

August 2019 –
Dezember 2021



vetsuisse-fakultät

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b
**UNIVERSITÄT
BERN**



Institut für Parasitologie
der Vetsuisse-Fakultät sowie
der Medizinischen Fakultät
der Universität Bern

Nationales Referenzlabor für Toxoplasmose
Nationales Referenzlabor für Trichinellose
Nationales Referenzlabor für Tritrichomonose
Nationales Referenzlabor für Beschälseuche
Nationales Referenzlabor für Neosporose
Nationales Referenzlabor für Besnoitiose

Co-Direktorinnen / Co-Directors:
Prof. Dr. C. Frey
Prof. Dr. B. Lundström-Stadelmann

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1. VORWORT DIREKTORINNEN / PREFACE DIRECTORS

Im August 2019 durften wir, Caroline Frey und Britta Lundström-Stadelmann, gemeinsam die Direktion des Instituts für Parasitologie (IPA) Bern übernehmen. Dank der guten Zusammenarbeit mit unserem Vorgänger Prof. Dr. Bruno Gottstein erfolgte der Leistungswechsel nahtlos. Trotzdem kam es im Rahmen der Neuberufung zu strukturellen Veränderungen und wir haben unsere Forschungsschwerpunkte und Lehrkonzepte eingebracht.

Wir leiten das Institut als Co-Direktorinnen und es freut uns sehr, dass wir damit eine Vorreiterrolle im Gebiet des Top-Sharing an der Universität Bern wahrnehmen können. Unser Modell stösst nicht nur in Bern, sondern in der gesamten Schweiz und selbst im europäischen Raum auf grosses Interesse. Die Co-Direktion hat sich nun zweieinhalb Jahre im Alltag bewährt und wir sind von den Vorteilen dieser Führungsform überzeugt.

Einen sehr grossen Einschnitt in das tägliche Leben, Forschen und Lehren am Institut bedeutete seit Frühjahr 2020 die Covid-19 Pandemie. Vorlesungen, Referate und Seminare mussten innert kürzester Zeit auf digitale Versionen umgestellt werden. Die Forschung dufte phasenweise kaum stattfinden, während der systemrelevante Diagnostikbetrieb weiter funktionieren musste, jedoch mit reduziertem Personal. Dies stellte für uns alle eine grosse Belastung dar. Herzlichen Dank an alle Institutsangehörige für die grosse Flexibilität, die sie während der letzten zwei Jahre gezeigt haben. Trotz Pandemie, Homeoffice-Pflicht und reduzierter Forschungsmöglichkeiten hat es das Team geschafft, hochwertige Lehre, exzellente Forschung und qualitativ höchststehende Diagnostik zu erbringen, und dabei den guten Teamgeist und zwischenmenschliche Kontakte zu erhalten und zu pflegen.

Eine weitere grosse Veränderung war der von der Fakultät beschlossene Transfer der humanparasitologischen Diagnostikabteilung vom IPA in das Institut für Infektionskrankheiten (IFIK) der Universität Bern. Vor allem personell und finanziell bedeutete dies einen grossen Verlust, hat aber auch zu verstärktem Austausch und Zusammenarbeit mit dem IFIK geführt. Auch hier möchten wir den Mitarbeitenden, die diese Veränderung im Alltag umgesetzt haben, ein grosses Dankeschön aussprechen.

Eine Herausforderung, welche bravurös gemeistert wurde, war die Neuakkreditierung der Diagnostikabteilung als eigenständiges Labor, welche mitten in der Pandemie über die Bühne ging. Seit Juli 2020 sind wir unter der STS-Nummer 0678 zu finden. Ein herzliches Dankeschön an alle Beteiligten!

Das Forschungskonzept des Instituts wurde zwar angepasst, beruht aber weiterhin im Wesentlichen auf der Hymeninen- (*Echinococcus* spp., *Trichinella* spp., *Fasciola hepatica*) und der Protozoenforschung (Apicomplexa, *Giardia* spp.). Sowohl im Bereich der Grundlagen- als auch der angewandten Forschung konnten die Aktivitäten erhalten und teilweise sogar ausgebaut werden. Der international anerkannte Forschungsruf konnte verteidigt, Zusammenarbeiten im In- und Ausland ausgebaut und Drittmittel erfolgreich eingeworben werden. Nähere Informationen zur Forschung sind diesem Jahbericht zu entnehmen.

Unsere Leidenschaft für das Fachgebiet fliest in die Lehre ein und steckt regelmässig junge Menschen an, welche wir dann auf ihrem weiteren Weg begleiten und unterstützen dürfen. Nachwuchsförderung ist uns ein grosses Anliegen und beginnt bereits bei Praktikumsmöglichkeiten für Gymnasiastinnen und Gymnasiasten, geht über die Betreuung von Maturaarbeiten und hört bei der klassischen Lehre und Praktika im Studium nicht auf: trotz Pandemie konnten Studierende der Veterinärmedizin und der Naturwissenschaften ihre Master- und Bachelorarbeiten bei uns durchführen und PhD-Projekte und Doktorarbeiten erfolgreich abgeschlossen. Neu bieten wir Veterinärmedizinerinnen und –medizinern die Möglichkeit, sich im Rahmen einer Residency zu spezialisieren und den Diplome-Titel des European Veterinary Parasitology College (EVPC) zu erwerben. Eine Übersicht über die Lehrtätigkeit, Abschlüsse und Praktika bietet der dieser Bericht.

Die politisch-strategische Zusammenarbeit innerhalb des Departements für Infektionskrankheiten und Pathobiologie (DIP), der Vetsuisse Fakultät, der Universität Bern und im schweizerischen parasitologischen Raum wurde gestärkt und ausgebaut, wie auch diesem Jahresbericht entnommen werden kann. Insbesondere möchten wir hier das DIP und die Schweizerische Gesellschaft für Tropenmedizin und Parasitologie (SGTP) erwähnen, mit welchen wir sowohl auf fachlicher, wie auch auf persönlicher Ebene eine intensive Zusammenarbeit aufbauen konnten und seither pflegen.

Eine uns täglich begegnende Herausforderung war und bleibt der Platzmangel, der sich nachteilig auf alle Aspekte des Instituts auswirkt. Wir werden uns auch in Zukunft mit Nachdruck dafür einsetzen, dass wir adäquate räumliche Bedingungen bieten können um in einem gesunden Rahmen als Institut zu wachsen.

Zusammenfassend waren die Jahre 2019-2021 geprägt von vielen Veränderungen innert kurzer Zeit und von unvorhersehbaren Ereignissen. Gemeinsam haben wir als Institut diese Herausforderungen sehr gut gemeistert und es geschafft, das Miteinander und die Freude an der Arbeit zu erhalten. Vielen Dank an das gesamte motivierte IPA-Team!



Britta Lundström-Stadelmann und Caroline Frey. © Conrad von Schubert.

2. ADMINISTRATION

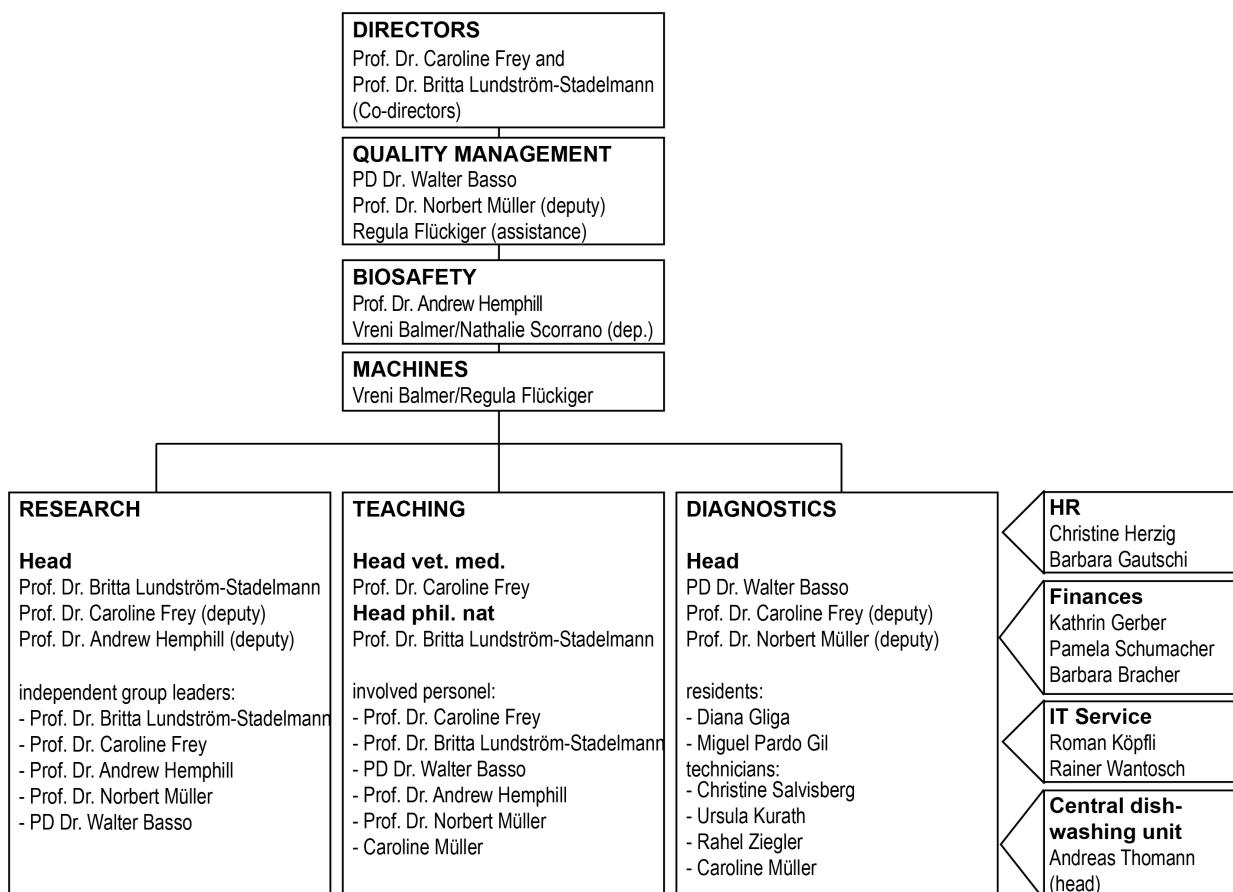
2.1 INSTITUTSBEZEICHNUNG / INSTITUTE NAME

Institut für Parasitologie
der Vetsuisse und der Medizinischen Fakultät
Universität Bern
Länggass-Strasse 122
3012 Bern
Schweiz

Institute of Parasitology
Vetsuisse Faculty and Medical Faculty
University of Bern
Länggass-Strasse 122
CH-3012 Bern
Switzerland

Webpage <https://www.ipa.vetsuisse.unibe.ch/>

2.2 ORGANIGRAMM / ORGANIGRAM (AS OF DEC. 2021)



3. MITARBEITENDE / EMPLOYEES (AUG. 2019 – DEC. 2021)

3.1 ARBEITSGRUPPEN / UNITS

Forschung / Research

Gruppenleitende / Principal Investigators

Prof. Dr. Britta Lundström-Stadelmann
Prof. Dr. Caroline Frey
Prof. Dr. Andrew Hemphill
Prof. Dr. Norbert Müller
PD Dr. Walter Basso

Postdocs

Dr. Ghalia Boubaker
Dr. Matías Preza

PhD Studierende und Doktorierende / PhD and doctoral students

Reto Rufener
Dominic Ritler
Anika Meyer Schülke
Pablo Winzer
Seraina Meister
Nicoleta Anghel
Dennis Imhof
Yosra Amdouni
Marc Kaethner
Diana Gliga
Kai Häggeli
Tobias Kämpfer
Miguel Pardo Gil

Adjunct Researchers

Dr. Helder Cortes
Victor Caeiro Laboratory of Parasitology
Mitra Center, University of Evora, Portugal

Prof. Dr. Maria Mar Siles Lucas
Instituto de Recursos Naturales y
Agrobiología de Salamanca
(IRNASA-CSIC), Salamanca, Spain

Dr. David Leitsch
Institut für Spezifische Prophylaxe und
Tropenmedizin
Medizinische Universität Wien, Austria

Wissenschaftliche Mitarbeitende / Scientific staff

PD Dr. Joachim Müller

Laborantinnen / Technicians

Vreni Balmer
Nathalie Scorrano
Regula Flückiger

Master Studierende / Master students

Naja Eberhard
Raphael Zurbriggen
Jessica Ramseier
Kai Häggeli
Roman Memedovski
Noé Haudenschild
Carling Schlange
Leonie von Bueren
Elena Sollberger
Jasmin Gerber
Fabienne Holenweger
Johanna Kauter
Sheena Chaudhry
Carmen Lugimbühl
Denise Grolimund
Marion Stettler
Lea Hiller
Nicole Dietrich
Pauline Liechti
Anna Schneider

Assistierende / Assistants

Tanja Karpstein

Diagnostik / Diagnostic unit

Leitung / Head

PD Dr. Walter Basso
Prof. Dr. Caroline Frey (Stv.)
Prof. Dr. Norbert Müller (Stv.)

EVPC Residents

Diana Gliga
Miguel Pardo Gil

Laborantinnen / Technicians

Christine Salvisberg
Caroline Müller
Larissa Hofmann
Liliane Krähenbühl
Ursula Kurath
Yamina Baumgartner
Rahel Ziegler

3.3 NEUE MITARBEITENDE / NEW EMPLOYEES

2021

Matías Preza
Regula Flückiger
Miguel Pardo Gil
Rahel Ziegler
Tobias Kämpfer
Lea Hiller
Nicole Dietrich
Pauline Liechti
Anna Schneider

2020

Marc Kaethner
Ursula Kurath
Diana Gliga
Nathalie Scorrano
Yamina Baumgartner
Marion Stettler
Denise Grolimund
Carmen Luginbühl
Jessica Ramseier
Kai Hänggeli

2019 (since Aug.)

Caroline Frey
Johanna Kauter
Jasmin Gerber
Roman Memedovski

3.4 AUSGETRETENE MITARBEITENDE / PAST EMPLOYEES

2021

Tanja Karpstein
Seraina Meister
Raphael Zurbriggen
Yamina Baumgartner
Jessica Ramseier
Nicoleta Anghel
Roman Memedovski
Johanna Kauter
Jasmin Gerber

2020

Liliane Krähenbühl
Pablo Winzer
Dominic Ritler
Reto Rufener
Larissa Hofmann
Fabienne Holenweger

2019 (since Aug.)

Anika Meyer Schülke
Yosra Amdouni
Naja Eberhard
Elena Sollberger
Leonie von Büren

4. FORSCHUNG / RESEARCH

4.1 GRANTS

Members of IPA as main PI

Uniscientia Foundation

Project title:	"Ocular toxoplasmosis: studies on drug susceptibility of novel field isolates and development of an animal model"
Principal Investigator:	A. Hemphill
Project Budget:	180'000 CHF
Project Period:	April. 2021 – March 2024

Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV)

Project Title:	"Erhebung der Seroprävalenz von <i>Neospora caninum</i> Infektionen bei Rindern in der Schweiz"
Principal Investigator:	W. Basso, C. Frey
Project Budget:	10'770 CHF
Project Period:	Dec. 2020 – Dec. 2021

Swiss National Science Foundation (SNSF)

Project number:	IZSTZ0_191762
Project title:	"The molecular basis of adaptation of <i>Aedes</i> mosquitoes, vectors of viral diseases, to saltwater environments"
Principal Investigator:	A. Hemphill
Project Budget:	132'550 CHF
Project Period:	Oct. 2020 – Sept. 2023

Swiss National Science Foundation (SNSF)

Project number:	310030_192072
Project title:	"Energy-generating pathways of the parasite <i>Echinococcus multilocularis</i> and their potential for novel, targeted treatments against alveolar echinococcosis"
Principal Investigator:	B. Lundström-Stadelmann
Project Budget:	700'000 CHF
Project Period:	Apr. 2020 – Mar. 2024

Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV)

Project Title:	"Feldversuch zur Anwendung von PrioCHECK® Trichinella AAD für den Nachweis von <i>Trichinella</i> spp. Larven mittels Trichomat-35"
Principal Investigator:	W. Basso
Project Budget:	7'350 CHF
Project Period:	Dec. 2019 – Dec. 2020

Swiss National Science Foundation (SNSF)

Project title:	"Effects of a double-edged sword: exploiting the interaction between immunity and chemotherapy in murine and ovine models of congenital neosporosis and toxoplasmosis"
Principal Investigator:	A. Hemphill
Project Budget:	846'720 CHF
Project Period:	Apr. 2019 – Mar. 2023

Novartis Foundation for medical-biological Research

Project title:	"Dual inhibition of the <i>Echinococcus multilocularis</i> energy metabolism as a novel concept for future treatment of alveolar echinococcosis"
Principal Investigator:	B. Lundström-Stadelmann
Project Budget:	60'000 CHF
Project Period:	Feb. 2019 – Jan. 2020

Swiss National Science Foundation (SNSF)

Project number:	31003A_179439
Project title:	"Targeting the metabolism of <i>Echinococcus multilocularis</i> for the development of novel drug treatments and immunotherapeutic tools"
Principal Investigator:	B. Lundström-Stadelmann
Project Budget:	350'000 CHF
Project Period:	Apr. 2018 – Mar. 2020

Novartis Research Foundation

Project title:	"Toxoplasmosis: more dangerous than expected? Studies on drug susceptibility of novel parasite isolates"
Principal Investigator:	A. Hemphill
Project Budget:	60'000 CHF
Project Period:	Nov. 2018 – Oct. 2022

Zoo Basel

Project Title:	"Dynamik des Parasitenbefalls bei Weissstörchen(<i>Ciconia ciconia</i>)"
Principal Investigator:	W. Basso
Project Budget:	55'000 CHF
Project Period:	Nov. 2018 – Dec. 2020

Verein zur Förderung der Forschung im Gesundheitssektor von Lamas und Alpakas, Kronberg im Taunus, Deutschland

Project Title:	"Epidemiological study of <i>Neospora caninum</i> and <i>Toxoplasma gondii</i> infections in South American camelids in Switzerland"
Principal Investigator:	W. Basso, P. Zanolari
Project Budget:	20'484 CHF
Project Period:	Jun. 2018 – Dec. 2019

Gottfried and Julia Bangerter-Rhyner-Stiftung

Project title:	"Starving a deadly pathogen: The metabolism of the fox tapeworm <i>Echinococcus multilocularis</i> "
Principal Investigator:	B. Lundström-Stadelmann
Project Budget:	100'000 CHF
Project Period:	Nov. 2016 – Jan. 2020

Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV)

Project title:	"Alveolare Echinococcose beim Schlachtschwein: Prävalenzschätzung und Erkennung von Risikofaktoren"
Principal Investigator:	C. Frey
Project Budget:	196'603 CHF
Project Period:	Mar. 2017 – Nov. 2019

IPA as collaborator

National Institutes of Health (NIH)

Project title: "Optimization of lead-BKIs for cryptosporidiosis therapy"
Principal Investigator: W. Van Voorhis, University of Washington, Seattle, USA.
Collaborator at IPA: A. Hemphill
Project Budget: 147'066 US-Dollars
Project Duration: March 2021 – Feb. 2026

National Institutes of Health (NIH)

Project title: "Bumped kinase inhibitor drug development for toxoplasmosis"
Principal Investigator: W. Van Voorhis, University of Washington, Seattle, USA.
Collaborator at IPA: A. Hemphill
Project Budget: 81'000 US-Dollars
Project Duration: Jan. 2021 – Dec. 2025

INSERM International Project

Project title: "NANOTHERA-ECHINO Project"
Principal Investigator: S. Dion, University of Rennes, F
Collaborator at IPA: B. Lundström-Stadelmann
Project Budget: 60'000 EUR
Project Duration: Jan. 2021 – Dec. 2025

Scientific Challenge funding from the University of Rennes

Project title: "Targeted therapy, a new therapeutic hope for alveolar echinococcosis"
Principal Investigator: S. Dion, University of Rennes, F
Collaborator at IPA: B. Lundström-Stadelmann
Project Budget: 6'000 EUR
Project Duration: 2020

BOSIT Rennes

Project title: "Targeted therapy, a new therapeutic hope for alveolar echinococcosis, *in vitro* evaluation"
Principal Investigator: S. Dion, University of Rennes, F
Collaborator at IPA: B. Lundström-Stadelmann
Project Budget: 4'700 EUR
Project Duration: 2020

Swiss National Science Foundation (SNSF)

Project title: "Ruthenium complexes for the treatment of protozoan diseases of medical and veterinary importance"
Principal Investigator: J. Furrer, Department of Chemistry, University of Bern
Collaborator at IPA: A. Hemphill
Project Budget: 1'547'903 CHF

Research supported by industries

Boehringer-Ingelheim

Project title: "Bulk milk serology for major helminthoses in dairy cattle"
Principal Investigator: C. Frey
Project Budget: 22'240 CHF
Project Duration: Aug. 2021 – Dec. 2021

ELANCO

Project title: "Development of novel *in vitro* screening methods"
Principal Investigator: B. Lundström-Stadelmann
Project Budget: 82'121 CHF
Project Duration: Jan. 2020 – Dec. 2020

ELANCO

Project title: "Research collaboration and laboratory services"
Principal Investigator: A. Hemphill
Project Budget: 237'370 CHF
Project Duration: Jan. 2019 – Dec. 2021

ELANCO

Project title: "Development of novel *in vitro* screening methods"
Principal Investigator: B. Lundström-Stadelmann
Project Budget: 82'121 CHF
Project Duration: Jan. 2019 – Dec. 2019

4.2 PROJEKTZUSAMMENFASSUNGEN / PROJECTS AND SUMMARIES OF MAIN PROJECTS**ECHINOCOCCUS MULTILOCULARIS – DER FUCHSBANDWURM / THE FOX TAPEWORM****Researchers at IPA (alphabetical order):**

Dr. G. Boubaker - S. Chaudhry - Prof. Dr. A. Hemphill - M. Kaethner - T. Kämpfer - T. Karpstein - Prof. Dr. B. Lundström-Stadelmann - R. Memedovski - Dr. J. Müller - Dr. M. Preza – Dr. D. Ritler - Dr. R. Rufener - N. Scorrano - R. Zurbriggen.

External collaborators (only PIs are listed, alphabetical order):

Prof. Dr. G. Beldi (University of Bern) - Dr. S. Bresson-Hadni (French National Reference Center for Echinococcosis, Besançon, F; Geneva University Hospital) - Dr. A. Casulli (Istituto Superiore di Sanità, Rome, I) - Dr. Sarah Dion (Institut de Recherche en Santé (IRSET), University of Rennes, F) - Prof. Dr. Stone Doggett (Oregon Health and Science University, Portland, OR, USA) - Prof. Dr. B. Gottstein (University of Bern) - Prof. Dr. Manfred Heller (University of Bern) - Prof. Dr. C. Largiader (University of Bern) – Dr. J. Li (Imperial College London, UK) - Prof. Dr. Martin Lochner (University of Bern) - Prof. Dr. M. V. Nora de Souza (Fundação Oswaldo Cruz, BR) - Prof. Dr. A. Odermatt (University of Basel) - Dr. Clement Regnault (Glasgow Polyomics, UK) - Prof. Dr. Stefan Schürch (University of Bern) - Prof. Dr. Antonio Vercasia (University of Sassari, I) - Dr. J. Wang (University of Bern).

Project background

The metacestode (larval stage) of the helminth *Echinococcus multilocularis* is the causative agent of **alveolar echinococcosis (AE)**, a severe and in many cases incurable disease in humans. AE is recognized to be an emerging disease in the Northern hemisphere, nevertheless it still is a largely neglected disease. Radical curative surgery is not possible in many AE patients, and therapy based on albendazole or mebendazole is presently the only approved option for a stabilizing, but non-curative, treatment.

Project description

Novel treatments against AE are urgently needed, and therefore we have established *in vitro* culture techniques for *E. multilocularis* metacestodes, as well as an *in vitro* screening platform for the identification of novel drugs against the parasite, which can then be followed-up in established mouse models of AE (summarized in: Lundström-Stadelmann et al., 2019). We are also working on improving drug-formulations and drug-delivery. Currently, we establish respective methods for screening against metacestodes of the closely related *E. granulosus*, the dog tapeworm, causative agent of **cystic**

echinococcosis (CE) (Kaethner et al., in preparation). Also CE is a neglected disease, even though it is roughly ten times more prevalent than AE, and it is found worldwide. In 2020, we were involved in a study of testing of novel benzimidazole formulations against CE in mice, which showed that indeed salt formulations of albendazole show an improved efficacy (Vural et al., 2020).

Due to the fact that pharmaceutical companies are reluctant to engage in preclinical drug development for AE, we have largely focused on **repurposing** of already existing drugs or compound classes that are on the market or being developed for other indications. With whole-organism screening we hereby focus on **anti-cancer compounds, natural compounds and anti-infective compounds** (Hemphill and Lundström-Stadelmann, 2021). We perform **pharmacodynamic studies** *in vitro* and *in vivo*, investigate the **mode of action** of active compounds, as well as the **structure activity relationship (SAR)**.

In 2020 and 2021, our main studies covered (a) the natural compound Maca and the anti-infective compounds (b) mefloquine and (c) endochin-like quinolones (ELQs).

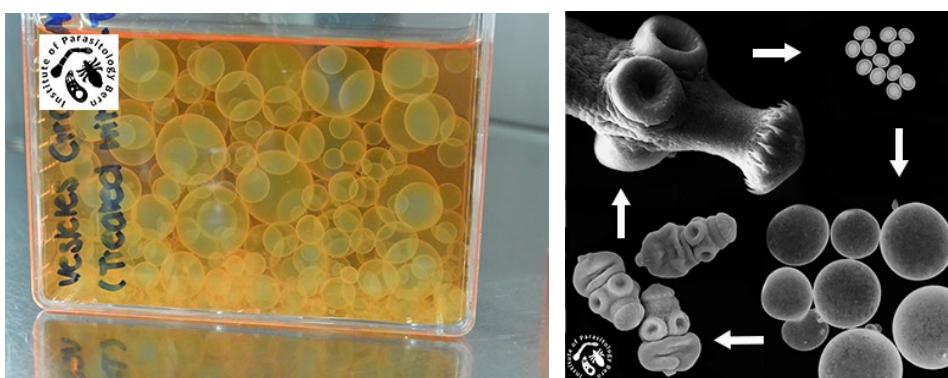
(a) Natural compounds and medicinal plant extracts receive increasing attention in biomedical research, as they are low in costs and show strong pharmacological potential, exhibit anti-oxidant, anti-inflammatory, or anti-proliferative potential and are therefore increasingly tested against various morbidities. We investigated the **Peruvian root extract Maca (*Lepidium meyenii*)** against AE (Karpstein et al., 2021). Based on the clinical observation of an AE patient, who had self-medicated himself with Maca (in addition to the standard benzimidazole therapy) and who was free of viable parasite tissue or any serological response of an ongoing infection after 2 years, we tested Maca in *E. multilocularis* infected mice. However, Maca was not efficacious in this *in vivo* testing, nor was it active in any *in vitro* tests against metacestodes of the parasite. Thus, Maca exhibited clearly no direct anti-parasitic activity, but we could show that it induced *in vitro* proliferation of murine spleen cells. This suggests that immunomodulatory properties of Maca could have contributed to the curative effect seen in the patient.

(b) We had previously identified that the **anti-malarial mefloquine** exhibited remarkable *in vitro* activities against *E. multilocularis* metacestodes, and that the drug was also active in AE mouse models (Lundström-Stadelmann et al., 2020). However, mefloquine was not able to act fully parasitically, thus was not killing the stem cells of the parasite. To improve the activity of mefloquine, two series of **mefloquine derivatives** were investigated for their anti-echinococcal activity, and subsequent SAR analysis (Memedovski et al., in preparation; Rufener et al., 2018b). Comparative affinity chromatography in combination with mass spectrometry thereby let us identify highly interesting drug targets, which are currently under further investigation.

(c) A previous screening had identified **buparvaquone and the endochin-like quinolone (ELQ) 400** as highly active compounds against *E. multilocularis* *in vitro* (Rufener et al., 2018). Buparvaquone was followed up for its mode of action, the inhibition of the mitochondrial *bc₁* complex, but failed to be active in a secondary AE infection model. We then investigated a series of ELQs for their activities against different *E. multilocularis* isolates, and performed a SAR analysis (Chaudhry et al., submitted). We investigated the mode of action of selected ELQs, which largely target the mitochondrial electron transfer chain (ETC), as previously shown for buparvaquone.

Based on these screening-based studies we have developed more target-based approaches for further treatment of echinococcosis: Possible targets that are studied are (d) the **energy metabolism** (ETC and malate dismutation (MD) , (e) **metabolic footprint** and requirements of the parasite, and (f) **immunomodulation** as well as other physiological effects of an *Echinococcus* infection.

- (d) The **mitochondrial electron transfer chain** was shown to be an excellent target in several of our more recent studies of anti-infective drugs against *E. multilocularis* (see above). However, as we could show in basic metabolomics studies (Ritler et al., 2019), *Echinococcus* does not employ one single mitochondrial pathway for energy generation and recycling of NAD, but alternative pathways are available, most prominently the **malate dismutation**, a pathway not found in mammals. We therefore now also assess effects of ELQs on the MD, and apply simultaneous blocking of the ETC and the MD pathway (Chaudhry et al., submitted). We also have started more basic molecular biological investigations of the MD pathway.
- (e) We have studied the **metabolic footprint of the parasite**, i.e. which nutrients metacestodes scavenge from their host, and whether there would be a way of blocking parasite growth by specifically starving them from these nutrients. Apart from the already above-mentioned MD pathway, we identified threonine as a highly consumed metabolite (Ritler et al., 2019). A pathway which might be central in threonine consumption is the threonine dehydrogenase (TDH) pathway. *E. multilocularis* actively expresses the pathway, and in humans, it is a non-functional pathway, thus being an ideal future target. We therefore focus on specific TDH-inhibitors in a collaborative project, and in tracing studies we investigate the threonine pathways in the parasite (Kaethner et al., in preparation). Our studies on the proteomic footprint of *E. multilocularis* showed that Antigen B (AgB) is one of the most highly released proteins, and we currently study its function in lipid-transport (Müller et al., in preparation).
- (f) Using T-cell deficient athymic nude mice, we demonstrated that **functional immunity is required** for albendazole to be efficacious against murine AE (Wang et al., 2020). These results are particularly important given the increasing number of immunocompromised patients with AE, and further underline the high potential of immunomodulatory therapies against AE. In a collaborative project, we identified the induction of a tolerogenic host immune response with FoxP3+ Treg as key players at the late stage of murine hepatic AE favouring metacestode survival (Wang et al., 2018). We have also collaborated on a study showing that PD-1/PD-L1 immune checkpoint blockage was effective against murine AE (Jebbawi et al., 2021). A further collaborative study showed that *E. multilocularis* infection of mice led to chronic inflammation, an upregulation of unfolded protein response (UPR) and endoplasmic reticulum-stress (ERS) (Weingartner et al., 2022). Albendazole treatment, as well as anti-PD-L1 treatment, reversed these effects. Future studies will show if UPR and ERS could offer novel treatment approaches. In a LC-MS/MS study, a significant decrease of unconjugated bile acids was detected in serum and liver tissue of AE infected mice (Gómez et al., 2021). Treatment with ABZ reversed these effects. Future studies will reveal if bile acids might be used as biomarkers of AE and for treatment monitoring.



Left: *In vitro* culture of *E. multilocularis* metacestodes, the disease-causing stage of the parasite. Right: Different life cycle stages of *E. multilocularis*. Clockwise from upper left: head of an adult fox tapeworm, eggs, metacestodes and protoscoleces. ©Institute of Parasitology Bern.

PREVENTIVE AND THERAPEUTIC TARGETS FOR THE CONTROL OF NEOSPOROSIS, TOXOPLASMOSIS AND DISEASES CAUSED BY OTHER APICOMPLEXANS

Researchers at IPA (alphabetical order):

Yosra Amdouni – Dr. Nicoleta Anghel – Vreni Balmer - Dr. Ghalia. Boubaker – Noé Haudenschild - Kai Hänggeli - Prof. Dr. Andrew. Hemphill - Dennis Imhof – Jessica Ramseier – PD Dr. Joachim. Müller – Prof. Dr. Norbert. Müller - Carling Schlange – Dr. Pablo Winzer.

External collaborators (only PIs are listed, alphabetical order):

Prof. Dr. Stone Doggett (Oregon Health and Science University, Portland, OR, USA) - Prof. Julien Furrer (University of Bern) - Prof. Dr. Gilles Gasser (Chimie Paris Tech, PSL University, Paris, F) – Prof. Dr. Richard Haynes (North West University, Potchefstroom, SA) - Prof. Dr. Manfred Heller (University of Bern) - Prof. Dr. Alexandre Leitao (University of Lisbon, P) – Prof. Dr. Nadia Mercader Huber (Institute of Anatomy, University of Bern) - Prof. Dr. Luis-Miguel-Ortega-Mora (Complutense University, Madrid, E) - Prof. Kayode K Ojo (University of Washington, Seattle, USA) - Prof. Isabel Roditi (University of Bern) - Prof. Wesley C Van Voorhis (University of Washington, Seattle, USA) - PD Dr. Philipp Olias and Dr. Kerry Woods (University of Bern) - Prof. Anna Oevermann (University of Bern).

Project background

Apicomplexan parasites such as ***Neospora caninum*** and ***Besnoitia besnoiti*** cause serious diseases in animals, most notably cattle. While *N. caninum* is an important causative agent of **abortion and fetal loss**, *B. besnoiti* can cause acute disease and death, or chronic infection of the skin and reproductive tract leading to infertility. ***Toxoplasma gondii*** and ***Cryptosporidium parvum*** infect both animals but also humans and have a high **zoonotic potential**. *T. gondii* infections can lead to abortion or hydrocephalus in newborn upon primary infection during pregnancy, and/or multiple organ failure and death in immunosuppressed individuals. Another important feature is ocular toxoplasmosis. *C. parvum* is an important cause of severe diarrhea in immunocompromised individuals or small children, and often leads to death. Our aim is to **identify and characterize novel drugs, and also novel potential drug targets**, especially for, but not exclusively, neosporosis and toxoplasmosis, with special emphasis in the situation during pregnancy. In addition, we aim to gain further insight into novel preventive measures such as **vaccines** that could be used for the control of these diseases. As a further aspect of high interest, we want to elucidate the **molecular basis of the mechanisms of action of selected compounds**, especially in relation to potential off-target effects.

Project description

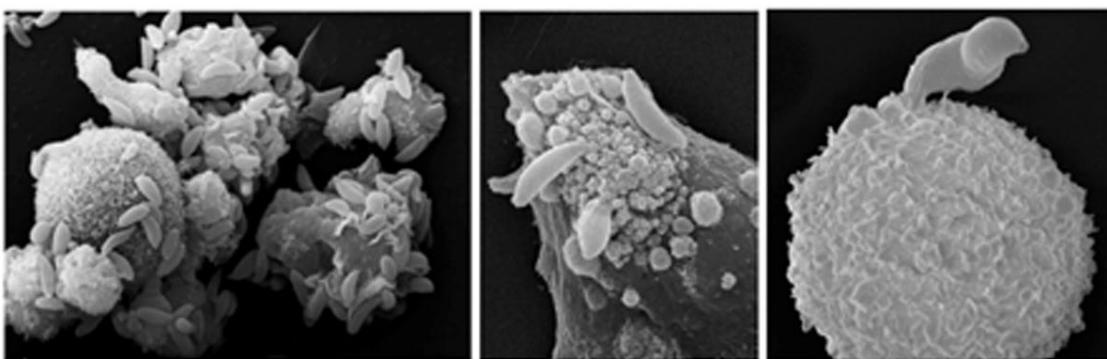
We have repurposed a number of compounds, and established a **standardized screening platform**. In a first instance, we studied safety and efficacy predominantly in *Toxoplasma* and *Neospora* *in vitro*, and for some drugs we also include *Giardia intestinalis* or *Theileria annulata*. *In vitro* or *ex vivo* assessments were done by IC₅₀ determination in cell cultures, cytotoxicity measurements in mammalian cells used as host cells, toxicity in a model of zebrafish embryo development and in splenocyte cultures (B- and T- cells). The effects of selected compounds were then further evaluated on the ultrastructural level by transmission electron microscopy. Promising drug candidates were carried further into experimental animal models. For this, we employed standardized pregnant models for neosporosis (Balb/c mice) or toxoplasmosis (CD1 mice). Primary safety assessment was carried out by studying the effects on pregnancy in mice, and if compounds did no interfere in pregnancy, *in vivo* challenge experiments are carried out.

Bumped kinase inhibitors (BKIs) are inhibitors of the calcium dependent protein kinase 1 (CDPK1), a kinase that is only expressed in plants, fungi, and apicomplexan parasites, but not in mammalian cells. Among those several BKIs were characterized extensively *in vitro*. BKIs do not act parasiticidal, but induce the formation of multinucleated complexes, resulting in parasite complexes that remain trapped within their host cells. These complexes remain viable for several weeks, and when this occurs *in vivo*, this will influence immunity. Despite the non-parasiticidal nature of these compounds *in vivo* safety and efficacy assessments

revealed that several BKIs are highly active in pregnant mouse models, and inhibit cerebral infection and vertical transmission. Two BKIs, namely BKI-1553 and BKI-1294, have been evaluated further in experimental pregnant sheep models for congenital toxoplasmosis and neosporosis, with several BKIs still in the pipeline. BKIs are also being developed for cryptosporidiosis, with our lab performing zebrafish assays and studies on interference in pregnancy in mice.

Mitochondrial inhibitors are another promising class of compounds. Among these are decoquinate and a series of novel decoquinate derivatives, buparvaquone, artemisin derivatives such as artemisid and artemison, and endochin-like quinolones (ELQs). Both *Neospora* and *Toxoplasma* exhibit unusually low IC₅₀ values against these compounds (0.01-4 nM), and a swift destruction of the structural integrity of the mitochondrion is observed. In some instances, this is accompanied by expression of bradyzoite antigens such as BAG1. However, some of these inhibitors impair pregnancy, thus were not suitable for treatment of pregnant mice. Some ELQs as well as buparvaquone are highly active against *B. besnoiti*. ELQ-422 and ELQ-334 were safe in pregnant mouse models and exhibited outstanding *in vivo* efficacy in terms of prevention of vertical transmission of *N. caninum*. In addition, a combination of ELQ-334 blocked vertical transmission in *N. caninum*-infected mice by 100%.

Trithiolato-bridged arene(II) ruthenium-based organometallic compounds: Within the framework for a Sinergia project, we evaluated > 350 newly synthesized compounds, mostly in the *Toxoplasma* model. A SAR study revealed the structural requirements that could improve safety and efficacy. In addition, we investigated duplex- and triple-ruthenium complexes, complexes conjugated to Coumarin and Bodipy, and complexes linked to organic drugs, lipophilic groups and metabolites. Some of these complexes were also active against *Trypanosoma brucei* bloodstream forms. Differential affinity chromatography of selected compounds conjugated to epoxy-activated sepharose with *Toxoplasma* and *Trypanosoma* extracts revealed that the main drug-binding proteins were in the mitochondrion of both organisms, or to a lower degree were involved in protein synthesis. For the ATP-synthase complex in *T. brucei* we could validate this protein as the main target, a result that confirmed TEM results showing a profound impairment of mitochondrial structural integrity.



Picture: Scanning electron microscopy of *N. caninum* tachyzoites invading lymphocytes.
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***Listeria monocytogenes* as a novel vaccine vector for the prevention of *Neospora* infections in pregnant mice:** A novel live-vaccine vector based on *L. monocytogenes* but lacking three virulence genes was assessed for safety and for efficacy in the neosporosis mouse model. *L. monocytogenes* was engineered to express NcSAG1, the major *N. caninum* tachyzoite surface antigen, resulting in the vector Lm3Dx_SAG1. After safety evaluation in pregnant and non-pregnant mice, a challenge experiment showed that vaccination of mice with this vector resulted in a profound inhibition of vertical transmission, postnatal survival of 67% of offspring, lower IgG antibody responses in the vaccinated group and cytokine recall responses in splenocyte cultures indicating a mixed Th1/Th2 cytokine response.

Vaccine-linked chemotherapy: We investigated the potential of a vaccine-linked chemotherapy approach for the prevention/treatment of *N. caninum* infection. In one study, mice were vaccinated with a subclinical low-dose of live *N. caninum*, which then protected these mice against experimental re-infection. However, treatment of such vaccinated mice with BKI-1294 prior to re-infection had detrimental effects, resulting in increased vertical transmission upon re-challenge. This effect was attributed to a potential inactivation of the live vaccine by the drug itself. In a second study, mice were vaccinated with Lm3Dx_SAG1, mated and infected with *N. caninum*, and subsequently treated with BKI-1748. We found that a combined vaccination/treatment approach profoundly reduced vertical transmission and led to significantly increased pup survival compared to monotherapies by vaccine or drug only. Such a vaccine-linked chemotherapy approach could be more widely applied in parasite infection models.

4.3 WEITERE PROJEKTE / OTHER PROJECTS

a) Prävalenz von und Risikofaktorenanalyse für Seropositivität auf Endoparasiten in der Tankmilch, ein Update

Forschende am IPA (alphabetisch):

Dr. W. Basso, Prof. Dr. C.F. Frey, D. Gliga.

Externe Forschende (alphabetisch):

Dr. M. Lang, Boehringer-Ingelheim, Dr. N. Marreros, HAFL Zollikofen, Prof. Dr. C. Strube, Tierärztliche Hochschule Hannover.

Zusammenfassung: In den Jahren 2014 bis 2016 wurde eine Prävalenz Studie und Risikofaktorenanalyse auf ausgewählten Endoparasiten (*Ostertagia ostertagi*, *Fasciola hepatica* und *Dictyocaulus viviparus*) bei schweizerischen Milchkühen durchgeführt (Frey et al., 2018). Der Parasitenbefall auf Betriebsebene wurde indirekt mittels Serologie aus Tankmilchproben bestimmt. Neben der Prävalenz konnte diese Studie signifikante Management- und Umweltfaktoren sowie geographische Clusters nachweisen, welche mit einem erhöhten Antikörperspiegel in der Milch verbunden waren. Solche Daten waren für die Schweiz neu und stellen eine Basis für zukünftige Vergleiche dar, in der Schweiz sowie mit dem Ausland. Neulich werden Betriebe wieder mittels Tankmilchserologie auf Endoparasiten getestet. Die neu erhobenen Daten sollen unsere Kenntnis über die parasitäre Situation im schweizerischen Milchbestand aktualisieren und allfällige Änderungen über die Zeit identifizieren.

b) *Neospora caninum* Infektionen beim Rind in der Schweiz

Forschende am IPA (alphabetisch):

Dr. W. Basso, Prof. Dr. C.F. Frey, D. Gliga.

Externe Forschende (alphabetisch):

Dr. JP Zumthor, ALT Graubünden, Dr. P. Zanolari, Wiederkäuerklinik Vetsuisse Bern.

Zusammenfassung: Die Ziele dieser Studie sind die Seroprävalenz von *Neospora caninum* Infektionen beim Rind in der Schweiz zu schätzen und die Risikofaktoren für die Infektion mit diesem Aborterreger zu identifizieren.

Der Kanton Graubünden plant unabhängig davon für das Jahr 2021 eine Studie, in der alle an das Veterinärlabor geschickten Aborte zusätzlich zu den amtlichen Untersuchungen auf *N. caninum* getestet werden. Ziel dieser Studie in GR ist es, die Bedeutung von *N. caninum* für die einzelnen LandwirtInnen abzuschätzen und zu sehen, ob eine erweiterte Abortdiagnostik den betroffenen TierhalterInnen von Nutzen ist.

Die Resultate beider Studien werden als Ganzes interpretiert und diskutiert werden, um die verschiedenen Blickwinkel auf dasselbe Problem zu einem Gesamtbild zu vereinen. Die beiden Studien liefern somit ein recht umfassendes epidemiologisches Verständnis der aktuellen Situation der bovinen Neosporose in der Schweiz, inklusive der Bedeutung dieser Parasitose auf Betriebsebene. Die Resultate können helfen, den Vollzug der Tierseuchenverordnung besser auf die Bedürfnisse des Bundes und der Landwirtschaft auszurichten.

c) *Fasciola hepatica* in vitro Kultur

Forschende am IPA (alphabetisch):

Prof. Dr. C.F. Frey, J. Gerber, D. Gliga, Prof. Dr. B. Lundström.

Externe Forschende (alphabetisch):

Prof. Dr. Mar Siles Lucas, Salamanca, Spanien.

Zusammenfassung: Ein *in vitro* Modell mit juvenilen *Fasciola hepatica* Egel soll etabliert werden, um die Effekte von Triclabendazol und anderen Medikamenten auf die Mobilität und den Stoffwechsel der juvenilen Egel zu charakterisieren. Die Arbeit steht vor dem Hintergrund von zunehmenden Triclabendazol-Resistenzen bei *F. hepatica*, einer wichtigen zoonotischen Parasitose der Nutztiere sowie des Menschen.

d) Einsatz und Wirksamkeit von kokzidiostatikahaltigem Futter bei Schweizer Fleischkaninchen

Forschende am IPA (alphabetisch):

Prof. Dr. C.F. Frey, D. Grolimund.

Externe Forschende (alphabetisch):

Dr. J. Schwarz, Dr. D. Wiederkehr: Abteilung Tiergesundheit HAFL Zollikofen.

Zusammenfassung: In einem Feldversuch mit zwei ausgewählten Kaninchenmastbetrieben soll die Wirksamkeit von Kokzidiostatika im Mastfutter überprüft werden. Hintergrund sind die zunehmenden Resistenzen von *Eimeria* spp. gegen handelsübliche Kokzidiostatika. Nebst den Oozysten-Mengen im Kot (OpG) von behandelten und unbehandelten Kontrollgruppen werden die klinischen Verläufe der Mastperioden und die Schlachtbefunde der Därme und Lebern beurteilt. Haltungs- und Managementsbedingungen werden beurteilt und der Einfluss dieser Faktoren auf das Mastergebnis in die Auswertung miteinbezogen.

e) *Toxoplasma gondii* and *Neospora caninum* infections in South American camelids (SAC) and small ruminants in Switzerland

Researchers at IPA (alphabetical order):

Dr. W. Basso; E. Sollberger; F. Holenweger.

External Researchers (alphabetical order):

F. Ardüber Clinic for Ruminants Vetsuisse Bern; G. Moore-Jones FIWI Vetsuisse Bern; Dr. G. Schares FLI Riems Germany; Dr. P. Zanolari Clinic for Ruminants Vetsuisse Bern.

Aims of this research project are (i) to estimate the occurrence and distribution of *T. gondii* and *N. caninum* infections in SAC, goats and sheep in Switzerland; (ii) to optimize serological tests for diagnosis; (iii) to identify risk factors, which may favour infection with these protozoa; (iv) to assess the association of *T.*

T. gondii and *N. caninum* to cases of abortion and reproductive failure in these animal species, and (v) to investigate the molecular epidemiology of these parasites.

f) Oral fluid as matrix for indirect diagnosis of *Toxoplasma gondii* infection in pigs

Researchers at IPA (alphabetical order):

Dr. W. Basso; J. Kauter.

External Researchers (alphabetical order):

Dr. R. Blaga and F. Damek ANSES, INRAE, Ecole Nationale Vétérinaire d'Alfort, Laboratoire de Santé Animale, BIPAR, France; Dr. L.M. Campero, INTA Balcarce, CONICET, Argentina; Prof. P. Deplazes Institute of Parasitology University of Zurich; Dr. G. Schares FLI Riems Germany; Dr. F. Schott private practitioner; Prof. X. Sidler Division of Swine Medicine Vetsuisse Zurich.

Toxoplasma gondii-infected pigs play a major role as a source of infection for humans. Detection of high-risk herds is essential to implement control measures at the farm level. The aims of this project are to determine whether oral fluid (OF) could be used as a matrix for indirect diagnosis of *T. gondii* infection in pigs (i.e., immunoblot and ELISA-based techniques), and to which extent OF-based methods could represent alternatives to standard serology.

g) *Toxoplasma gondii* infection in protected wild mammals in Switzerland: lynx (*Lynx lynx*) and beaver (*Castor fiber*)

Researchers at IPA (alphabetical order):

Dr. W. Basso; Prof. Dr. C.F. Frey.

External Researchers (alphabetical order):

Prof. Dr. M.-P. Ryser-Degiorgis, P. Scherrer and S. Borel, FIWI Vetsuisse Bern; Dr. M. Ruetten and L. Vaughan, PathoVet AG Tagelswangen.

Aims of the project are to assess (i) the prevalence, epidemiology, and impact of *T. gondii* infections in the Swiss Eurasian lynx (*Lynx lynx*) and beaver (*Castor fiber*) populations; (ii) to assess risk factors for infection; and (iii) to investigate the molecular epidemiology of *T. gondii* in these wild mammals.

h) Avian malaria and other haemosporidian parasites in captive birds and white storks (*Ciconia ciconia*)

Researchers at IPA (alphabetical order):

Dr. W. Basso; S. Meister.

External Researchers (alphabetical order):

Dr. C. Gurtner and O.K. Richard Institute of Animal Pathology Vetsuisse Bern; Dr. S. Hoby Tierpark Dählhölzli Bern; Dr. C. Wenker and Dr. F. Wyss, Zoo Basel.

Avian malaria is a vector-borne disease caused by *Plasmodium* species, which may affect a broad spectrum of bird families worldwide. In most endemic and migratory birds, *Plasmodium* infections seem not to cause severe harm; however, non-indigenous species kept in human care such as penguins and puffins may experience high morbidity and mortality rates.

Aims of the study are (i) to identify infections by haemosporidian parasites (*Plasmodium* spp., *Haemoproteus* spp. and *Leucocytozoon* spp.) in captive birds and free-living white storks in Switzerland, (ii) to characterize the involved parasites at the molecular level, and (iii) to assess the clinical significance of these infections.

i) The molecular basis of adaptation of *Aedes* mosquitoes, vector of viral diseases, to saltwater environments

Researchers at IPA (alphabetical order):

D. Ghalia Boubaker, Prof. Dr. A. Hemphill.

External Researchers (alphabetical order):

Sivasingham Arthiyan (University of Jaffna, Sri Lanka), Dr. Arunasalam Naguleswaran (ITPA, Vetsuisse, Bern), Prof. Dr. Isabel Roditi (IZB), Prof. Dr. Noble Surendran (University of Jaffna, Sri Lanka).

This project is a collaborative undertaking with Prof. Noble Surendran, University of Jaffna, Sri Lanka, and Prof. Isabel Roditi and Dr. Arunasalam Naguleswaran from the Institute of Cell Biology, Bern. The project studies *Aedes* mosquitoes, which transmit many viral diseases including Yellow Fever, Dengue, Zika, and Chikungunya. *Aedes* usually undergoes development in sweet water. However, our Sri Lankan partners have found that these insects can also develop in brackish water with higher salt content. We investigate the molecular mechanisms that enable *Aedes* to adapt to salt water, and study the corresponding changes by transcriptomics, immunohistochemistry and TEM. The project finances two PhD positions in Sri Lanka, and will also enable these students to spend time in Swiss laboratories to perform recombinant protein expression and TEM. In addition, a bioinformatics workshop for PhD students will be held in Sri Lanka.

j) Occurrence of endoparasites in reindeer (*Rangifer tarandus*) in Switzerland and actual management situation in Swiss breeding farms

Researchers at IPA (alphabetical order):

Dr. W. Basso; C. Luginbühl.

External Researchers (alphabetical order):

Dr. J.J. Gross Veterinary Physiology Vetsuisse Bern; Dr. P. Zanolari Clinic of Ruminants Vetsuisse Bern.

Aims of the project are to investigate the occurrence of endoparasites in the Swiss reindeer population, and to get information on the local husbandry and management practices, in order to support breeders and practising veterinarians in making appropriate recommendations for parasite control and sanitary management.



South American camelids in Switzerland and sporulated *Toxoplasma gondii* oocysts (right).

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5. PREISE UND EHRUNGEN / AWARDS AND HONORS

2021

Walter Basso: Board Member of the European Veterinary Parasitology College (EVPC).

2020

Reto Rufener: Young Investigator Award der SGTP (Schweizerische Gesellschaft für Tropenmedizin und Parasitologie).

Caroline Frey: Vizepräsidentin ESCCAP Schweiz (European Scientific Counsel Companion Animal Parasites).

2019 (since Aug.)

Caroline Frey: Haller-Medaille der Vetsuisse Fakultät der Universität Bern.

Andrew Hemphill: Visiting Professor an der Nationalen Univerität La Plata (Argentinien).

Andrew Hemphill: Honorary Professor an der Complutense Universität Madrid (Spanien).

Britta Lundström-Stadelmann: Präsidentin der SGTP (Schweizerische Gesellschaft für Tropenmedizin und Parasitologie).



Verleihung der Hallermedaille am Dies Academicus 2019.

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6. ÖFFENTLICHKEITSARBEIT / PUBLIC RELATIONS

6.1 PUBLIKATIONEN / PUBLICATIONS

Peer-reviewed scientific articles

2021

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6.2 VORTRÄGE UND POSTER / PRESENTATIONS AND POSTERS

2021

Anghel N, Müller J, Serricchio M, Jelk J, Bütikofer P, Boubaker G, Imhof D, Ramseier J, Desiatkina O, Păunescu E, Braga-Lagache S, Heller M, Furrer J, Hemphill A. Cellular and molecular targets of nucleotide-tagged trithiolato-bridged arene ruthenium complexes in the protozoan parasites *Toxoplasma gondii* and *Trypanosoma brucei*. Munchenwiller, DIP Retreat, **Nov. 11, 2021**.

Scherrer P, Ryser-Degiorgis MP, Borel S, Frey CF, Basso W "Toxoplasma gondii infection in the Eurasian lynx (*Lynx lynx*)". Munchenwiller, DIP Retreat, **Nov. 11, 2021**.

Müller J, Proteomics and Protein Chromatography - Then and Now. A paradigm shift? Proteomics Webinar Series, Bern, **Nov. 10, 2021**.

Autier B, Manuel C, Lundström-Stadelmann B, Girard J-P, Gottstein B, Samson M, Robert-Gangneux F, Dion S. IL-33 has a detrimental role in the progression of alveolar echinococcosis in a mouse model. European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021** (Poster).

Kaethner M, Grossenbacher P, Lochner M, Schürch S, Regnault C, Villalobos Ramirez D, Lundström-Stadelmann B. The Achilles' heel of the fox tapeworm? Investigation of the threonine metabolism of *Echinococcus multilocularis*. European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021**.

Chaudhry S, Zurbriggen R, Doggett S, Lundström-Stadelmann B. Dual inhibition of the *Echinococcus multilocularis* energy metabolism. European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021.**

Memedovski R, Rufener R, Zurbriggen R, Braga S, Heller M, Müller J, Vinicius Nora de Souza M, Lundström-Stadelmann B. Activity and mechanism of action of mefloquine derivatives against *Echinococcus*. European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021.**

Dale M, Dettwiler I, Troell K, Robinson G, Chalmers RM, Basso W, Rentería-Solís ZM, Daugschies A, Mühlenthaler K, Raghavendra JB, Ruf MT, Poppert S, Meylan M, Olias P. "TIDE analysis of *Cryptosporidium* chromatograms reveals obscured mixed population infections" Woods Hole Molecular Parasitology Meeting (MPM) 2021, USA (hybrid) **Oct 5/9 2021** (Poster).

Schönbächler K, Hoby S, Richard O.K., Dervas E., Origgi F.C., Veiga I., Basso W. "Spirorchiidiasis in European pond turtles (*Emys orbicularis*) from switzerland – new insights" 2021 Joint AAZV-EAZWV 53rd Annual Conference **Oct 4. – Sep. 5, 2021** (on-line) (Poster).

Chaudhry S, Zurbriggen R, Doggett S, Lundström-Stadelmann B. Dual inhibition of the *Echinococcus multilocularis* energy metabolism. Joint annual meeting 2021 of the Swiss Societies for Infectious Diseases (SSI), Hospital Hygiene (SSH) with fibs/SIPI, Tropical Medicine and Parasitology (SSTMP) and the Swiss Society of Tropical and Travel Medicine (SSTM), Montreux, CH, **Sept. 2/3, 2021.**

Kaethner M, Grossenbacher P, Lochner M, Schürch S, Regnault C, Ramírez DV, Lundström-Stadelmann B. The Achilles' heel of the fox tapeworm? Investigation of the threonine metabolism of *Echinococcus multilocularis*. Joint annual meeting 2021 of the Swiss Societies for Infectious Diseases (SSI), Hospital Hygiene (SSH) with fibs/SIPI, Tropical Medicine and Parasitology (SSTMP) and the Swiss Society of Tropical and Travel Medicine (SSTM), Montreux, CH, **Sept. 2/3, 2021.**

Memedovski R, Rufener R, Müller J, Zurbriggen R, de Sousa MVN, Braga S, Heller S, Lundström-Stadelmann B. Mefloquine based analogs evaluated against *Echinococcus multilocularis* metacestodes. Joint annual meeting 2021 of the Swiss Societies for Infectious Diseases (SSI), Hospital Hygiene (SSH) with fibs/SIPI, Tropical Medicine and Parasitology (SSTMP) and the Swiss Society of Tropical and Travel Medicine (SSTM), Montreux, CH, **Sept. 2/3, 2021.**

Anghel N, Müller J, Serricchio M, Jelk J, Bütkofer P, Boubaker G, Imhof D, Ramseier J, Desiatkina O, Păunescu E, Braga-Lagache S, Heller M, Furrer J, Hemphill A. Cellular and molecular targets of nucleotide-tagged trithiolato-bridged arene ruthenium complexes in the protozoan parasites *Toxoplasma gondii* and *Trypanosoma brucei*. Montreux, Joint Annual Meeting 2021 of the Swiss Societies for Infectious Diseases (SSI), Hospital Hygiene (SSH) with fibs/SIPI, Tropical Medicine and Parasitology (SSTMP) and the Tropical and Travel Medicine (SSTM), **Sep. 2/3, 2021.**

Hänggeli K, Müller N, Schimanski B, Olias P, Hemphill A, Boubaker G. CRISPR-Cas9 genome editing in *Toxoplasma gondii*: single and duplex quantitative PCRs to reliably detect off-target effects associated with multiple integrations of selectable markers. Joint Annual Meeting Swiss Society of Tropical Medicine and Parasitology (SSTMP), Montreux, CH, **Sept. 2/3, 2021.**

Imhof D, Pownall W R, Monney C, Oevermann A, Hemphill A. "Safety evaluation and efficacy assessment of a *Listeria monocytogenes*-based vaccine against abortion and vertical transmission of *Neospora caninum* Joint Annual Meeting Swiss Society of Tropical Medicine and Parasitology (SSTMP), Montreux, CH, **Sept. 2/3, 2021.**

Frey CF, Basso W, Marti IA, Zürcher-Giovannini S, Borel S, Guthruf S, Gliga D, Lundström-Stadelmann B, Origgi F, Ryser-Degiorgis MP: The golden jackal (*Canis aureus*): A new host for *Echinococcus multilocularis* and *Trichinella britovi* in Switzerland. Joint Annual Meeting Swiss Society of Tropical Medicine and Parasitology (SSTMP), Montreux, CH, **Sept. 2/3, 2021** (Poster).

Scherrer P, Ryser-Degiorgis MP, Borel S, Frey CF, Basso W. "Toxoplasma gondii infection in the protected Eurasian lynx (*Lynx lynx*) in Switzerland". 69th WDA, 14th EWDA conference, Cuenca, Spain, (online), **Aug 31 – Sept 2, 2021**.

Keller S, Basso WU, Gliga DS, Moore-Jones G, Origgi FC, Frey CF, Ryser-Degiorgis MP. Subcutaneous cysticercosis of *Taenia crassiceps* in two red fox (*Vulpes vulpes*). 69th WDA, 14th EWDA conference, Cuenca, Spain, online, **Aug 31 – Sept 2, 2021** (Poster).

Frey CF, Meyer-Schülke A, Olias P, Schüpbach G, Henrich B, Gottstein B, Henzi M: Combined cross-sectional and case-control study on *Echinococcus multilocularis* infection in pigs in Switzerland. WAAVP, Dublin, IRL, **Jul 19-22, 2021**.

Frey CF, Meyer-Schülke A, Olias P, Schüpbach G, Henrich B, Gottstein B, Henzi M: Fall-Kontroll-Studie zu *Echinococcus multilocularis* Infektionen bei Schlachtschweinen in der Schweiz. DVG Tagung Fachgruppe Parasitologie, Munich, Germany, **Jun 28-30, 2021**.

Unterköfler MS, Eipeldauer I, Basso W, Brunthaler R, Merz S, Pantchev N, Hinney B. „Strongyloides stercoralis Infektion bei einer Französischen Bulldogge“ Tagung der DVG-Fachgruppe Parasitologie und parasitäre Krankheiten, on-line, **Jun 28/30, 2021**.

Meyer-Schülke A, Gottstein B, Henrich B, Frey CF: Alveoläre Echinococcose beim Schlachtschwein. 8. Schweizerische Tierärztetage, online, **May 6, 2021**.

Basso W, Holenweger F, Schares G, Müller N, Campero LM, Frey CF, Zanolari P. "Toxoplasma gondii and *Neospora caninum* infections in small ruminants in Switzerland" 9th Conference of the Scandinavian - Baltic Society for Parasitology, Vilnius Lithuania (on-line), **Apr 21/23, 2021**.

Meister SL, Richard OK, Hoby S, Gurtner C, Basso W. "Fatal avian malaria in captive Atlantic puffins (*Fratercula arctica*) in Switzerland" 9th Conference of the Scandinavian - Baltic Society for Parasitology, Vilnius Lithuania (on-line), **Apr 21/23, 2021**.

Imhof D, Pownall W R, Fernandez Trigo N, Ganal-Vonarburg S C, Plattet P, Monney C, Forterre F, Hemphil A, Oevermann A. "Safety evaluation and efficacy assessment of a *Listeria monocytogenes*-based vaccine against abortion and vertical transmission of *Neospora caninum*." 29th Annual Meeting of the German Society for Parasitology, virtual meeting, **Mar. 17, 2021**.

Anghel N, Imhof D, Winzer P, Balmer V, Ramseier J, Häggeli K, Choi R, Hulverson M, Whitman G, Arnold S, Ojo K. K, Van Voorhis W. C, Doggett S, Ortega-Mora L. M, Hemphill A. Endochin-like quinolones (ELQs) and bumped kinase inhibitors (BKIs): Synergistic and additive effects of combined treatments against *Neospora caninum* infection *in vitro* and *in vivo*. Online meeting, 29th Annual meeting of the German Society of Parasitology, **Mar. 15/17, 2021**.

Anghel N, Imhof D, Winzer P, Balmer V, Ramseier J, Häggeli K, Choi R, Hulverson M, Whitman G, Arnold S, Ojo K. K, Van Voorhis W. C, Doggett S, Ortega-Mora L. M, Hemphill A. Endochin-like quinolones (ELQs) and bumped kinase inhibitors (BKIs): Synergistic and additive effects of combined treatments against *Neospora caninum* infection *in vitro* and *in vivo*. Online meeting, Bern, GCB Symposium, **Jan. 28, 2021**.

2020

Anghel N, Winzer P, Imhof D, Müller J, Langa X, Rieder J, Barrett L. K, Vidadala R. S. R, Huang W, Choi R, Hulverson M. A, Whitman G. R, Arnold S. L, Van Voorhis W. C, Ojo K. K, Maly D. J, Fan E, Hemphill A. Comparative assessment of the effects of bumped kinase inhibitors on early zebrafish embryo development and pregnancy in mice. Online meeting, SSTMP Student meeting, **Nov. 4, 2020**.

Memedovski R, Rufener R, Müller J, Zurbriggen R, de Sousa M, Lundström-Stadelmann B. Mefloquine based analogs evaluated against *Echinococcus multilocularis* metacestodes. Swiss Society of Tropical Medicine and Parasitology Students Meeting, online, CH, **Nov. 4/5, 2020**.

Karpstein T, Rufener R, Zurbriggen R, Bresson-Hadni S, Aebi Y and team, Hemphill A, Lundström-Stadelmann B. Is Maca the next super drug against alveolar echinococcosis? Or A reverse approach starting with a cured patient. Swiss Society of Tropical Medicine and Parasitology Students Meeting, online, CH, **Nov. 4/5, 2020**.

Kaethner M, Schürch S, Lundström-Stadelmann B. Starving a deadly parasite: Investigation and inhibition of the threonine metabolism of the fox tapeworm *Echinococcus multilocularis*. Swiss Society of Tropical Medicine and Parasitology Students Meeting, online, CH, **Nov. 4/5, 2020**.

Hänggeli K, Müller N, Schimanski B, Olias P, Hemphill A, Boubaker G. CRISPR-Cas9 genome editing in *Toxoplasma gondii*: single and duplex quantitative PCRs to reliably detect off-target effects associated with multiple integrations of selectable markers. Swiss Society of Tropical Medicine and Parasitology Students Meeting, online, CH, **Nov. 4/5, 2020**.

Imhof D. "Chemotherapy against neosporosis and toxoplasmosis." Swiss Society of Tropical Medicine and Parasitology Students Meeting, online, CH, **Nov. 4/5, 2020**.

Imhof D, Anghel N, Winzer P, Balmer V, Ramseier J, Häggeli K, Choi R, Hulverston MA, Whitman G R, Arnold S L M, Ojo K K, Van Voorhis W C, Doggett J S, Ortega-Mora L M, Hemphill A. "Bumped kinase inhibitors and endochin-like quinolones: individual and combined treatments investigated *in vitro* and in the pregnant mouse model for neosporosis." ApiCowplexa virtual meeting, **Oct. 15, 2020**.

Jebbawi F, Bellanger A-P, Lunström-Stadelmann B, Rufener R, Dosch M, Goepfert C, Gottstein B, Millon L, Grandgirard D, Leib SL, Beldi G, Wang J. Innate and adaptive immune responses following PD-L1 immune checkpoint blockade in treating chronic murine alveolar echinococcosis. 14th World Immune Regulation Meeting (WIRM), Davos (online), CH, **Oct. 4-8, 2020**.

Anghel N, Boubaker G, Amdouni Y, Lin A, Ong Yih C, Lin Y, Keller S, Furrer J, Gasser G, Hemphill A. Synthesis, characterization and antiparasitic activity of organometallic derivatives of the anthelmintic drug albendazole. Paris, Sinergia Annual Consortium Meeting, **Feb 17/18, 2020**.

Anghel N, Boubaker G, Amdouni Y, Păunescu E, Desiatkina O, Furrer J, Hemphill A. Novel Ruthenium complexes for the treatment of *Toxoplasma gondii*. Bern, GCB Symposium, **Jan. 30, 2020**.

2019 (since Aug.)

Campero LM, Schott F, Gottstein B, Sidler X, Basso W. Detection of antibodies to *Toxoplasma gondii* in oral fluid from pigs. 5th International Meeting on Apicomplexan Parasites in Farm Animals (ApicoWplexa), Berlin, Germany **Oct. 2/4, 2019** (Poster).

Rufener R. Fighting against *Echinococcus multilocularis*. Swiss Society of Tropical Medicine and Parasitology Students Meeting, Schwarzenberg, CH, **Nov. 14-15, 2019**.

Höby S, Basso W, Grau Roma L, Rosset M, Hadorn J, Hertzberg H. Mach mal Dampf! –neue Strategie zur Sanierung einer Elchanlage, 39. Arbeitstagung Verbandes der Zootierärzte VZT, Dortmund, Germany, **Oct. 31 / Nov. 3, 2019**.

Campero LM, Runco M, Basso W, Schares G, Gual I, Dellarupe A, De Felice L, Ortega-Mora LM, Moore DP, Moré G, Venturini MC. Molecular characterization and *in vitro* virulence phenotypes of Argentinean *Neospora caninum* bovine isolates. 5th International Meeting on Apicomplexan Parasites in Farm Animals (ApicoWplexa), Berlin, Germany **Oct 2/4, 2019** (Poster).

Koudela B, Basso W, Schares G, Škorič M, Smola J. Experimental toxoplasmosis in pigs inoculated with different parasite stages and different genotypes of *Toxoplasma gondii*. 5th International Meeting on Apicomplexan Parasites in Farm Animals (ApicoWplexa), Berlin, Germany **Oct 2/4, 2019**.

Schares G, Nascimento D, Bärwald A, Jutras C, Riavid S, Brodeur V, DeNotta SL, Basso W, Conraths FJ. Serological diagnosis of besnoitiosis: A multi-species competitive enzyme linked immunosorbent assay overcoming the problem of false-positive reactions. 5th International Meeting on Apicomplexan Parasites in Farm Animals (ApicoWplexa), Berlin, Germany **Oct 2/4, 2019**.

Ritler D, Rufener R, Li J, Serricchio M, Kämpfer U, Bühr C, Schürch S, Bütkofer P, Lundström-Stadelmann B. Identification of novel drug targets in *Echinococcus multilocularis* by metabolomics. Joint annual meeting 2019 SGI / SGInf / SGSH / SGTP / SGTRM, Lausanne, CH, **Sept. 18-20, 2019** (Poster).

Jebbawi F, Bellanger A, Lundström-Stadelmann B, Rufener R, Dosch M, Belid G, Millon L, Gottstein B, Wang J. Innate and adaptive immunity interactions following PD-1/PDL-1 immune checkpoint blockade in murine alveolar echinococcosis. Joint annual meeting 2019 SGI / SGInf / SGSH / SGTP / SGTRM, Lausanne, CH, **Sept. 18-20, 2019**.

Basso W, Gottstein B, Frey CF. Evaluation of the “PrioCHECK Trichinella AAD kit” to detect *Trichinella britovi*, *T. spiralis* and *T. pseudospiralis* in muscle tissue of domestic pigs by the automated digestion method Trichomatic-TM35. 15th International Conference on Trichinellosis. Cluj-Napoca, Romania, **Aug. 26/30, 2019**.

Ruprecht R, Hilbe M, Basso W, Hertzberg H. Gastrointestinal nematodes as cause of death in sheep and goats in Switzerland. Joint COMBAR-ACSRPC meeting: “Anthelmintic Resistance in ruminants: Who cares?” Ghent, Belgium, **Aug. 27/29, 2019**.

6.3 INVITED PRESENTATIONS

2021

Müller N: Antigenic variation and proteome plasticity associated with drug resistance formation in the intestinal protozoan parasite *Giardia lamblia*. DIP seminar, Vetsuisse Faculty Bern, **Nov 25, 2021**.

Frey CF: Ektoparasiten bei Hund & Katze im Winter. Swiss Vet Forum, Luzern, **Nov 4, 2021**.

Lundström-Stadelmann B: Novel approaches for the treatment of the fox tapeworm *Echinococcus multilocularis*. Seminar on Drug Sciences. University of Basel, online, **Nov 3, 2021**.

Frey CF und **Zumthor JP**: Informationen zur Neospora-Seroprävalenz-Studie der Uni Bern und zum Neosporose-Projekt im Kanton GR. BLV Laborleitertagung, Bern-Liebefeld, **Oct. 21, 2021**.

Frey CF, Dąbrowska J, Keller I, Karamon J, Kochanowski M, Gottstein B, Cencek T, Müller N: *Tritrichomonas foetus* or what else? Insights from genetic comparisons. European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021**.

Basso W, Schares G: *Toxoplasma gondii* and *Neospora caninum* infections in South American camelids, European Mulicolloquium of Parasitology (EMOP), Belgrade, SRB, **Oct. 12-16, 2021**.

Memedovski R, Rufener R, Chaudhry S, Kaethner M, Müller J, Lundström-Stadelmann B: Asessment of mitochondrial respiration in *Echinococcus multilocularis* germinal layer cells by Seahorse Mini Analyzer. Seahorse Seminar Day and User Meeting, Bucher Biotech, **Sept. 22, 2021**.

Basso W: Cyst-forming coccidian parasites in veterinary medicine: clinical, diagnostic and epidemiological aspects, in: Continuing Education in Veterinary Parasitology for EVPC Diplomates and Residents “VIPs in

Zurich: Very Important Parasites in Zurich –from fundamental to applied research” **Sep. 12/18, 2021** (oral presentation and practical activity).

Lundström-Stadelmann B: Novel treatment options against echinococcosis. Joint annual meeting 2021 of the Swiss Societies for Infectious Diseases (SSI), Hospital Hygiene (SSH) with fibs/SIPI, Tropical Medicine and Parasitology (SSTMP) and the Swiss Society of Tropical and Travel Medicine (SSTM), Montreux, CH, **Sept. 2/3, 2021.**

Basso W: Parasitologie: Mögliche Fragestellungen und Untersuchungsarten, verwendbares Material, Laborbefunde und -interpretation, Fallbeispiele, Aufbaukurs Interpretation von Laborbefunden, Schweizerische Vereinigung für Schweiñemedizin (SVSM) Bern, **Jun 11/21, 2021.**

Frey CF: *Tritrichomonas foetus*: Genetische Unterschiede zwischen bovinen und feline Isolaten. 8. Schweizerische Tierärztetage, online, **May 7, 2021.**

Frey CF: Verkalkte Cysticercus bovis im Schlachtkörper: Nachweis mittels RT-PCR. 8. Schweizerische Tierärztetage, online, **May 7, 2021.**

Frey CF: Giardien und *Tritrichomonas* – Was ist der Unterschied und wie berate ich die Kunden. 8. Schweizerische Tierärztetage, online, **May 6, 2021.**

Basso W: „Parasitologie“ ITB III Aufbaukurs Interpretation von Laborbefunden, Swiss Association for Pig Medicine (SVSM-ASMP) Bern, **11/21 Jun 2021.**

Basso W: *Strongyloides stercoralis* Infektionen beim Hund, 8. Schweizerische Tierärztetage, Basel, on-line, **May 6/7, 2021.**

Lundström-Stadelmann B and CF Frey: Impulsreferat zum Topsharing an der Universität Bern, University of Bern, CH, online, **Mar. 8, 2021.**

2020

Frey CF: *Echinococcus multilocularis* in Schweinen. Webinar, Bundesamt für Lebensmittelsicherheit und Veterinärwesen, Bern-Liebefeld, **Nov. 23, 2020.**

Hemphill A: Novel treatments against apicomplexan parasites. Joint annual meeting of the Swiss Society of Tropical Medicine and Parasitology (SSTMP) and the Swiss Society of Tropical and Travel Medicine (SSTM), online. **Nov. 5, 2020.**

Frey CF: *Echinococcus multilocularis* – a foodborne parasite of great concern. Webinar, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India, **Oct. 29, 2020.**

Frey CF: Parasiten – was geht? Rindergesundheitsdienst, HHH Tagung, Zürich, **Oct. 15, 2020.**

Frey CF: Wie sieht es aus mit Resistenzen? Rindergesundheitsdienst, HHH Tagung, Zürich, **Oct. 15, 2020.**

Basso W: Bovine Neosporosis und Bovine Besnoitiosis. Rindergesundheitsdienst, Tagung: “Hotspot Herd Health 2020: Parasitologie – mal anders”. Bern, **Sept. 24, 2020** und Zürich, **Oct 15, 2020.**

Frey CF: Parasiten – was geht? Rindergesundheitsdienst, HHH Tagung, Bern, **Sept. 24, 2020.**

Frey CF: Wie sieht es aus mit Resistenzen? Rindergesundheitsdienst, HHH Tagung, Bern, **Sept. 24, 2020.**

Müller N: Antigenic variation and proteome plasticity associated with drug resistance formation in the intestinal protozoan parasite *Giardia lamblia*. Universitätsspital Bern, Universitätsklinik RIA, Fachbereich Immunologie, Bern, **Mar. 11, 2020.**

Lundström-Stadelmann B: Mefloquine and derivatives against *Echinococcus multilocularis*. Anthelmintics IV meeting, Santa Monica Bay, CA, **Feb. 6, 2020.**

2019 (since Aug.)

Lundström-Stadelmann B: Novel drug treatments against parasites: the example of *Echinococcus multilocularis*. Seminar on new approaches in anti-infective therapy, University of Rennes, F, **Nov. 28, 2019.**

Basso W: Parasiten in der Schweineproduktion-Bedeutung für Schwein und Mensch, 22. Seminary Swiss Association for Pig Medicine (SVSM-ASMP) "Infectious Diseases", Grindelwald, Switzerland **Sept. 5/7, 2019.**

Basso W: Entwurmung, Zuchtwarte-Tagung, Swiss Cynologic Association (SKG-SCS), Murten, Switzerland, **Aug. 31, 2019.**

Hemphill A: Jornadas de actualizacion en immunoprasitologia diagnostica de protozoos apicomplexa. University of La Plata, Argentina, **Sept 18, 2019.**



A virtual group leader meeting in spring 2020.

7. AUS-, FORT-, UND WEITERBILDUNG / TEACHING AND CONTINUING EDUCATION

7.1 VETSUSSSE CURRICULUM

2021

FS21: Oekologie mit Beispielen aus der Parasitologie. 1. Studienjahr, 8 Lektionen. Referenten: Caroline Frey.
FS21: 473087 Parasitologie. 2. Studienjahr, 2 Stunden / Woche, Referenten: Caroline Frey, Walter Basso.
FS21: 473096 Schwerpunkt Nutztiere. 4. Studienjahr, 4 Lektionen. Referenten: Caroline Frey, Walter Basso.
HS21: 473087 Parasitologie. 3. Studienjahr, 2 Stunden / Woche, Referenten: Caroline Frey, Walter Basso.
HS21: Fallbesprechungen und Praktikum, 4. Studienjahr, 30 Lektionen, Referent: Walter Basso, Caroline Müller.

2020

FS20: Oekologie mit Beispielen aus der Parasitologie. 1. Studienjahr, 8 Lektionen. Referenten: Caroline Frey
FS20: 473087 Parasitologie. 2. Studienjahr, 2 Stunden / Woche, Referenten: Caroline Frey, Walter Basso.
FS20: 473096 Schwerpunkt Nutztiere. 4. Studienjahr, 4 Lektionen. Referenten: Caroline Frey, Walter Basso.
HS20: 473087 Parasitologie. 3. Studienjahr, 2 Stunden / Woche, Referenten: Caroline Frey, Walter Basso.

2019 (since Aug.)

HS19: 473087 Parasitologie. 3. Studienjahr, 2 Stunden / Woche, Referenten: Caroline Frey, Walter Basso.
HS19: Fallbesprechungen und Praktikum, 4. Studienjahr, 30 Lektionen, Referent: Walter Basso, Caroline Müller.

7.2 MEDIZINISCHE PARASITOLOGIE / MEDICAL PARASITOLOGY LECTURES

2021

HS21 2804 Medizinische Parasitologie und tropische Parasiten, Vorlesung für Studierende der Naturwissenschaften, Veterinärmedizin und Medizin, Referenten: Britta Lundström-Stadelmann, Andrew Hemphill, Norbert Müller, Kerry Woods (ITPA), Walter Basso, Volker Heussler (IZB), Christof Grüning (IZB), 3 Stunden / Woche.

Teilensem: FS21 2806 Molekulare Parasitologie, Norbert Müller, Britta Lundström-Stadelmann.

2020

HS20 2804 Medizinische Parasitologie und tropische Parasiten, Vorlesung für Mediziner, Zellbiologen und Veterinärmediziner, Referenten: Britta Lundström-Stadelmann, Andrew Hemphill, Norbert Müller, Kerry Woods (ITPA), Walter Basso, Volker Heussler (IZB), Christof Grüning (IZB), 3 Stunden / Woche.

Teilpensum: FS20 2806 Molekulare Parasitologie, Norbert Müller, Britta Lundström-Stadelmann.

2019 (since Aug.)

HS19 2804 Medizinische Parasitologie und tropische Parasiten, Vorlesung für Mediziner, Zellbiologen und Veterinärmediziner, Referenten: Britta Lundström-Stadelmann, Andrew Hemphill, Norbert Müller, Kerry Woods (ITPA), Walter Basso, Volker Heussler (IZB), Christof Grüning (IZB), 3 Stunden / Woche.

7.3 FORT- UND WEITERBILDUNG / CONTINUING EDUCATION

Für die institutsinterne Fort- und Weiterbildung wurden wöchentlich alternierend Forschungsseminare und Journal-Clubs zusammen mit der Gruppe «molekulare Pathologie» des Institutes for Tierpathologie (ITPA) gehalten.

Es fanden regelmässige DIP Seminare statt mit Forschungsvorträgen von internen und externen Gästen.

Diagnostische Kolloquien fanden regelmässig statt und beinhalteten die Besprechung interessanter und lehrreicher Fälle.

Das Institut hat 2020/2021 folgende Weiterbildungsveranstaltungen organisiert und durchgeführt:

Introduction to the QM system of the IPB für alle Mitarbeitenden, 2. Juni 2021.

Nothilfe Refresher Crashkurs für alle Mitarbeitenden; 23. Sept. 2020.

Einführung ins PCR-Konzept am IPA, 23.12.2021.

7.4 DOKTORARBEITEN ABSCHLÜSSE /DOCTORAL/PHD THESES

2021

Nicoleta Anghel, working title: "Advances, efficacy and safety of compounds for the treatment against protozoan parasites *Toxoplasma*, *Neospora* and *Trypanosoma*". October 2021.

Pablo Winzer, working title: "Molecular changes of *Neospora caninum* treated with the calcium dependent protein kinase inhibitor BKI-1294 and implications on the immune response", June 2021.

2020

Anika Meyer Schülke, title: "Combined cross-sectional and case-control study on *Echinococcus multilocularis* infection in pigs in Switzerland", October 2020.

Dominic Ritler, working title: "New ways to target the deadly parasite *Echinococcus multilocularis*", June 2020.

Reto Rufener, working title: "New drugs against *Echinococcus multilocularis*: targeting the energy metabolism", April 2020.

7.5 MASTERARBEITEN ABSCHLÜSSE / MASTER THESES

2021

Johanna Kauter, project title: "Oral fluid-based diagnosis of *Toxoplasma gondii* infections in pigs", **Sept. 2021**.

Jasmin Gerber, project title: "*Fasciola hepatica* in vitro culture", **Sept. 2021**.

Jessica Ramseier, project title: "Artemisinin and decoquinate derivatives for the treatment of *Toxoplasma gondii* and *Neospora caninum* infections", **May 2021**.

Roman Memedovski, project title: "Investigation of the mechanism of action of novel potential chemotherapeutic agents against the parasite *Echinococcus multilocularis*", **May 2021**.

Kai Haenggeli, project title; "Verification and characterization of SAG1 knockouts in *Toxoplasma gondii*", **May 2021**.

2020

Raphael Zurbriggen, project title: "Inhibition of the *Echinococcus multilocularis* energy metabolism" **Jan. 2020**.

Fabienne Holenweger, project title: "*Toxoplasma gondii* and *Neospora caninum* infections in sheep and goats in Switzerland" **Sept. 2020**.

2019 (since Aug.)

Elena Sollberger, "Neospora caninum and *Toxoplasma gondii* infections in South American camelids in Switzerland" **Sept. 2019**.

Leonie von Bueren, "Investigation of endparasitosis as cause of death in small ruminants and actual situation of anthelmintic resistance in sheep farms in West Switzerland" **Sept. 2019**.

7.6 PRAKTIKA / INTERNSHIPS

Carolina Rodriguez Sanz, Research Internship, **Nov. 2021**.

Andrin Rickli, Praktikum, **Sept.- Dec. 2021**.

Svenja Amacker, Maturaarbeit, project title: „Parasitologie Wirkung von CBD auf alveolare Echinokokkose“, Kollegium Spiritus Sanctus Brig, **Jul. 2021**.

Atifa Kurshid Awan, MINT Praktikum, **Jul. 2021**.

Sinah Lückner, Hilfslaborantin, **Jul. – Sept. 2021**.

Kim Tanja Louisa Tracey, Hilfslaborantin, **Jun. – Aug. 2021**.

Ljubo Propadalo, Hilfslaborant, **Jun. - Aug. & Nov.- Dec. 2021**.

Agustina Basso, Assistentin, **Mar. – May 2021**.

Kim Tanja Louisa Tracey, Praktikum, **Apr. 2021**.

Nylas Wenger, Praktikum, **Mar. 2021**.

7.7 ORGANISATION VON SYMPOSIEN/KONFERENZEN / ORGANISATION OF SYMPOSIA/CONFERENCES

2021	2020	2019 (since Aug.)
Lundström-Stadelmann, B: Scientific, ethical and emotional challenges of animal experimentation, Vetsuisse Bern, CH, Dec. 2021.	Lundström-Stadelmann, B: Joint annual meeting of the SSTMP and the SSTM (online event), co-organizer, Bern, CH, Nov. 2020.	Lundström-Stadelmann, B: Ethical and emotional challenges of animal experimentation, Vetsuisse Bern, CH, Dec. 2019.
Basso, W: European Mulicolloquium of Parasitology (EMOP), Symposium "Protozoan infections in livestock and their control – zoonotic and animal health aspects", co-organizer, Belgrade, SRB, Oct., 2021.	Lundström-Stadelmann, B: PhD candidate meeting, co-organizer, Swiss Society of Tropical Medicine and Parasitology (SSTMP), online event, CH, Nov. 2020.	Lundström-Stadelmann, B: PhD candidate meeting, co-organizer, Swiss Society of Tropical Medicine and Parasitology (SSTMP), Schwarzenberg, CH, Nov. 2019.
Lundström-Stadelmann, B: PhD candidate meeting, co-organizer, Swiss Society of Tropical Medicine and Parasitology (SSTMP), Schwarzenberg, CH, Oct. 2021.		Lundström-Stadelmann, B: Scientific committee of the joint annual meeting 2019 SGI / SGSH / SGTP / SGTRM, Lausanne, CH, Sept. 2019.
Lundström-Stadelmann, B: Scientific committee of the joint annual meeting 2021 SGI / SGSH / SGTP / SGTRM, Lugano, CH, Sept. 2021.		

8. GÄSTE / GUESTS

8.1 SEMINARE / SEMINARS

2021

Prof. Dr. Hanno Würbel, Division of Animal Welfare, Vetsuisse Bern, "Environmental enrichment, animal welfare and replicability of animal research".

Prof. Dr. Angela Martin, Fachbereich Philosophie, Universität Basel, "The Ethics of Animal Research – A Panorama".

Anneke Keizer, Copeplus, "From Compassion Fatigue to Compassion Satisfaction".

Ana Kalichava, Universität Bern, " Ultrastructure Expansion Microscopy (U-ExM) in *Trypanosoma brucei*".

Dr. Jon Jerlström-Hultqvist, Universität Uppsala, Schweden, " Symbiosis – perspectives from Anaeramoeba".

Prof. Dr. Emily Jenkins, University of Saskatchewan, Canada " Food-borne parasites in the Canadian Arctic: simply not simple".

2019 (since Aug.)

Prof. Dr. Angela Martin, Fachbereich Philosophie, Universität Basel, "The Ethics of Animal Research".
Anneke Keizer, Copeplus, "Compassion Fatigue".

8.2 GASTFORSCHENDE / GUEST RESEARCHERS

Dr. Junhua Wang, Institut für Infektionskrankheiten IIFK, Universität Bern.

Brice Autier, Institut de Recherche en Santé (IRSET), University of Rennes, France.

Carolina Rodriguez Sanz, Department of Animal Health, Faculty of Veterinary Medicine, Universidad Complutense de Madrid, Spain.

Aisha Khan, COMSATS University Islamabad (CUI), Pakistan.

9. DIENSTLEISTUNG / DIAGNOSTICS

9.1 AKKREDITIERUNG / ACCREDITATION

Die veterinärparasitologische Diagnostik ist durch die Schweizerische Akkreditierungsstelle (SAS) unter der STS-Nummer 0678 nach ISO/IEC 17025:2017 akkreditiert.

QS-Leitung: Dr. W. Basso.

Alle Mitarbeiter*innen sind bestrebt, durch korrekte Laborbefunde zur Diagnosefindung oder Beurteilung des Therapieerfolges beizutragen. Die dazugehörige Qualitätssicherung und Qualitätsverbesserung erfolgt auf verschiedenen Ebenen:

- Methodische Qualität: Erfahrung und permanente Weiterbildung der Verantwortlichen, kontrollierter Einsatz bewährter Methoden, laufende Evaluierung neuer Technologien sowie Investition in modernste Analysegeräte.
- Analytische Qualität: Interne und externe Überwachung (Audits) der Präzision und Richtigkeit sowie EDV-unterstützte Validierung von Laborresultaten.
- Ringversuche: Das Institut nimmt regelmässig an internationalen Ringversuchen zur Leistungs- und Qualitätskontrolle teil.

In den Jahren 2020-2021 beteiligte sich das IPB an den Ringversuchen zur Koproparasitologie des „United Kingdom National External Quality Assessment Services for Microbiology“ (UK NEQAS), der Direktnachweise in Stuhlproben abdeckt. Die Performance des IPB lag über dem Durchschnitt aller internationalen und Schweizer Labore.

Das IPB nahm jährlich an zwei internationalen Ringversuchen (European Union Reference Laboratory for Parasites, Istituto Superiore di Sanità (ISS), Rome und Bundesinstitut für Risikobewertung (BfR), Berlin) zum Nachweis von *Trichinella*-Larven im Fleisch und an einer internationalen Qualitätskontrolle (ISS, Rome) zur molekularen Bestimmung von *Trichinella*-Arten teil und schnitt dabei immer sehr gut ab.

Zudem nahm das IPB auch am europäischen Ringversuch der UK VETQAS, London, England, zum Nachweis von *Toxoplasma*-AK in Schafseren (3 x jährlich) sowie *Neospora*-AK in Rinderseren (2x jährlich) teil. Alle diese Ringversuche wurden erfolgreich abgeschlossen.

Das IPB nahm an Ringversuchen (2x jährlich) der EU Quality Control for Molecular Diagnostic, (QCMD), Glasgow, Schottland, für den Nachweis von *Toxoplasma*-DNA mittels qPCR teil und die Performance wurde als "highly satisfactory" eingestuft.

Zudem nimmt das IPB an den Ringversuchen zur Dourine Serologie organisiert durch das Anses, Frankreich, teil. Auch hier fielen die Resultate immer gut aus.

Das IPB organisiert jährlich eine Qualitätskontrolle zum *Trichinella*-Nachweis im Fleisch und führt diese auch durch. Die Qualitätskontrolle besteht aus einem Haupt- und einem Nachversuch (für Teilnehmende mit suboptimalen Ergebnissen im Hauptversuch).

9.2 REFERENZLABOR / REFERENCE LABORATORY

Beteiligung per 31.12.2021: Dr. W. Basso (Leitung), Prof. Dr. C. Frey, Dr. N. Müller, D. Gliga, M. Pardo Gil, C. Salvisberg., C. Müller, U. Kurath, R. Ziegler.

Das IPB amtet als Nationales Referenzlabor für folgende Tierseuchen:

Trichinellose: Das IPB hat mehrere Fälle von verdächtigen *Trichinella*-Larven von *Trichinella*-Untersuchungsstellen zur weiteren diagnostischen Abklärung bekommen. Die Diagnose einer *Trichinella*-Infektion konnte nur in einem der Fälle bestätigt werden. Es handelte sich um *Trichinella* Larven, die mittels PCR als *Trichinella britovi* charakterisiert werden konnten. Diese Larven wurden bei einem Wildschwein aus dem Tessin entdeckt.

Darüber hinaus wurden in den Jahren 2020 - 2021 *T. britovi* Larven bei einem Wolf und einem Goldschakal im Kanton BE, bei zwei Luchsen im Kanton FR, bei einem Luchs im Kanton VD und bei einem weiteren Luchs und drei Wölfen im Kanton GR am IPB nachgewiesen. Außerdem wurde bei einem Luchs im Kanton FR eine Infektion mit *T. spiralis* festgestellt.

Wir haben Referenzmaterial für interne Kontrolle und Training an verschiedene Labore geliefert.

Beschälseuche (*Trypanosoma equiperdum*): Der Parasit wurde 2020-2021 in der Schweiz weder serologisch noch direkt nachgewiesen.

Toxoplasmose: 2020 – 2021: *Toxoplasma gondii* Oozysten wurden bei 3 Hauskatzen und bei 2 Luchsen mittels Flotation + real-time PCR diagnostiziert. Darüber hinaus wurde *T. gondii* DNA im Gewebe von einer weiteren Katze, 2 Rotfüchsen und einem Steinmarder nachgewiesen.

Tritrichomonose: 2020-2021 wurden beim Rind keine Fälle gemeldet. Der Parasit tritt jedoch gehäuft bei der Katze auf. *Tritrichomonas foetus* DNA wurde bei 13 von 69 (18.8%) untersuchten Katzenkotproben mittels real-time PCR nachgewiesen. Der Parasit konnte aus 5 von 26 (19.2%) Kotproben mittels in-Pouch Kulturmethode isoliert werden.

Neosporose: 2020 - 2021: *Neospora caninum* DNA wurde mittels real-time PCR bei insgesamt 28 von 133 (21%) abortierten Rinderfötten nachgewiesen.

Besnoitiose: 2020-2021 wurde der Parasit in der Schweiz nicht festgestellt.

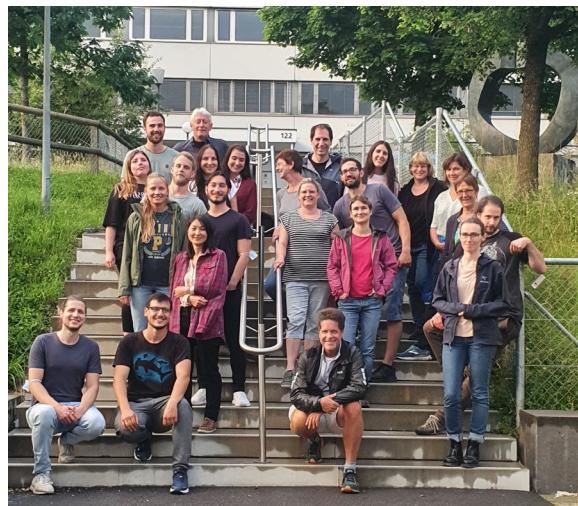
9.3 DIAGNOSTIKAUFRÄGE / DIAGNOSTIC SERVICES

Durchgeführte Untersuchungen: 2020-2021

Jahr	Serologie-Untersuchungen		Direknachweis (inkl. PCRs)
	Serum- Untersuchungen	Milch-Serologie	
2019	656	374	7056
2020	498	361	7411
2021	749	1821	8672

10. INSTITUTANLÄSSE / INTERNAL INSTITUTE EVENTS

2021



Institutsausflug 2021

2020



Weihnachtswanderung 2020

2019



Institutsausflug 2019



Abschiedsparty Prof. Dr. B. Gottstein

11. WEITERE FUNKTIONEN TÄTIGKEITEN DER GRUPPENLEITENDEN / FURTHER FUNCTIONS OF THE GROUP LEADERS

11.1 GESELLSCHAFTEN UND KOMMISSIONEN / SOCIETIES AND COMMITTEES

W. Basso

Board Member EVPC, European Veterinary Parasitology College.
Member of the Credentials Committee EVPC, European Veterinary Parasitology College.
Member of the Executive Committee ESCCAP Schweiz, European Scientific Counsel Companion Animal Parasites.
Member of the Working Group "Veterinary Parasitology" SSTPM, Swiss Society of Tropical Medicine and Parasitology.
Member of the Management Committee for Switzerland EU COST Project COMBAR (Combatting Anthelminthic Resistance in Ruminants).
Member ICT, International Commission on Trichinellosis.

C. Frey

Vizepräsidentin ESCCAP Schweiz, European Scientific Counsel Companion Animal Parasites.
Mitglied ICT, International Commission on Trichinellosis.
Mitglied EVPC, European Veterinary Parasitology College.
Mitglied SGTP, Schweizerische Gesellschaft für Tropenmedizin und Parasitologie (Swiss Society for Tropical Medicine and Parasitology).
Mitglied SVVLD, Schweizerische Vereinigung für Veterinär-Labordiagnostik.
Mitglied GST, Gesellschaft Schweizer Tierärzte und Tierärztinnen.

A. Hemphill

Mitglied, Schweizerische Gesellschaft für Tropenmedizin und Parasitologie (Swiss Society for Tropical Medicine and Parasitology).
Mitglied des Vorstandes der DGP, Deutsche Gesellschaft für Parasitologie (German Society for Parasitology).
Member, British Society for Parasitology.
Member, American Society for Parasitology.

N. Müller

Mitglied, Schweizerische Gesellschaft für Tropenmedizin und Parasitologie (Swiss Society for Tropical Medicine and Parasitology).
Mitglied DGP, Deutsche Gesellschaft für Parasitologie (German Society for Parasitology).

B. Lundström-Stadelmann

Präsidentin SGTP/SSTMP, Schweizerische Gesellschaft für Tropenmedizin und Parasitologie (Swiss Society for Tropical Medicine and Parasitology).
Mitglied DGP, Deutsche Gesellschaft für Parasitologie (German Society for Parasitology).

Mitglied SFM, Svenska föreningen för mikrobiologi (Swedish Society for Microbiology).

Mitglied SGV, Schweizerische Gesellschaft für Versuchstierkunde (Swiss Laboratory Animal Science Association).

11.2 EVALUATIONSGREMIEN / SCIENTIFIC POSITIONS OF TRUST

W. Basso

Evaluation Committee Ph.D. Thesis Rocío Checa Hernáiz "Aspects about the epidemiology and control of the infection by *Babesia vulpes* (*B. microti-like*) in domestic and wild carnivores from Galicia", Universidad Complutense de Madrid, Spain, **Dec. 2020**.

Evaluation Committee Ph.D. Thesis Chiara Lucchetti "*In vitro* study of the molecular mechanisms responsible for the filaricide effect of macrocyclic lactones combined with doxycycline against *Dirofilaria immitis*", Universita' degli Studi di Parma, Italy, **Mar. 2020**.

Evaluation Committee Ph.D. Thesis Carlos Diezma Diaz "Development of a bovine model of experimental infection with *Besnoitia besnoiti*", Universidad Complutense de Madrid, Spain, **Nov. 2019**.

C. Frey

Member Thesis (PhD) Committee, Filip Dámek, "Study of the tropism and persistence of *Toxoplasma gondii*: from pork carcass to sausage, a quantitative risk assessment", Anses, INRAE, Ecole nationale vétérinaire d'Alfort, Maisons-Alfort, France, **Nov. 2020 – present**.

Member Research Advisory Committee (PhD), Temitope U. Kolapo, "Improved veterinary diagnostics for *Echinococcus* and other gastrointestinal parasites of canids", Veterinary Microbiology Department, Western College of Veterinary Medicine, Saskatoon, Canada, **Nov. 2017 – present**.

Member Thesis (PhD) Committee, Zoé Delefortrie, "Haemosporidians & white-throated sparrows (*Zonotrichia albicollis*): parasite diversity, factors influencing infection, and effects of infection on fitness", The College of Graduate and Professional Studies, Department of Biology, Indiana State University, Terre Haute, Indiana, USA, **Nov. 2018 – Feb. 2022**.

External examiner, PhD candidate Jonathon D. Kotwa, "Wild canids as sentinels for pathogens of public health and veterinary significance", Ontario Veterinary College, University of Guelph, Guelph, Canada, **Aug. 2019**.

A. Hemphill

Novo Nordisk Foundation Challenge Programme on "Emerging Infectious Diseases", **2019**.

B. Lundström-Stadelmann

Evaluation for recruitment of Faculty position to Uppsala University, SE, **Nov. 2020**.

PhD Committee, Thesis Flavio Lombardo "Development of novel strategies to fill the empty drug pipeline for schistosomiasis: from drug sensitivity assay development to preclinical studies", Swiss Tropical and Public Health Institute, Basel, CH, **Dec. 2019**.

11.3 UNIVERSITÄT BERN UND VETSUISSE FAKULTÄT / UNIVERSITY OF BERN AND VETSUISSE FACULTY

W. Basso

Representative for the Institute of Parasitology in the “Mittelbau” (Intermediate Staff Faculty Members).

Member of the Mittelbau Board of Directors of the Vetsuisse Bern, as Representative for the Departement of Infectious Diseases and Pathobiology (DIP).

Member of the advisory group (Begleitgruppe Arbeitskreis Bern) in the ZoE-BTA Programm from the Federal Food Safety and Veterinary Office (BLV) to improve pig health in Switzerland.

C. Frey

Mitglied Vetsuisse Beförderungskommission, Vetsuisse Bern & Zürich.

Mentor Vetment Programm, Vetsuisse Bern.

Echogruppe neues Curriculum Vetsuisse, Vetsuisse Bern.

Echogruppe Strategie 2030, Universität Bern.

B. Lundström-Stadelmann

Mitglied Proteomics & Mass Spectrometry Core Facility Working Group of the DBMR, Universität Bern.

Mitglied Strukturkommission Tierpathologie Bern, Vetsuisse Bern.

Mitglied Strukturkommission Veterinärparasitologie Professur, Vetsuisse Zürich.

Mitglied Neglected Disease Cluster of the Multidisciplinary Center for Infectious Diseases (MCID), University of Bern.

Mitglied Strukturkommission Assistenzprofessur Pharmakologie, Vetsuisse Zürich.

Mitglied of the University of Bern group of the Swiss Alliance against Neglected Tropical Diseases (SANTD).

Mitlgied der Kommission des Experimental Animal Center (EAC), Universität Bern.

Mitglied der Berufungskommission Veterinärparasitologie, Vetsuisse Zürich.

Mentor VetCareer Programm, Vetsuisse Zürich.

Mentor Vetment Programm, Vetsuisse Bern.

Board member of the Vetsuisse Bern midlevel staff.