient		1.93		
2. Understand fluid therapy for a neurological patient		2.1		
3. Understand peri-operative antibiotic recommendations		2.17		
4. Understand tissue handling theory and techniques (Biopsies)		1.9		
> Practical				
5. Ventral slot		1.53		
6. Thoracolumbar hemilaminectomy		1.61		
7. Dorsal laminectomy of cervical spine		1.49		
8. Fenestration		1.51		
9. Cervical vertebral distraction- fusion	1.44			
10. Ventriculo-peritoneal shunt	1.44			
11. craniotomy / craniectomy	1.43			
12. Brain biopsy	1.41			
13. Fracture repair		1.54		
14. Dorsal laminectomy of lumbosacral spine		1.52		
15. Atlantoaxial subluxation fixation techniques		1.48		
16. Muscle biopsy		1.66		

17. Nerve biopsy		1.54		
Neuroradiology				
> Theory				
1. Understand CT scanning technique		1.8		
2. Understand CT physics		1.66		
3. Understand MRI scanning technique		1.71		
4. Understand MRI physics		1.57		
5. Understand nervous system ultrasound technique		1.5		
6. Understand nuclear medicine technique	1.44			
7. Understand radiation therapy principles		1.54		
> Practical				
8. Ability to interpret radiographs of the abdomen and thorax			2.5	
9. Ability to interpret radiographs of the axial and appendicular skeleton		2.41		
10. Ability to interpret radiographs of the skull		2.18		
11. Ability to interpret CT scan of the brain and skull		1.73		
12. Ability to interpret CT scan of the vertebral column and spinal cord		1.73		
13. Ability to interpret MRI scans of the brain		1.71		
14. Ability to interpret MRI scans of the spine		1.7		
15. Ability to interpret MRI scans of the peripheral nervous system		1.59		
16. Ability to identify the different MRI scan techniques and their use in clinical practice		1.59		
17. Ability to interpret myelograms in the cat, dog and horse		1.71		
18. Ability to perform myelography in the dog and cat	1.42			
19. Ability to perform myelography in the horse	1.29			
20. Ability to perform nervous system ultrasound interpretation	1.35			
21. Ability to perform nuclear medicine interpretation	1.29			
22. Apply radiation therapy technique	1.27			
Pathology				
1. Understand hematological cytological interpretation		2.25		
2. Understand the technique to acquire CSF samples in small animals		1.92		
3. Understand the technique to acquire CSF samples in large animals		1.75		
4. Exhibit competence in CSF cytological interpretation in small animals		1.61		
5. Exhibit competence in CSF cytological interpretation in horses/ruminants/food animals		1.51		
6. Exhibit competence in CSF sample examination (protein content, cell counting)		1.54		
7. Understand basic CNS pathological interpretation		1.7		
8. Understand basic PNS pathological interpretation		1.65		
9. Understand microscopic pathological features of specific small animal diseases		1.63		
10. Understand microscopic pathological features of specific horse diseases		1.54		
11. Understand microscopic pathological features of specific ruminant / food animal disease		1.53		
12. Understand Infectious disease testing techniques (PCR / Western blot / Serology)		1.87		
13. Understand Infectious disease testing interpretation		1.96		
14. Exhibit competence in bone marrow cytological interpretation		1.61		
15. Exhibit competence in brain biopsy cytological interpretation	1.42			

* Free text questions

9.2 Learning objectives with mean values and level distribution for Residents / Diplomates of the European College of Veterinary Neurology

Learning Objectives	N	B	A	E
N = Not Necessary (blue) (1 - 1.44) B = Beginner Level (green) (1.45 - 2.44) A = Advanced Level (orange) (2.45-3.44) E = Expert Level (red) (3.45 - 4)				
Anatomy and Physiology				
1. The gross neuroanatomic structures of the cat and dog brain and spinal cord				3.98
2. The microscopic anatomy of the nervous system				3.72
3. The functional neuroanatomy of the central nervous system				3.96
4. The functional neuroanatomy of the peripheral nervous system				3.96
5. The functional neuroanatomy of the autonomic nervous system				3.86
6. The basic principles of neurophysiology in regards to membrane potentials, action potential generation, ion channel conductance and synaptic neurotransmission in the central and peripheral nervous system				3.79
7. The principles of cerebrospinal fluid dynamics and intracranial pressure				3.94
* What other aspects of Anatomy and Physiology (besides those listed above) do you think should form part of the ECVN Residency Training?				
Pharmacology and Toxicology				
> pharmacodynamic and Pharmacokinetic				
1. The autonomic nervous system receptors and neurotransmitters				3.74
2. The major neurotransmitters and their receptors of the central and peripheral nervous system				3.76
3. The mechanisms of drug- delivery through the blood-brain barrier				3.72
4. The basic principles of drug absorption, metabolism and clearance				3.65
5. The difference between pharmacokinetics and pharmacodynamic qualities of drugs and the parameters used to quantify these qualities			3.37	
6. Therapeutic index in relation to drug efficacy and safety				3.52
* What other aspects of pharmacodynamic & pharmacokinetic (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Pain				
7. The principles of pain activation pathways				3.79
8. The mechanism of action of pain therapy				3.8
* What other aspects of pain (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Neurotoxin				
9. The major classes of neurotoxins and the effect on the nervous system				3.79
* What other aspects of neurotoxin (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Antiepileptic drugs				
10. The mechanism of the major classes of anti-epileptic drugs				3.96
11. The pharmacokinetics of anti- epileptic drugs				3.86
12. The side-effect profiles of anti-epileptic drugs				3.94
* What do you think are the 10 most important antiepileptic drugs currently in use in veterinary neurology practice?				
> Immunosuppression				
13. The mechanism of immunosuppressive drugs for CNS inflammatory disease				3.75
14. The pharmacokinetics of immunosuppressive drugs for CNS inflammatory disease				3.56
15. The side-effect profiles of the immunosuppressive drugs for CNS inflammatory disease				3.81
* What do you think are the 10 most important immunosuppressive drugs currently in use in veterinary neurology practice?				
> Chemotherapeutic drugs				
16. The mechanism of chemotherapeutic drugs for nervous system neoplasia / inflammation				3.55
17. The pharmacokinetics of chemotherapeutic drugs for nervous system neoplasia / Inflammation			3.43	

18. The side-effects profiles of chemotherapeutic drugs for nervous system neoplasia / inflammation				3.67
* What do you think are the 10 most important chemotherapeutic drugs currently in use in veterinary neurology practice?				
Genetics and Molecular Biology				
1. The structure of DNA and a gene			3.17	
2. The difference between transcription versus translation			3.01	
3. The genome organization and chromosome structure			2.94	
4. The inheritance patterns and types of mutations			3.23	
5. The principles of common molecular genetic tools (laboratory methods; SNPs, microsatellite mapping, candidate genes)			2.86	
6. The principles of errors of cellular metabolism			3.13	
7. How to investigate a breed related disorder for an underlying genetic mutation			3.32	
* What other aspects of genetics and molecular biology (besides those listed above) do you think should form part of the ECVN Residency Training?				
Clinical Methodology				
> Neurologic Examination				
1. Perform a neurologic examination of all species				3.94
2. Neurolocalize a lesion based on the examination findings				3.99
* What other aspects of neurologic examination (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Laboratory				
3. Interpret hematological, serum chemistry and urinalysis results				3.88
4. Understand organ function tests (liver, endocrine)				3.85
5. Interpret organ function tests (liver, endocrine)				3.83
* What other aspects of laboratory (besides those listed above) do you think should form part of the ECVN Residency Training?				
> CSF				
6. Understand the risk factors and contraindications of CSF collection and methods to ameliorate these risks.				3.99
7. Perform cistern magna collection of CSF in the dog and cat				3.98
8. Perform lumbar collection of CSF in the dog and cat				3.97
9. Perform lumbar CSF collection in the horse / ruminant / food animal			3.39	
10. Interpret laboratory results of CSF				3.96
* What other aspects of cerebrospinal fluid (besides those listed above) do you think should form part of the ECVN Residency Training?				
Electrodiagnostic tests				
* Which electrodiagnostic tests, procedures or investigations do you perform in your neurology practice?				
> EEG				
11. Perform EEG testing in the dog and cat			3.16	
12. Interpret EEG testing in the dog and cat			3.2	
* What other aspects of EEG (besides those listed above) do you think should form part of the ECVN Residency Training?				
> EMG				
13. Perform EMG and nerve conduction testing in the dog and cat				3.93
14. Interpret EMG and nerve conduction testing in the dog and cat.				3.93
15. Perform F-waves, Repetitive stimulation and H-wave testing in the dog and cat.				3.71
16. Interpret F-waves, Repetitive stimulation and H-wave testing in the dog and cat.				3.81
17. Perform EMG and nerve conduction testing in the horse.			3.17	
18. Interpret EMG and nerve conduction testing in the horse.			3.36	
19. Perform EMG and nerve conduction testing in the ruminant / food animal .			2.92	
20. Interpret EMG and nerve conduction testing in the ruminant / food animal			3.16	
21. Perform single fiber EMG testing in the dog and cat.			2.86	
22. Interpret single fiber EMG testing in the dog and cat.			3.13	
* What other aspects of EMG (besides those listed above) do you think should form part of the ECVN Residency Training?				
> SSEP (SOMATOSENSORY EVOKED POTENTIAL TESTING)				

23. Perform somatosensory evoked potential testing in the dog and cat			3.11	
24. Interpret somatosensory evoked potential testing in the dog and cat			3.3	
* What other aspects of somatosensory evoked potential testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> BAER (AUDIOTORY EVOKED POTENTIAL TESTING)				
25. Perform brainstem auditory evoked potential testing in the dog and cat				3.84
26. Interpret brainstem auditory evoked potential testing in the dog and cat				3.9
* What other aspects of audiotory evoked potential testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> OEA (OTOACOUSTIC EMISSION TESTING)				
27. Perform otoacoustic emission testing in the dog and cat			2.78	
28. Interpret otoacoustic emission testing in the dog and cat			2.98	
* What other aspects of otoacoustic emission testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> VEP (VISUAL EVOKED POTENTIAL TESTING)				
29. Perform visual evoked potential testing in the dog and cat			2.7	
30. Interpret visual evoked potential testing in the dog and cat			2.89	
* What other aspects of visual evoked potential testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> URINARY TRACT ELECTRO. TESTING				
31. Perform urinary tract electrodiagnostic testing in the dog and cat		2.43		
32. Interpret urinary tract electrodiagnostic testing in the dog and cat			2.69	
* What other aspects of urinary tract electro. testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> OPHTAMOLOGIC ELECTRO. TESTING				
33. Perform ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat.			2.68	
34. Interpret ophthalmologic electrodiagnostic testing (ERG, VEP) in the dog and cat			2.89	
* What other aspects of ophtalmologic electro. testing (besides those listed above) do you think should form part of the ECVN Residency Training?				
> BONE MARROW ASPIRATION & CORE BIOPSY				
35. Perform a bone marrow aspirate and or core biopsy			2.83	
36. Interpret results of bone marrow aspirate and or core biopsy			2.85	
* What other aspects of bone marrow aspiration and core biopsy (besides those listed above) do you think should form part of the ECVN Residency Training?				
Disease Mechanisms				
> CNS				
1. The understanding of CNS diseases according to the VITAMIN-D principal				3.98
*2. Please list the 10 most important diseases of CNS that a Residents or an ECVN Diplomates should know.				
*3. What other aspects of diseases of CNS (besides those listed above) do you think should form part of the ECVN Residency Training?				
> PNS				
4. The understanding of PNS diseases according to the VITAMIN-D principal				3.99
*5. Please list the 10 most important diseases of PNS that a Residents or an ECVN Diplomates should know.				
*6. What other aspects of diseases of PNS (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Seizure				
7. Seizure disorders of dogs and cats. The understanding of the pathogenesis				3.97
7.1 The understanding of the diagnosis and treatment				4
8. Seizure disorders in horses. The understanding of the pathogenesis				3.59
8.1 The understanding of the diagnosis and treatment				3.65
9. Seizure disorders in ruminants / food animals. The understanding of the pathogenesis			3.36	
9.1 The understanding of the diagnosis and treatment			3.35	
* What other aspects of seizure (besides those listed above) do you think should form part of the ECVN Residency Training?				

> Disc Disease				
10. Disc disease in dogs and cats. The understanding of the pathogenesis				3.99
10.1 The understanding of the diagnosis and treatment				4
11. Disc disease in horses. The understanding of the pathogenesis			3.34	
11.1 The understanding of the diagnosis and treatment			3.36	
* What other aspects of disc diseases (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Micturition Disorders				
12. Micturition disorders of dogs and cats. The understanding of the pathogenesis				3.92
12.1 The understanding of the diagnosis and treatment				3.94
13. Micturition disorders of horses. The understanding of the pathogenesis			3.33	
13.1 The understanding of the diagnosis and treatment			3.28	
14. Micturition disorders of ruminants / food animals. The understanding of the pathogenesis			3.05	
14.1 The understanding of the diagnosis and treatment			3.06	
* What other aspects of micturition disorders (besides those listed above) do you think should form part of the ECVN Residency Training?				
Neuroanaesthesia & Neurosurgery				
> Theory				
1. Understand anesthesia of the neurological patient				3.65
2. Understand fluid therapy for a neurological patient				3.78
3. Understand peri-operative antibiotic recommendations				3.76
4. Understand tissue handling theory and techniques (Biopsies)				3.77
* What other aspects of neuroanaesthesia and neurosurgery - THEORY (besides those listed above) do you think should form part of the ECVN Residency Training?				
> Practical				
5. Ventral slot				3.82
6. Thoracolumbar hemilaminectomy				3.85
7. Dorsal laminectomy of cervical spine				3.72
8. Fenestration				3.82
9. Cervical vertebral distraction- fusion				3.47
10. Ventriculo-peritoneal shunt			3.41	
11. craniotomy / craniectomy				3.51
12. Brain biopsy			3.41	
13. Fracture repair			3.42	
14. Dorsal laminectomy of lumbosacral spine				3.7
15. Atlantoaxial subluxation fixation techniques				3.47
16. Muscle biopsy				3.9
17. Nerve biopsy				3.88
* What other aspects of neuroanaesthesia and neurosurgery - PRACTICAL (besides those listed above) do you think should form part of the ECVN Residency Training?				
* Which neurosurgical procedures do you perform in your neurology practice?				
Neuroradiology				
> Theory				
1. Understand CT scanning technique				3.66
2. Understand CT physics			3.13	
3. Understand MRI scanning technique				3.62
4. Understand MRI physics			3.14	
5. Understand nervous system ultrasound technique			3.1	
6. Understand nuclear medicine technique			2.83	
7. Understand radiation therapy principles			3.11	
* What other aspects of neuroradiology - THEORY (besides those listed above) do you think should form part of the ECVN Residency Training?				

> Practical				
8. Ability to interpret radiographs of the abdomen and thorax				3.53
9. Ability to interpret radiographs of the axial and appendicular skeleton				3.79
10. Ability to interpret radiographs of the skull				3.8
11. Ability to interpret CT scan of the brain and skull				3.93
12. Ability to interpret CT scan of the vertebral column and spinal cord				3.95
13. Ability to interpret MRI scans of the brain				3.96
14. Ability to interpret MRI scans of the spine				3.96
15. Ability to interpret MRI scans of the peripheral nervous system				3.8
16. Ability to identify the different MRI scan techniques and their use in clinical practice				3.78
17. Ability to interpret myelograms in the cat, dog and horse				3.87
18. Ability to perform myelography in the dog and cat				3.83
19. Ability to perform myelography in the horse			2.88	
20. Ability to perform nervous system ultrasound interpretation			2.78	
21. Ability to perform nuclear medicine interpretation			2.63	
22. Apply radiation therapy technique		2.36		
* What other aspects of neuroradiology - PRACTICAL (besides those listed above) do you think should form part of the ECVN Residency Training?				
* Which neuroradiology procedures do you perform in your neurology practice?				
Pathology				
1. Understand hematological cytological interpretation				3.5
2. Understand the technique to acquire CSF samples in small animals				3.94
3. Understand the technique to acquire CSF samples in large animals				3.54
4. Exhibit competence in CSF cytological interpretation in small animals				3.8
5. Exhibit competence in CSF cytological interpretation in horses/ruminants/food animals			3.33	
6. Exhibit competence in CSF sample examination (protein content, cell counting)				3.68
7. Understand basic CNS pathological interpretation				3.75
8. Understand basic PNS pathological interpretation				3.66
9. Understand microscopic pathological features of specific small animal diseases				3.52
10. Understand microscopic pathological features of specific horse diseases			3.16	
11. Understand microscopic pathological features of specific ruminant / food animal disease			3.09	
12. Understand Infectious disease testing techniques (PCR / Western blot / Serology)			3.21	
13. Understand Infectious disease testing interpretation				3.59
14. Exhibit competence in bone marrow cytological interpretation			2.69	
15. Exhibit competence in brain biopsy cytological interpretation			3.01	
* What other aspects of pathology (besides those listed above) do you think should form part of the ECVN Residency Training?				
* Which Clinical Pathology procedures do you perform in your neurology practice or do you have performed through a laboratory?				
Competencies of Academia				
1. In teaching for undergraduates				3.67
2. In teaching for postgraduates				3.68
3. In veterinary education (Didactics)				3.58
4. In study design				3.49
5. In statistics			3	
6. In principles of evidence based medicine				3.55
7. In good clinical practice				3.78
8. In laboratorium			3.12	
9. In epidemiology			3.06	
* What other aspects of competencies of academia (besides those listed above) do you think should form part of the ECVN Residency Training?				

*What additional training as part of the ECVN Residency Programme do you think differentiates an ECVN Diplomate from an Advanced Veterinary Practitioner, specifically with regard to subsequently allowing the one to act as an ECVN Residency Supervisor, but not the other?				

* Free text questions

9.3 Difference between ECVN diplomates and veterinary practitioners

Are there any other skills/competencies which can differentiate a general practitioner and an advanced practitioner from a Diplomate?		For general practitioners	For advanced practitioners	For diplomates
1. A high level of competency through teaching, research or practice in the specialty.				
	True			
	False			
2. Acquisition and understanding of a substantial body of knowledge which is at the forefront of the area of veterinary professional practice.				
	True			
	False			
3. The ability to apply high level knowledge and skills at the forefront of the specialist area to their own professional work.				
	True			
	False			
4. A high level of clinical expertise in their specialty area including the ability to deal with non-routine and complex cases.				
	True			
	False			
5. A detailed understanding of applicable techniques for research and clinical enquiry, including ability to design and implement a project for the generation of new knowledge, clinical methodologies and techniques at the forefront of the professional area.				
	True			
	False			
6. Make informed judgements on complex issues in their specialist field, often in the absence of complete data, and be able to communicate their ideas and conclusions clearly and effectively to specialist and non-specialist audiences, including clients.				
	True			
	False			
7. Continue to undertake research and/or clinical studies in their field at an advanced level, contributing substantially to the development of new knowledge, techniques, ideas or approaches in the specialty.				
	True			
	False			
* What part of the Residency Training and subsequent ECVN College organisation do you think differentiates an ECVN Diploma holder from an advanced practitioner who provides a neurology referral service?				

* Free text questions

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