



**University of
Zurich**^{UZH}

**Zurich Open Repository and
Archive**

University of Zurich
Main Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2018

Veterinary parasitology teaching: Ten years of experience with the Vetsuisse curriculum

Schnyder, Manuela; Hertzberg, Hubertus; Mathis, Alexander; Schönmann, Marietta; Hehl, Adrian; Deplazes, Peter

Abstract: Pursuant to the Joint Declaration by 29 European education ministers in June 1999 in the city of Bologna, Italy, the so-called ‘Bologna Process’ was officially introduced at the Vetsuisse Faculty (Universities of Zurich and Berne) in Switzerland in 2007. The long-term goal of restructuring the study programmes was to create a common European Higher Education Area (EHEA), with uniform and clearly defined standards for degrees (“diplomas”). Accordingly, the Vetsuisse curriculum was organised as a 3-year Bachelor and a 2-year Master study program. For the final Federal examination in veterinary medicine, both programs and a master thesis have to be completed. Parasitology, as a subject, is introduced with selected examples in the ecology course during the first academic year. The second and third years of the Bachelor program comprise non-organ-centred (NOC) and integrated organ-centred (OC) course modules, respectively. In the NOC modules, parasitology is taught in consecutive courses, focussing on topics including occurrence, biology, pathogenesis, clinical manifestations, diagnostics and the strategic principles of therapeutic and prophylactic interventions against major veterinary and zoonotic parasites. This syllabus is complemented with live demonstrations as well as practical laboratory exercises. Lecture notes, with defined learning objectives, are based on the textbook “Parasitology in Veterinary Medicine” which is available free of charge to students as an on-line edition in German. Furthermore, students review relevant parasitoses in the diagnostic context of OC case presentations. In another module, immunological aspects of parasitic diseases are elaborated on group sessions, supported through the use of specialist literature. The two-year Master program is divided into a core syllabus for all students, and elective subjects are chosen from six areas of specialisation (three each with clinical or non-clinical focus). Within the clinically focused specialisations, interactive teaching of control strategies against parasitoses of companion and farm animals is the focus. Students specialising in ‘Pathobiology’ experience a deep immersion in parasitology. Learning objectives are verified in different test formats. E-learning tools, including a learning management on-line platform, allow interactive student training in coproscopic diagnostic techniques and in arachno-entomology and provide case-oriented teaching. Since an aptitude test limits the number of first-year students in veterinary medicine in Switzerland (80 in Zürich, 70 in Berne), the conditions for students and teachers are similar each year. The fragmentation of teaching in veterinary parasitology, the reduction of the number of diagnostic exercises and clinically oriented day-1-skills pertaining to the control of parasitoses are critically commented upon.

DOI: <https://doi.org/10.1016/j.vetpar.2018.01.033>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-149933>

Journal Article

Accepted Version



The following work is licensed under a Creative Commons: Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) License.

Originally published at:

Schnyder, Manuela; Hertzberg, Hubertus; Mathis, Alexander; Schönmann, Marietta; Hehl, Adrian; Deplazes, Peter (2018). Veterinary parasitology teaching: Ten years of experience with the Vetsuisse curriculum. *Veterinary Parasitology*, 252:148-152.

DOI: <https://doi.org/10.1016/j.vetpar.2018.01.033>

1 **Veterinary parasitology teaching: ten years of experience with the**
2 **Vetsuisse curriculum**

3

4 Manuela Schnyder^{a*}, Hubertus Hertzberg^a, Alexander Mathis^a, Marietta Schönmann^b, Adrian Hehl^a,
5 Peter Deplazes^a

6

7 ^a *Institute of Parasitology, Vetsuisse Faculty, University of Zurich, Winterthurerstrasse 266a, 8057*
8 *Zürich, Switzerland*

9 ^b *Dean's Office, Study Administration, Vetsuisse Faculty, University of Zurich, Winterthurerstrasse*
10 *260, 8057 Zürich, Switzerland*

11

12

13

14

15 ^{*} *Corresponding author.* Institute of Parasitology, University of Zurich, Vetsuisse Faculty,
16 Winterthurerstrasse 266a, 8057 Zürich, Switzerland.

17 Tel: +41 (0)44 635 85 25; Fax: +41 (0)44 635 89 07. *E-mail:* manuela.schnyder@uzh.ch

18

19

20 ABSTRACT

21 Pursuant to the Joint Declaration by 29 European education ministers in June 1999 in the city of
22 Bologna, Italy, the so-called 'Bologna Process' was officially introduced at the Vetsuisse Faculty
23 (Universities of Zurich and Berne) in Switzerland in 2007. The long-term goal of restructuring the
24 study programmes was to create a common European Higher Education Area (EHEA), with uniform
25 and clearly defined standards for degrees ("diplomas"). Accordingly, the Vetsuisse curriculum was
26 organised as a 3-year Bachelor and a 2-year Master study program. For the final Federal examination
27 in veterinary medicine, both programs and a master thesis have to be completed. Parasitology, as a
28 subject, is introduced with selected examples in the ecology course during the first academic year.
29 The second and third years of the Bachelor program comprise non-organ-centred (NOC) and
30 integrated organ-centred (OC) course modules, respectively. In the NOC modules, parasitology is
31 taught in consecutive courses, focussing on topics including occurrence, biology, pathogenesis,
32 clinical manifestations, diagnostics and the strategic principles of therapeutic and prophylactic
33 interventions against major veterinary and zoonotic parasites. This syllabus is complemented with live
34 demonstrations as well as practical laboratory exercises. Lecture notes, with defined learning
35 objectives, are based on the textbook "Parasitology in Veterinary Medicine" which is available free of
36 charge to students as an on-line edition in German. Furthermore, students review relevant
37 parasitoses in the diagnostic context of OC case presentations. In another module, immunological
38 aspects of parasitic diseases are elaborated on group sessions, supported through the use of
39 specialist literature. The two-year Master program is divided into a core syllabus for all students, and
40 elective subjects are chosen from six areas of specialisation (three each with clinical or non-clinical
41 focus). Within the clinically focused specialisations, interactive teaching of control strategies against
42 parasitoses of companion and farm animals is the focus. Students specialising in 'Pathobiology'
43 experience a deep immersion in parasitology. Learning objectives are verified in different test formats.
44 E-learning tools, including a learning management on-line platform, allow interactive student training
45 in coproscopic diagnostic techniques and in arachno-entomology and provide case-oriented teaching.
46 Since an aptitude test limits the number of first-year students in veterinary medicine in Switzerland (80
47 in Zürich, 70 in Berne), the conditions for students and teachers are similar each year. The
48 fragmentation of teaching in veterinary parasitology, the reduction of the number of diagnostic

49 exercises and clinically oriented day-1-skills pertaining to the control of parasitoses are critically
50 commented upon.

51

52 **Keywords:** Veterinary parasitology, teaching, Vetsuisse, Switzerland

53

54

55 **1. Introduction**

56

57 Effective teaching of the subject “Veterinary Parasitology” has been under discussion in regular
58 intervals within and beyond the framework of the WAAVP. Based on new evidence in the field of
59 parasitology and also in didactics for higher education, continuous adaptations have been made. In
60 particular, a trend away from the classical ‘disciplinary approach’, as applied by awarded veterinary
61 parasitologists (Euzéby, 1996; Soulsby, 1994), towards a more problem-based, interdisciplinary
62 approach has been implemented in several countries worldwide, in Europe (Gottstein and Eckert,
63 2002; Kramer and Genchi, 2002; Vercruyssen and Eckert, 2002), Australia (Thompson et al., 2002)
64 and North America (Stromberg, 2002). Concurrently, as a result of the 18th International congress in
65 Stresa, Italy, the WAAVP adopted a resolution in which minimum requirements in undergraduate
66 teaching of veterinary parasitology were defined (Krecek, 2002). Among these, a fundamental
67 principle concerning the minimal number of contact hours was restated, based on teaching expertise
68 (Eckert, 2000) and on previously performed studies on the worldwide average hours employed for
69 teaching veterinary parasitology (Cordero-del-Campillo et al., 1986). A total of at least 70-90 contact
70 hours, including lectures and practicals, were promoted. Interestingly, it was also stated that in
71 addition to teaching basic skills, at least another 10-20 hours of problem-based and interdisciplinary
72 activities *could* be applied in advanced teaching of veterinary parasitology. The focus of this advanced
73 teaching might be placed on animal species or organ systems. In this resolution, the advantage of
74 focussing on animal species rather than on organ systems emerged as a consensus, based on the
75 spectrum of professional activities of veterinarians (Krecek, 2002).

76 The WAAVP resolution was evidently intended to support appropriate undergraduate education in
77 veterinary science and to counteract a general trend to reduce contact hours, in favour of the above
78 mentioned interdisciplinary and problem-based activities. Therefore, the proposal was directed at
79 veterinary faculties and the authorities which were in charge of reforming the curricula (Krecek, 2002).

80 In addition, common minimal standards were promoted in view of the increased flexibility of students.
81 For example, the European student exchange program ‘Erasmus’ was started in 1987 with the aim of
82 increasing student mobility and collaborations between the European Universities. The University of
83 Zurich joined this program in 1992.

84 In 1999, a Joint Declaration by 29 European education ministers in the city of Bologna, Italy, was
85 made, which was the basis for the so called 'Bologna Process'. The long-term goal of this action was
86 to restructure study programmes, in order to create a common European Higher Education Area with
87 uniform and clearly defined standards for degrees (or "diplomas").

88 In Switzerland, a new curriculum, which was based on a more organ-focused and problem-based
89 approach, was implemented in 1999 at the Faculty of Veterinary Medicine of the University of Berne.
90 First experiences with this curriculum revealed some issues, particularly in disciplines associated with
91 infectious diseases. Additional challenges, such as an increase of the necessary resources, i.e. study
92 rooms, teaching personnel and finances were identified (Gottstein and Eckert, 2002). However, these
93 experiences turned out to be valuable for the implementation of the following steps in the country.

94 In 2003, a common unified Vetsuisse curriculum for the two University sites for veterinary medicine,
95 Berne and Zurich, was introduced (Lutz and Schläppi, 2008). The degree program still comprised 5
96 study years and was structured into modules, in order to be compatible with the 'Bologna Process',
97 which was officially introduced at the Vetsuisse Faculty in 2007.

98 In the following, we will summarise our 10-year experience in teaching veterinary parasitology within
99 the Vetsuisse curriculum based on the combination of a disciplinary as well as problem-based and
100 organ-focussed approaches, discussing the advantages, disadvantages and challenges of such
101 fragmentation.

102

103 **2. Veterinary Parasitology in the Vetsuisse curriculum**

104

105 The Vetsuisse curriculum is organised according to the 'Bologna Process' as a 3-year Bachelor and a
106 2-year Master study program. Thus, the study program actually includes 5 academic years, and in
107 each of them 60 ECTS (European Credit Transfer System) points have to be acquired. As a guide
108 value, one ECTS point corresponds to approximately 30 working hours for the students.

109 Admission conditions for the final Federal examination in Veterinary Medicine in Switzerland
110 (comprising practical examinations in the subjects small animals, horses, farm animals and pathology)
111 include the completion of both Bachelor and Master programs, two externships and a Master thesis.
112 For details, see the English study guide for Veterinary Medicine at the University of Zurich, available
113 online (www.vet.uzh.ch/en/Studium/vetmed.html).

114

115 *2.1. Bachelor program*

116

117 Basics in parasitology are introduced, with important examples of animal parasitoses and zoonoses,
118 in the first academic year in lectures (8 hours) (Table 1). Selected life cycles of protozoa, helminths
119 and arthropods are presented, along with aspects of the basic biology of the parasites. Furthermore,
120 the ecology of wild animal hosts or the husbandry conditions of domestic animal hosts are presented
121 in the context of their veterinary or public health importance. The second and third years of the
122 Bachelor program comprise courses in non-organ-centred (NOC) and integrated organ-centred (OC)
123 modules. The NOC modules deal with biological and clinical as well as pathobiological aspects and
124 closely correspond to what is defined as the 'disciplinary approach'. Parasitology is taught in
125 consecutive course modules, focussing on topics such as life cycles, epidemiology, pathogenesis,
126 clinical manifestations, immunology, diagnostics and the strategic principles of prophylactic and
127 therapeutic interventions directed against major veterinary and zoonotic parasites. This syllabus is
128 complemented with live demonstrations as well as practical laboratory exercises which are centred on
129 microscopic and macroscopic examinations. Comprehensive lecture notes with defined learning
130 objectives are based on the textbook 'Parasitology in Veterinary Medicine' (Deplazes et al., 2016), of
131 which the German edition (Deplazes et al., 2013) is available for students on-line and free of charge.
132 This module is taught in a multifunctional room with up to 84 fully equipped working places
133 (microscope, binocular). At the end of the NOC modules, an individual oral examination is held,
134 preceded by a preparation period of 20 minutes to examine two parasite samples (microscopy slides,
135 organs, isolated parasites) and read two theoretical questions, followed by 20 minutes for a
136 discussion about the parasite samples and the questions. The exam is conducted by two
137 parasitologists, in the presence of an independent veterinarian and additionally recorded through a
138 written protocol. A 'pass' grade is required for a student to enter the Master program (years 4 and 5).
139 In addition, students get the opportunity to review relevant parasitological diseases within OC course
140 modules, in the context of the organ-centred topics blood/immune system, digestion/metabolism,
141 heart/circulation/respiration, and skin/thermoregulation. The focus in these interactively taught
142 practical modules is clearly on diagnosis, actively trained by the students on the basis of authentic
143 case presentations.

144 Learning objectives of the OC course contents are verified by individual online examinations that have
145 been implemented and recently renewed with substantial administrative and financial effort. A
146 professional platform (Q-Exam®) assures compliance with formal quality criteria. The efforts
147 necessary to generate appropriate question/answer combinations for regular alternative replacement
148 questions should not be underestimated.

149

150 *2.2. Master program*

151

152 The two-year Master program is divided into a so-called core syllabus for all students and an elective
153 subject chosen from six areas of specialisation: three with a clinical focus (companion animals
154 including zoo animals, horses, and farm animals) and three with paraclinical foci (pathobiology,
155 biomedical research, veterinary public health). The fifth and last study years mainly consist of
156 rotations in the various clinics and in pathology, and of two externships.

157 Within the clinically focused specialisations, interactive teaching of diagnostic strategies, prophylactic
158 and therapeutic measures against the most important parasitic diseases of companion and farm
159 animals and horses are the major teaching activities in veterinary parasitology. Particular emphasis is
160 given to strategies for the control and treatment of parasitic diseases on an individual or herd level.
161 Students are evaluated by means of group case simulations and presentations. The clinically relevant
162 subjects of veterinary parasitology mentioned above are deepened separately within each of the
163 clinically focussed specialisations. This precludes that all students acquire the same broad and
164 practically-oriented parasitological knowledge for the most relevant animals.

165 Students wishing to specialise in 'Pathobiology' experience a particularly deep immersion in
166 parasitology, other infectious disease topics (virology, bacteriology), pathology and immunology
167 during practical courses with two foci: 1) to obtain day-1-skills for practising first-line laboratory
168 methods; 2) to gain a profound knowledge of diagnostic methods, including test establishment and
169 evaluations. Learning objectives are verified through evaluations of individual participation and
170 practical skills as well as presentations in a general laboratory class, and by means of individual oral
171 and written reports of an independently chosen and performed project.

172 Within this specialisation, the students get the opportunity to choose a topic for a Master thesis
173 proposed by pathobiology research groups, but they are also encouraged and supported to develop
174 their own projects.

175 All students follow the module 'immuno-infectiology', shared with virology, bacteriology and
176 immunology. Immunological aspects of parasitic infections or infestations are reinforced in groups of
177 5-6 students. General aspects, such as immunomodulation, immunoprotection, the hygiene
178 hypothesis and the challenges of vaccine development as well as immunodiagnostics, are deepened
179 using selected literature. Poster presentations by the students and the preparation of abstracts ensure
180 that all students benefit from the work done by each group. Learning objectives are evaluated by
181 presentations (individually and as part of a group) and group audits.

182 In this module 'immuno-infectiology', there is some repetition, and the module contributes to the
183 fragmentation of the subject veterinary parasitology. On the other hand, this different learning
184 environment approach strongly promotes interactivity within groups and also with lecturers, thereby
185 fulfilling also the need for training social competence and presentation techniques. Furthermore, by
186 reading specialist literature and by giving the opportunity to critically discuss scientific contents, the
187 module prepares the students for the Master thesis.

188

189 *2.3. Master thesis*

190

191 Single lectures, covering topics such as literature search and expertise for scientific work and basics
192 in image processing, are part of the core curriculum. In addition, elective IT and language courses
193 (including 'scientific writing') and others are offered by the University. With few exceptions, the Master
194 thesis represents the first interface with scientific writing. Master theses with a parasitological topic
195 can be initiated within the specialisation of pathobiology or by students involved in a clinical
196 specialisation. In the first case, students are trained to carry out the most important parasitological
197 diagnostic methods during the two week Pathobiology course in the 8th semester (Table 1). The
198 master theses can be mostly performed within the pathobiology specialisation. Students of the clinical
199 specialisations, instead, are fully involved in the clinical education and are expected to work for the
200 master thesis beside this ambitious program, a situation that needs to be improved in the future.

201

202 **3. Infrastructure**

203

204 Since an aptitude test limits the number of first-year students of veterinary medicine in Switzerland
205 (80 in Zürich, 70 in Berne), the capacity requirements for teaching are similar each year. As our room
206 for practical lessons has a capacity of more than 80 students, no repetition of any course or group
207 splitting is needed, and, therefore, no additional teaching resource is usually required.

208 Occasionally, the 2-week course for Pathobiology students in the 8th semester (see Table 1) has to be
209 repeated, because a part of this course is compulsory also for Master students focussed in clinical
210 subjects. This has, however, the advantage of a common basic instruction and introduction into the
211 daily business of the Institute for all Master students. Within this and other elective courses, the size
212 of the classes allows a close interaction between teachers and students.

213

214 **4. E-learning environment**

215

216 The University of Zurich uses OLAT (Online Learning and Training) as a strategic learning
217 management on-line platform. OLAT works as a document repository and can be used as
218 communication platform, linking teachers and students in asynchronous (forum) and, occasionally,
219 synchronous (chat) ways. It also contributes to ameliorate and supervise self-learning processes (Lutz
220 and Schläppi, 2008). OLAT has been developed by the University of Zurich and is continuously being
221 refined. Students and staff of the University of Zurich obtain access through their personal digital
222 access data that also allow access to WLAN at the University and worldwide access to their webmail
223 and other learning courses.

224 With the term 'E-learning', we generally refer to educational technology being "the study and ethical
225 practice of facilitating learning and improving performance by creating, using, and managing
226 appropriate technological processes and resources" (Robinson et al., 2016). Computer-based tools
227 allow independent training during or outside of contact hours, and online-based exercises can be
228 applied for interactive exchanges and also for examinations. Such tools are promoted to improve
229 learning outcomes, and students should be trained in their self-guided acquisition of knowledge.
230 Highest priority is given to interactivity, meaning that exchanges between students, teachers and the
231 learning material are thought to increase knowledge and competencies. In particular, active

232 participation is considered more sustainable for the acquisition of knowledge than listening or reading
233 alone. In addition, this helps to anchor expertise and practical knowledge more firmly. Innovative
234 learning forms are aimed at supporting and optimising learning processes, and have to be evaluated
235 and adapted accordingly. Similarly, feedback from students is important to evaluate the success of
236 the transmission of subject matter, while students actively deal with different learning procedures and
237 have the possibility to reflect on their own learning processes.

238 E-learning tools in veterinary parasitology are promoted to improve learning processes of students but
239 not necessarily to reduce the number of student contact hours. They can allow a more vivid and
240 striking presentation of subject matter, as well as stimulating the learning experience in a different
241 way than just by reading texts. An evident advantage is that the teaching material is available at any
242 time (Huang et al., 2006), and is therefore compatible with the individual study program of the
243 students. Another relevant factor is that electronic display of parasites helps preserve physically
244 available teaching material, which is especially important in the case of rare specimens. Individual
245 training sessions at the microscope or personal exchanges when discussing clinical cases are
246 invaluable, but not always possible.

247 Our E-learning tools in parasitology allow interactive student training in coproscopic diagnostic
248 techniques and in arachno-entomology. These tools are recommended as preparation for practical
249 courses in the OC course modules and for revision of the practical parts of the NOC modules. Student
250 evaluations of these E-learning tools were always positive in the last years. Disappointingly, the use
251 of these tools during the semester is rather limited. Confronting the students with this discrepancy
252 revealed that the students postpone the use of the tools to the exam preparation due to priorities in
253 other subjects examined before veterinary parasitology. This is possibly a consequence of the
254 'Bologna Process' in which each module needs to be terminated by an examination, causing the time
255 attributed to self-study (including the use of such training tools) used for preparation of other
256 upcoming exams instead.

257 The CASUS® platform (<http://www.instruct.eu/de/start>) completes the array of on-line training tools
258 and is designed to provide case-oriented teaching for students and specialists. It is an interactive
259 multimedia learning system that allows training based on case reports, therefore linking different
260 aspects of veterinary parasitology and also broader features of veterinary medicine.

261

262 **5. Consequences of the subdivision of the curriculum in a Bachelor and Master program**

263

264 As indicated, the structure of the NOC courses reflects a classical 'disciplinary' approach. It
265 represents the basics and allows a systematic introduction to veterinary parasitology. This course is
266 considered indispensable because it furnishes the students with a solid base for other approaches,
267 such as the organ- and problem-based approaches and those focusing on animals (Eckert, 2000;
268 Vercruyssen and Eckert, 2002). Based on regularly performed surveys, the combination of lectures
269 with practical exercises and demonstrations is highly appreciated by the students. We estimate that
270 hands-on training and own visual observations are important components of interactivity that
271 contribute to sustainable learning processes. For this, fortunately, veterinary parasitology is a
272 particularly rewarding subject, to be presented with 'exciting and stimulating examples' (Soulsby,
273 1994). At the Vetsuisse Faculty, sustainability of learning contents is supported by the textbook
274 Parasitology for Veterinary Medicine (German version available also online free of charge) and a
275 concise course script. Passing the oral and practical exams at the end of the fifth semester is
276 compulsory for starting the Master program. Thus, the great effort of a 40 min individual examination,
277 in which 3 highly qualified persons and a teaching assistant are involved, is justified.

278 After the uniform Bachelor program for all students, the Master program offers the opportunity to
279 acquire a larger number of skills within one of the 6 elective focus curricula. A common core syllabus
280 for all students should, nevertheless, guarantee an adequate start of a professional career in any
281 direction. However, past experience shows that the step from the Bachelor to the Master program
282 represents a challenge for both students and lecturers. For some students, selection of the focus
283 subject has to consider different factors, based on individual preferences and/or future opportunities.
284 For the lecturers, it is desirable to have an adequate number of students, in order to work with
285 suitable group sizes that correlate with the available resources (training personnel, rooms and
286 laboratory equipment).

287

288 **6. Selection of students for a career in veterinary parasitology**

289

290 Importantly, recruiting students who focus on Pathobiology should result in appropriate candidates for
291 continuing education in veterinary parasitology. Although Master theses performed by students with a

292 clinical focus can represent an ideal combination of the student's interests and their preferred access
293 to patients and patient material for parasite issues, there is the potential to develop topics with more
294 scientific profundity. In such cases, the Master thesis can constitute a suitable starting point for a
295 doctoral thesis. Currently, at the Vetsuisse Faculty, the doctoral thesis (title: Dr. med. vet.) is still a first
296 step towards a specialisation for veterinary graduates, as a directly accessible PhD program has not
297 yet been implemented. At present, the veterinary students can enrol in the Life Science Zurich
298 Graduate School of the University of Zurich or participate in the Graduate School for Cellular and
299 Biomedical Sciences of the University of Berne, with some difficulty: as the Master of the Vetsuisse
300 Faculty is not recognised as equivalent to a Master of the Faculties of Science, the acquisition of
301 further ECTS and additional exams are required.

302 Additionally, since 2003, among the specialisations within the European Board of Veterinary
303 Specialists (EBVS), European veterinary parasitologists are offered the opportunity to obtain the
304 specialisation through a residency program of the European Veterinary Parasitology College (EVPC).
305 The program has been fully recognised since 2013. Therefore, a challenge identified more than 15
306 years ago has been mastered (Eckert, 2000). Within this veterinary specialisation, the residents deal
307 with wide-ranging topics in the field, representing, among others, access to valuable teaching
308 resources.

309

310 **7. Concluding remarks**

311

312 The fragmentation of teaching in veterinary parasitology, connected with the reduction of diagnostic
313 exercises, partially precludes newly graduated students from being sufficiently prepared to cope with
314 the requirements in clinical practice. Such concerns with regard to day-1-skills have been raised
315 generally. Based on complaints from practitioners, lecturers and students concerning the graduate
316 outcome from veterinary studies, the Vetsuisse Faculty decided to extend the curriculum by two
317 additional semesters. One of the major boosts for the extension is to provide an adequate time
318 interval to conduct the Master thesis.

319 Specialisation in veterinary medicine conforms more and more to the situation in human medicine,
320 including the trend for specialised practitioners. Still, priority must be given to teach veterinary
321 parasitology by supporting students to gain practical skills for research and diagnostics as a sound

322 basis for all specialisations in the curriculum and for the future academic, continuing education as
323 well. Organisations such as the European Scientific Counsel for Companion Animal Parasites
324 (ESCCAP) or the Companion Animal Parasite Council (CAPC) provide helpful support, contributing to
325 the dissemination of robust and sound knowledge. For farm animals, optional continuous education in
326 applied veterinary parasitology is provided by specialist organisations and federal institutions,
327 supporting the implementation of regulations, including the correct usage of drugs.

328 Recruiting appropriate candidates for a career in veterinary parasitology was (Eckert, 2000) and still is
329 challenging. The aim should be to “close the circle”: appropriately instructed young graduates should
330 be motivated to become specialised veterinary parasitologists (e.g., diplomates of the EVPC) and
331 ‘research professionals’ who will be the teachers in the future, able to motivate new undergraduate
332 students to build a career in veterinary parasitology.

333

334

335 **References**

- 336 Cordero-del-Campillo, M., Rojo-Vazquez, F.A., Diez-Banos, P., Castanon-Ordenez, L., Pereira-
337 Bueno, J.M., Diez-Banos, N., Hidalgo-Arguello, R., 1986. Teaching veterinary parasitology
338 throughout the world. *Vet. Parasitol.* 19, 1-12.
- 339 Deplazes, P., Eckert, J., Mathis, A., von Samson-Himmelstjerna, G., Zahner, H., 2016. Parasitology in
340 Veterinary Medicine. Wageningen Academic Publishers, Wageningen.
- 341 Deplazes, P., Eckert, J., von Samson-Himmelstjerna, G., Zahner, H., 2013. Lehrbuch der
342 Parasitologie für die Tiermedizin. Enke Verlag, Stuttgart.
- 343 Eckert, J., 2000. WAAVP/Pfizer award for excellence in teaching veterinary parasitology: Teaching of
344 veterinary parasitology - quo vadis? *Vet. Parasitol.* 88, 117-125.
- 345 Euzeby, J., 1996. WAAVP/Pfizer award for excellence in teaching veterinary parasitology: My
346 philosophy on teaching parasitology and parasitic diseases. *Vet. Parasitol.* 64, 21-29.
- 347 Gottstein, B., Eckert, J., 2002. Various approaches of teaching veterinary parasitology. *Vet. Parasitol.*
348 108, 267-272.
- 349 Huang, W.Y., Wang, M., Suo, X., Lun, Z.R., Zhu, X.Q., 2006. How is veterinary parasitology taught in
350 China? *Trends Parasitol.* 22, 564-567.
- 351 Kramer, L., Genchi, C., 2002. Teaching of veterinary parasitology: the Italian perspective. *Vet.*
352 *Parasitol.* 108, 317-322.
- 353 Krecek, R., 2002. Resolution on teaching veterinary parasitology. World Association for the
354 Advancement of Veterinary Parasitology (WAAVP). *Vet. Parasitol.* 108, 333-335.
- 355 Lutz, T.A., Schläppi, S., 2008. Das Vetsuisse-Curriculum und die Umgestaltung der Studiengänge
356 nach "Bologna". *Schweiz. Arch. Tierheilk.* 150, 324-326.
- 357 Robinson, R., Molenda, M., Rezabek, L., 2016. Facilitating learning. Association for Educational
358 Communications and Technology
359 (www.aect.org/publications/EducationalTechnology/ER5861X_C002.pdf.)
- 360 Soulsby, L., 1994. WAAVP and Pfizer Award for excellence in teaching veterinary parasitology. *Vet.*
361 *Parasitol.* 54, 23-26.
- 362 Stromberg, B.E., 2002. Teaching veterinary parasitology: the North American perspective. *Vet.*
363 *Parasitol.* 108, 327-331.

364 Thompson, R.C., Lymbery, A.J., Hobbs, R.P., 2002. Teaching of parasitology to students of veterinary
365 medicine and biomedical sciences. *Vet. Parasitol.* 108, 283-290.

366 Vercruysse, J., Eckert, J., 2002. Teaching of undergraduate veterinary parasitology in some
367 European countries. *Vet. Parasitol.* 108, 309-315.

368

369

370 Table 1: Schematic representation of veterinary parasitology teaching within the Vetsuisse curriculum.

Bachelor program			
Semester	Topic	No. of hours (h), type of lesson	Type of examination
Semester 2	basic parasitology and ecology	8 h, lecture	written, MC
Semester 3	OC, module haematology and immune system organs	2 h, practical	written, MC within the module
Semester 4	NOC, helminthology	30 h, lectures combined with practical exercises	oral and practical (end of semester 5)
	OC, module gastro-intestinal tract	6 h, practical	written, MC within the module
Semester 5	NOC, arachno-entomology and protozoology	28 (30) h, lectures combined with practical exercises	oral and practical
	OC, cardiovascular and respiratory module	2 h, practical	written, MC within the module
Semester 6	OC skin and thermoregulation	2 h, practical	written, MC within the module
Master program			
Semester 7	immuno-infectiology, parasitology	10 (12) h	audit opinion
Semester 8	focus pathobiology, parasitology*	2 weeks, practical	oral and written report
	focus in "small animals", "farm animals", "horses", parasitology*	2-6 h each, practical	group presentation
Semester 9	focus pathobiology, parasitology*	3 months	written report

371

372 OC: organ-centred; NOC: non-organ-centred; MC: multiple choice; *: elective subjects chosen from

373 six areas of specialisation