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**DEPARTMENTAL SEMINAR
INTEGRATIVE ZOOLOGY
Summer Term 2016**

Programme and Abstracts

Tuesdays, 10-11:30 hrs

SR 3, UZA1, Althanstraße 14, 1090 Wien



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Programme

- March 1: Oliver Vöcking**
Molecular characterization of photoreceptors of the chiton species *Leptochiton asellus*. (p.4)
- March 8: Livia Rudoll**
Lab Safety II.
- March 15: Thomas Schwaha**
The japanese bryozoan safari 2. (p.5)
- Bartolomeo Gorgoglione**
The discovery of migrating autozooids in *Fredericella sultana*, following the first PKD outbreak in Austria. (p.6)
- April 5: Michael Seiter**
Whip spiders (Arachnida, Amblypygi). (p.7)
- April 19: Helmut Kratochvil**
Talking plants - Their message about photosynthesis and environmental change. (p.8)
- April 26: Katrin Diensthuber**
The morphology of the labial palpi of *Heliconius* butterflies. (p.9)
- Yurii Kornilev**
Determining feeding mechanics in the Balkan-Anatolian crested newt (*Triturus ivanbureschi*) through high-speed video. (p.10)
- May 3: Anna Sophia Feix**
Mapping of watersnails in upper Austria with special regards on parasitic infestations. (p.11)
- Luiza Saad**
Functional morphology of the seminal receptacle of the squid *Doryteuthis plei* (Blainville, 1823) (Cephalopoda, Loliginidae): unraveling postcopulatory sexual selection mechanisms in cephalopods. (p.12)

- May 10: Saskia Krüger**
Feeding mechanism in *Ambystoma dumerilii*
(Salamandroidea, Amphibia). (p.13)
- Marlene Weberndorfer**
Feeding mechanism in *Ambystoma andersoni* (Krebs &
Brandon 1984) (Salamandroidea, Amphibia). (p.14)
- May 31: Norbert Milasowszky & Martin Hepner**
News from the spider research group in the Integrative
Zoology. (p.15)
- June 7: Michaela Punz**
Was erzählen Skelette über die Lebensweise von Tieren?
Eine Bearbeitung der ausgestellten Säugetierskelette im UZA1 Wien
inklusive fachdidaktischer Wissensvermittlung zu Lebensraum,
Fortbewegung und Ernährung. (p.16)
- Susanne Reier**
DNA-barcoding of fish parasites of Austria with special emphasis
on Acanthocephala. (p.17)
- June 14: Hannah Schmidbaur**
Nervous system diversity in Syllidae (Annelida, Phyllococida).
(p.18)
- June 21: Sonia Rodriguez-Monje**
Molluscan Wnt gene expression and the evolution of
morphological novelties. (p.19)
- Natalie Gawin**
Myoanatomy of *Pectinatella magnifica* and *Cristatella mucedo*
(Bryozoa, Phylactolaemata). (p.20)
- Bianca Matulik**
Mouthparts in wasps (*Vespula*). (p.21)
- June 28: Jessica Rushton**
Highlighting the role of equine corneal nerves in sickness and in
health. (p.22)
- Philipp Pröts**
Morphology of *Hypophorella expansa* (Bryozoa, Ctenostomata).
(p.23)

Molecular characterization of photoreceptors of the chiton species *Leptochiton asellus*.

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Invertebrate light sensing organs show great variety of structures from complex eyes to simple eyespots or several kinds of extraocular photoreceptors leading to the questions how this diversity evolved and which photoreceptive structures can be considered as homologues. Mollusk photoreceptors are a matter of interest for some time but detailed studies refer mainly to representatives of conchiferans like cephalopods, gastropods or bivalves. We chose a phylogenetically distinct polyplacophoran species as a study object (1) to obtain insights in the mollusk ancestral set of photoreceptors and (2) since homology of polyplacophoran eyes to eyes of other lophotrozoans has been questioned due to their posttrochal position in the larva. We study the development and evolution of photoreceptors of the species *Leptochiton asellus* by means of morphological as well as molecular methods, including a broad set of markers for the patterning of the larval neuroectoderm, eye and CNS development, pigment synthesis and phototransduction providing clear insights into their evolutionary origin, but also on the mechanism of photopigment renewal in mollusks and beyond. Beside in the eyes, we found and characterized photoreceptors as well and for the first time in the very anterior and the posterior end of a mollusk providing further evidence that light sensation is an important feature during larval life.

The japanese bryozoan safari 2

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Among the Bryozoa, the Phylactolaemata are of particular phylogenetic importance since they represent the sister-group to all remaining large bryozoan clades. Consequently, their analysis can be crucial to determine the basic ground pattern of morphological features of the whole phylum and thus yield insight into their relationship to other phyla. Among the Phylactolaemata, the monotypic family Stephanellidae with the probably single species *Stephanella hina* was considered both, from morphological and molecular perspective, to be one of the earliest branches within the Phylactolaemata. Recent analyses were able to gain more insight into the biology and morphology of this species, but its sexual reproduction is totally unknown. The latter is supposedly in winter. Consequently, I travelled to Japan the last two winters in order to find any signs of sexual reproduction and larvae in order to reconstruct the basic pattern of sexual reproduction in the Phylactolaemata. So far, the small winter colonies never exhibited any sign of sexual reproduction. Once, a testis-like structure was encountered, but its validity needs confirmation by histology. However, additional information concerning colony morphology as well as coelomocytes and their exposure were found. In addition, material from an undescribed species from *Lanceopora* incl. a commensal loxosomatid kamptozoan, both from Okinawa, was obtained. The kamptozoan mostly likely also represents a new species that is characterized by its long muscular stalk as well as a row of spines on the margin of the calyx as well as in the stalk.

The discovery of migrating autozooids in *Fredericella sultana*, following the first PKD outbreak in Austria.

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Myxozoan parasites have never before caused major issues for Austrian wild and farmed fish populations. Although, following mortality outbreaks happening in the context of a syndrome locally so-called “Black Trout”, Proliferative Kidney Disease (PKD) was diagnosed for the first time in Austria. A farm pre-restocking small scale test confirmed the infection with *Tetracapsuloides bryosalmonae* in juvenile autochthonous brown trout (*Salmo trutta*). *Fredericella sultana* (Phylactolaemata) act as the primary host within the two-host life cycle of the myxozoan parasite *T. bryosalmonae*, the aetiological agent of PKD in salmonids. Indeed, overtly infected *F. sultana* colonies were retrieved from the affected site and from the river Kamp, up to 6 km upstream the infected farm. To conduct experimental trout infection, bryozoan colonies are adapted to laboratory summer conditions to release infective malacospores. A novel dispersal mechanism was observed when zooids were cultured under unfavourable summer-like conditions, actively undertaken by viable zooids to escape from degenerating branches. Upon retraction of their funiculus and packing of all organs into a pear-shaped capsule, they actively dislocate from the degenerating tubular zooecial sheath. Following somewhere else attachment, a new colony could grow by undertaking astogeny, similarly as for those newly hatched from piptoblasts. Further study is now required to better assess the occurrence of autozooids migration phenomenon in bryozoans and to provide ultrastructural details. The evidence of migrating autozooids for *F. sultana* colonization of new habitats could increase their intrinsic capacity of spreading infective *T. bryosalmonae* malacospores.

Whip spiders (Arachnida, Amblypygi).

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Whip spiders (Amblypygi) belong to the class Arachnida (Chelicerata) and are distributed globally in the tropics and subtropics, but they also established populations in dry regions of the world. They are a very small group of arachnids with 194 currently known species. They are nocturnal and cavernicolous predators, which are catching their prey with their raptorial pedipalps armed with numerous spines. Their first pair of legs is modified as sensory organs and extremely elongated. These are essential for hunting and mating, and bear important multisensory functions. The body of whip spiders is flattened and cryptically colored. They show a ritualized courtship and indirect insemination via a stalked spermatophore. Spermatophore structure and mating behavior of various species have been described in recent history. Mating behavior and courtship but rather the very complex structure of the spermatophore are valuable characters for taxonomic analysis and are highly species-specific. This is in general a primitive mode of sperm transfer compared to other arachnids, but is by no means primitive structures. The spermatophore is highly complex and bears several polymorphic appendages. It is species-specific modified and have significant wide differences in all known families.

I intend to conduct two projects at the University of Vienna, i.e. (i) the functional anatomy of the reproductive system, and (ii) sexual selection and ontogenesis in whip spiders. On the one hand, I want to illustrate the functional anatomy of the reproductive organs via μ CT-images and various histological methods of the spermatophores, female gonopods and male genitalia, and evaluate the mating behavior, spermatophore formation and insemination in all whip spider species inhabiting the Dominican Republic. On the other hand, I want to scrutinize the fitness implications of male body size, interrelated with (i) agonistic behavior (male-male competition), (ii) with sexual selection (female choice), and

(iii) highlight the interrelated effects of learning, and illustrate the ontogenetic changes in trichobothria and the spination on the pedipalp. Both represent a very useful tool for species classification and highlights evolutionary trends, because the number and arrangement of trichobothria and spines are greatly increased, maybe also very variable, early in life, whereas they are reduced, more or less constant after the deutonymphal stage.

Talking plants: Their message about photosynthesis and environmental change.

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Measurements of photosynthetic processes in hydrophytes mostly involve photosynthometers, which capture the escaping gas for subsequent analysis. The most common method to detect changes in the rate of photosynthetic processes is to count the series of escaping gas bubbles. The emerging bubbles are either simply counted or they are recorded using light barriers, which is very difficult because of their small size and often varying ascent rate. The gas bubbles generated during photosynthesis by aquatic plants produce distinctive sound pulses when leaving the plants. These acoustic side effects enable completely new and highly accurate measurements. The frequency and reaction time changes of the pulses caused by external influences are therefore accurately detectable. The precise time measurements enable registering and evaluating the curves as reactions to changes in physical or chemical environmental conditions. It is shown that such acoustic analyses open completely new research opportunities for plant physiology.

The morphology of the labial palps in *Heliconius* butterflies a comparison between different species of Heliconiinae.

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Heliconius melpomene (Lepidoptera, Nymphalidae) belongs to the neotropical guild of pollen-feeding butterflies. Most adult Lepidoptera use flower nectar as their primarily food source. During feeding butterflies regularly come into contact with pollen which is normally not used as food source. But the genus *Heliconius* evolved a unique technique to utilize the nutritive value of pollen. In addition to collecting nectar, they actively collect pollen from flowers. Previous investigations of the feeding mechanisms of *Heliconius* are focused on the proboscis morphology, on the movement sequences and the physiological aspects. This study focuses on the labial palps of these butterflies. For better understanding of the biological role of the labial palps, shape and lengths of the different segments will be measured. Furthermore several structures of bristles and sensilla will be studied.

For the investigation of the labial palps, their bristles and sensilla, light microscope and scanning electron microscope are used.

In contrast to other Lepidoptera the third segment of *Heliconius melpomene* does not possess a pit organ. The SEM study revealed two different types of bristles that are located on the frontal and orbital side of the labial palps. Because of the distribution and form of the orbital bristles, it is expected, that the orbital bristles remove pollen from the compound eyes. Further analyses of labial palps are in progress, that will compare labial palp morphology with closely related species (*H. wallacei*, *H. sara*, *H. erato*, *Laparus doris*, *Neruda aoedo*, *Agraulis vanillae*, *Boloria*, *Issoria lathonia*, *Dione glycera*, *Dryas Julia*).

Thermal conditions' impacts on the feeding performance of model amphibians.

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Among the overarching ecological advantages of ectothermy is that it allows organisms to survive with minimal energy resources and convert highly efficiently the acquired nutrients into body mass. Still, successful feeding is vital, and determines not only the behaviors of species even on a daily basis, but has implications for their short and long-term survival and evolution.

Therefore, organisms have developed a range of morphological, physiological, and behavioral adaptations to feed efficiently and cope with challenges imposed not only by their prey, but by the medium they inhabit.

In terrestrial situations, prey capture is usually achieved through jaw prehension or tongue protrusion. On the other hand, the incompressibility of water both forces and allows for other effective modes to be utilized in an aquatic environment – specifically suction feeding (generated through expansion of the buccal cavity or separation of two parallel surfaces in close apposition).

Therefore, extensive research has been carried on the biomechanics and the functional morphology of the feeding apparatus of a wide variety of ectothermic organisms, but usually under single temperature.

However, environmental temperatures are widely recognized as heavily impacting each aspect of the lives of ectotherms: e.g. sex determination, speed of embryonic development, seasonal and daily behavior cycles, digestion rates, ability to avoid predation. That is why it is interesting that until now only a limited set of publications has considered the impact of body temperature on feeding mechanics. Elastic recoil in feeding

mechanism are less thermally dependent than muscle contractions and various combinations of the two likely exist amongst ectotherms.

Semi-aquatic salamanders (such as *Triturus ivanbureschi*) offer an excellent study system to explore feeding mechanics' correlation with temperature: they undergo significant morphological changes during their ontogenesis, experience separate terrestrial and aquatic phases during which they exhibit different types of feeding, and are active in the wild in a wide range of temperatures. Analysis of high-speed filming (3,000-6,000 fps) under a range of laboratory conditions of both phases and larval/adult stages, along with CT-scans, will be utilized. Such information and methods can be utilized to understand better species and structures evolution, niche partitioning, micro-habitat choices, life-history characteristics, and possible future implications of climate change.

Mapping of freshwater snails in the “Donau-Auen”, “Leitha-Auen” und the “Leithagebirge” in Lower Austria and the Burgenland with special regards on parasitic infestations of trematodes.

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Project

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In the past years parasitic screenings throughout the Danube river systems got more important, due to the inhabiting of invasive parasitic species. Since this region will be joined with adjacent areas through wildlife crossings, several parasitic species could also spread with their final hosts. This report is going to show the preliminary results of studies regarding *F. magna*, *Trichobilharzia*, and *Alaria alata*. This parasitic monitoring consequently also includes the mapping of freshwater snails in this area, as all of them need snails as an intermediate host. The invasive parasite *F.magna* mainly utilizes *Galba truncatula* in Austria. Previous studies suggest that also *Radix sp.* and *Stagnicola sp.* are

possible intermediate hosts. Swimmers itch, in Europe most commonly *Trichobilharzia*, needs Lymnaeid snail species as their intermediate host. *Alaria alata* parasites *Planorbis planorbis* and *Planorbarius corneus*. All of which could be found on the research sites. Parasites not only threaten their hosts, but consequently the hosts population and their environment. To maintain a healthy environment a long-term monitoring can help to apply several preventive measures in the future. However, an absolute protection might be impossible.

Functional morphology of the seminal receptacle of the squid *Doryteuthis plei* (Blainville, 1823) (Cephalopoda, Loliginidae): unraveling postcopulatory sexual selection mechanisms in cephalopods.

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Sexual selection has a crucial role in the evolution of reproductive traits. Males use several strategies to ensure fertilization, but females also play a major role in pre and postcopulatory processes. Cephalopod mollusks have unique and quite variable reproductive strategies, such as the males, who usually transfer sperm packed within spermatophores, and the females, that in some cases bear specialized organs for sperm storage (i.e., seminal receptacles). However, the morphology of these organs and their functioning (e.g., sperm uptake, storage and release by the seminal receptacles) remain poorly known. The present study investigates the morphology of the seminal receptacles in the Loliginidae squid *Doryteuthis plei* as well as their role in sperm uptake, storage and release, using techniques as histology, immunohistochemistry, scanning and transmission electron microscopy, confocal scanning laser microscopy and microscopic X-ray computed tomography, aiming at a better understanding in the mechanisms of postcopulatory sexual selection in cephalopods. The seminal receptacle

is an invagination of the buccal membrane epithelium, and it is divided into glandular bulbs that are connected to a common duct, in which leads to the opening of the seminal receptacle, connecting it to the exterior. Histological sections show that secretions are constantly released by the secretory cells into the lumen of the common duct and the bulbs. The secretion keeps the sperm immotile, but can be related with chemical attraction mechanisms. Male's spermatozoa are stored within the organ and are probably released by a muscular contraction of the organ. Some seminal receptacles were found with up to three whole spermatangia inside the organ, in which at least one spermatangium of the distal tip fitted the opening of the seminal receptacle, blocking it and apparently preventing the release of the stored spermatozoa. Furthermore, these features reveal a potential female control in the release of sperm and also a selective response of the males, who possibly deposits mating plugs that physically prevents the use of others sperms stored inside the seminal receptacle. However further studies are required for understanding sexual selection mechanisms related in this specie.

Feeding mechanism in *Ambystoma dumerilii* (Salamandroidea, Amphibia).

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The Lake Pátzcuaro salamander *Ambystoma dumerilii* is a highly endangered species, which only occurs in the lake Pátzcuaro in north-western Michoacán, Mexico, at an elevation of 1920 meters above sea level. This salamander is believed to be close to extinction in the wild because of overfishing and water pollution but it is bred by nuns of a nearby monastery to gain raw material for cough syrup.

Ambystoma dumerilii is neotenic, which means that the salamanders remain their whole life aquatic and retain their juvenile characteristics

while achieving sexual maturity. They cannot metamorphose and live terrestrial like most other salamander species when conditions get threatening.

The highly specialised species is perfectly adapted for aquatic lifestyle. The broad flattened head is ideal for hunting elusive prey such as fish.

In this master thesis the feeding mechanism of *Ambystoma dumerilii* is investigated by means of high speed filming. The videos will be analysed with a MatLab based tracking software. The motion, duration and speed of the kinematic profile will be analysed and compared to related species.

The anatomy of the skull and jaw muscles will be investigated using computer tomography and will also be compared to related species and former descriptions.

The Zoo Schönbrunn started a conservation breeding program and provide some individuals for this master thesis.

Individuals for computer tomographic investigation are provided from the Zoo Schönbrunn or from the Naturhistorisches Museum Wien.

Feeding mechanisms in *Ambystoma andersoni* (Krebs & Brandon 1984) (Salamandroidea, Amphibia).

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The *Ambystoma andersoni*, or Anderson's salamander, is a critically endangered salamander species within the family Ambystomatidae and is endemic to the Lake Zacapú and its feeding stream in northwestern Michoacán, Mexico, at an elevation of 2000 meters above sea level. It is a purely aquatic, neotenic salamander species, thus retains its juvenile, larval morphology, including external gills and a caudal fin, when it reaches sexual maturity. The neotenic lifestyle is believed to be either caused by limited production of the hormone thyroxine or by

threatening terrestrial environments. *Ambystoma andersoni* is, as all other neotenic salamanders, perfectly adapted to the aquatic lifestyle. Although its head is less flat, compared to other ambystomatid salamanders, it has a broader mouth, which enables it to engulf bigger prey.

Within the scope of this diploma thesis, the feeding mechanism of *Ambystoma andersoni* will be investigated via high-speed filming and analyzed using a MatLab based tracking-software. Within this analysis, motion, duration and velocity of the kinematic profile will be explored and compared to closely related species. Moreover, the anatomy of the skull and jaw musculature will be investigated, using micro computed tomography, and will also be compared to closely related species.

The animals are temporarily provided by the Vienna Zoo, which conducted a conservation breeding program of *Ambystoma andersoni* and *Ambystoma dumerilii*. The specimen for the Micro-CT scans were provided by the National History Museum of Vienna and the Vienna Zoo.

News from the spider research group in the Integrative Zoology.

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Associate Scientists

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In this lecture we report about our previous and ongoing research activities in the scientific fields of conservation biology and taxonomy. We use web-spiders (Arachnida: Araneae) as a tool in biodiversity and environmental assessment studies. Currently, 45.961 species of spiders belonging to 3.984 genera and 114 families, are known world-wide. In Austria, at least 1.037 spider species are documented so far. We also report about our collaborations with other Austrian arachnologists and present the latest developments in our research. In particular, we report

on the “prehistory” of our current publication which deals with a previously undescribed spider species, which was found in Carinthia close to the Austrian-Slovenian border in 2009.

Was erzählen Skelette über die Lebensweise von Tieren?

Eine Bearbeitung der ausgestellten Säugetierskelette im UZA1 Wien inklusive fachdidaktischer Wissensvermittlung zu Lebensraum, Fortbewegung und Ernährung.

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Mammals are distributed over the whole world and have adapted in special ways to their environments. This diploma thesis describes the skeletons of six mammals, which are exhibited in the hallway of the Biozentrum UZA 1 in Vienna. The main focus lies on adaptations for feeding and locomotion.

There are an Asian elephant (*Elephas maximus*, Linnaeus 1758), a giraffe (*Giraffa camelopardalis*, Brisson 1762), a walrus (*Odobenus rosmarus*, Brisson 1762), a minke whale (*Balaenoptera acutorostrata*, Lacepède 1804) and two toothed whales – the pilotwhale (*Globicephala melas*, Linnaeus 1758) and the narwhale (*Monodon monoceros*, Traill 1809). All six skeletons were primarily collected by Joseph Hyrtl (1810 – 1894), the founder of the museum of comparative anatomy in Vienna. This thesis includes a short biography of Hyrtl.

The main goal of this thesis is the final degree of the Lehramtsstudium (Biologie und Umweltkunde & Geschichte, Sozialkunde, Politische Bildung). The other goal is, to design plates, which will give short overviews of the biology and ecology of the animals and will be on display. For further reading, QR-codes will be used to give access to this thesis.

Target audience is students of biology. Because of this, there are some introductory chapters and important terms will be explained.

Molecular and morphological identification of Austrian Acanthocephala (Kohlreuther, 1771).

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The current master thesis is a result from the pilot study of parasitic worms, a sub-project of the Austrian Barcode of Life (ABOL) initiative. Up to the point there are no studies dealing with the acanthocephalan fauna of Austria based on molecular methods. The purpose of this master thesis is to provide a first insight into the phylogenetic relationships among members of the phylum Acanthocephala. 305 acanthocephalans were found in 26 fish species from various rivers in Styria and Lower Austria. Overall, 159 fish intestines were examined. For the molecular identification the cytochrome oxidase subunit 1 marker (COI) and specific primers designed for the phylum Acanthocephala were used. In addition, a morphological identification was conducted, using different staining and microscope methods. Three different genera of Acanthocephala could be detected: *Acanthocephalus* (Kohlreuther 1771), *Echinorhynchus* (Zoega in Müller 1776) and *Pomphorhynchus* (Monticelli 1905). All genera belong to the class Palaeacanthocephala. Two species could be differentiated within the genus *Pomphorhynchus*: *P. tereticollis* and an unidentified species. The morphology of the unidentified species points to the species *P. laevis*, the most common and wide spread *Pomphorhynchus*-species in Europe. However, the genetic analysis revealed a genetic distance of 10.2% between the sequences of the Austrian species and the *P. laevis*-sequences from the NCBI Genbank. Morphological and molecular traits of the Austrian animals of the genus *Acanthocephalus* lead to the assumption that they belong to the species *A. lucii*. The Austrian

helminths belonging to the genus *Echinorhynchus* could not be identified on species level. The master thesis demonstrates how important it is to link morphological and molecular characteristics, particularly because of the lack of reference sequences in the Genbank and the risk of species misidentification.

Nervous system diversity in interstitial Syllidae (Annelida, Phyllodocida).

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Syllidae are a species rich, cosmopolitan family of the Phyllodocida. Due to their small size many morphological features are difficult to observe and their phylogeny is ambiguously discussed. Confocal laser scanning microscopy and histological reconstructions can reveal new features that aid in this cause. The adult nervous system of five species belonging to two subfamilies of Syllidae (*Syllis gerlachi*, *Syllis garciai*, *Plakosyllis brevipes*, *Prosphaerosyllis c.f. marmarae* and *Sphaerosyllis taylori*) is reconstructed. The anatomy of the brain and innervation of palps and antenna is similar in all five species. Serotonin-like immunoreactive perikarya associated to the brain seem to differ in number between species. The paired nuchal organ is located on the dorsal or lateral side of the head and connects to the dorsal root of the circumoesophageal connective via a small neurite bundle. A stronger, posterior nerve connects it to the brain. Two pairs of stomatogastric nerves originate from the brain, three pairs from the ventral root of the circumoesophageal connective. Four neurite bundles enter the proventriculus and subsequently innervate the ventricle. The gut itself is innervated by a diffuse nervous plexus. A trineuralian ventral nerve cord is most common. Only *P. brevipes* possesses five connectives, which fuse to three in segmental ganglia. Four segmental ring nerves

are present in all species. The fourth is found at segment boundaries and may be missing in some segments. The first ring nerve and the dorsal commissure of the parapodial nerve are linked by paired dorsal connectives. A dorso-lateral longitudinal nerve connects the ring nerves of adjacent segments. A second ventro-lateral longitudinal nerve seems to be present, but is difficult to trace. The parapodial innervation comprises at least a main parapodial nerve and an anterior neurite bundle. Differences between species in nuchal organ anatomy, segmental nerves and associated ganglia and ventral nerve cord connectives are evident. The reconstruction of a ground plan for the family remains difficult, as too little data is available on other Nereidiformia except Nereididae, and sister group relationships are uncertain. Convergent modifications of the peripheral nervous system have occurred in several annelid families, and a homologisation of segmental nerves is not possible at present. Some features of the nervous system of *Plakosyllis brevipes*, such as five ventral connectives and additional peripheral ganglia, seem to be common in interstitial species, but their origin and function remain unclear.

Molluscan Wnt gene expression and the evolution of morphological novelties.

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Wnt signaling proteins are highly conserved molecules that play key roles during metazoan development. They bind to transmembrane family receptors such as frizzled, LRP and tyrosine kinases and subsequently trigger the transcription of several Wnt target genes. Studies on *Drosophila*, *Xenopus* and zebrafish show that Wnt signaling activity is involved in processes such as gastrulation and patterning of the body axis. Unfortunately, there is still a considerable gap in knowledge concerning the expression and the role of Wnt genes in the

protostome superphylum Lophotrochozoa that includes diverse groups such as the annelids or mollusks. The latter are particularly interesting due to their vast diversity of body plans as well as life cycles.

We retrieved transcripts of members of 12 Wnt subfamilies from transcriptomes of three different mollusks: *Dreissena polymorpha* (Bivalvia), *Acanthochitona crinita* (Polyplacophora) and *Antalis entalis* (Scaphopoda) and corroborated their identity through a phylogenetic analysis. Currently, in situ hybridization experiments are carried out in order to document the Wnt expression profile during development. Preliminary results show that Wnt1 is expressed in the most posterior body region in the polyplacophoran, a condition that is similar to other bilaterians and congruent with the notion that Wnt genes are primarily involved in patterning the bilaterian anterior-posterior axis. In the scaphopod, the expression of certain Wnt genes is confined to specific organ systems such as the prototroch and the dorsal mantle margin around the opening. A comparative analysis of Wnt gene expression in the above-mentioned mollusks might reveal shared as well as diverging expression domains among class-level taxa and may contribute to understand the evolution of molluscan body plans.

Myoanatomy of *Pectinatella magnifica* and *Cristatella mucedo* (Bryozoa, Phylactolaemata).

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Phylactolaemate bryozoans occur exclusively in freshwater and are commonly regarded as the earliest branch within bryozoans which makes them important for reconstructing the general bauplan of the phylum. In this study the myoanatomy of *Pectinatella magnifica* and *Cristatella mucedo* is analyzed by means of histology, f-actin staining and confocal laserscanning microscopy in order to gain a better understanding of muscular systems in Phylactolaemata. Two prominent bundles of longitudinal muscles form the retractor muscles. All

musculature of the digestive tract is circular. The lophophore shows several types of musculature: frontal and abfrontal longitudinal muscle bands in the tentacles, longitudinal muscles in the lophophoral arms, musculature of the epistome and so-far undescribed muscles of the ring canal musculature. The epistome musculature differs in *Cristatella* and *Pectinatella*. In *Cristatella* smooth muscle fibers form a muscular basket, whereas *Pectinatella* shows additional fibers that traverse the coelomic cavity. The tentacle sheath possesses longitudinal and circular musculature. The bodywall in *Cristatella* has an outer circular layer and an inner longitudinal layer whereas *Pectinatella* possesses a third diagonal layer. The orifice is surrounded by the orifice sphincter consisting of circular musculature, The vestibular wall is surrounded by vestibulum dilators, which are single longitudinal muscle fibers traversing the coelomic cavity. The peritoneal duplicature bands are supplied with longitudinal muscle fibers and run proximally of the vestibulum dilators. In *Pectinatella magnifica* also a vestibular pore surrounded by muscle fibers could be identified and is associated with a white spot. In general the muscular system of both species is very similar with differences merely in the body wall and epistome. Differences among analysed Phylactolaemata are mainly in the tentacle sheath, epistome, bodywall and ring canal. Data about the muscular system from *Stephanella*, which is considered as the earliest branch within phylactolaemate bryozoans, could yield better insight into the muscular ground pattern of this group and thus enable a more profound comparison to key differences to other bryozoan taxa, i.e. the Steno- and Gymnolaemata.

Mouthparts in wasps (*Vespula*, Vespidae).

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This diploma thesis investigates the morphology of the mouthparts in *Paravespula germanica* and *Paravespula vulgaris* with special emphasis on the differences between female workers and males. For the analysis of the mouthparts light microscopes but also scanning electron microscopes have been used. Despite the fact that wasps are so widely

known and widespread, the mouthparts are relatively poorly investigated. During the last few decades only a small number of researchers have concerned themselves with the morphology of these insects and those researchers that did investigate the mouthparts, focused primarily on the female workers.

The mouthparts of wasps are of particular interest, because they can be regarded as micro-tools that accomplish different kinds of tasks. Alimentation on carbohydrate-rich fluids, nestbuilding, hunting insects for the alimentation of the larvae and brood care are duties accomplished with the aid of the mouthparts. Since male wasps neither hunt insects for the alimentation of the larvae, nor participate in nest building processes and they only feed on sugary fluids it can be supposed that the mouthparts of the male wasps show different morphology than female wasps.

In both sexes the mouthparts consist of the mandibles, the labrum and the labio-maxillary complex, which can further be divided into the labium and the two maxillae. Sexual dimorphism related to the mouthparts was observed. The divergence between the two sexes was restricted to the length and number of the sensilla found but no differences in types of sensilla could be observed. The higher number of sensilla in males when compared to female workers was particularly well observable on the mandibles and on the labial palps. Morphometric measurements showed that the mandibles in males are significantly shorter than those of female wasps even though the head tends to be bigger in male wasps than in female workers.

Highlighting the role of equine corneal nerves in sickness and in health.

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Corneal diseases in horses are very common and often difficult to treat, so that the diseased eye possibly needs to be removed for the benefit of the horse's welfare. As the pathophysiology of many corneal diseases isn't completely understood, a 100% appropriate therapy is not easy to achieve. Corneal nerves play a major role in the protection and nutrition

of the eye (blink reflex, neurotrophic factors) and a normal nerval function is essential for wound healing. Therefore a loss of nerval function in the cornea results in an increased permeability of the corneal epithelium, a decreased cell migration is a risk factor for ulcers, impaired wound healing and infections.

For a better understanding of the pathophysiology of corneal diseases, especially (indolent) ulcers and neurogenic keratitis, familiarity of the distribution and localization of the nerve fiber qualities in the cornea, taking into consideration disease and age related differences, is crucial.

Although many studies have been published about corneal nerves in humans, monkeys, rodents, cats and dogs, only little is known about corneal nerves in horses, therefore this study is intended to outline a description of the distribution and localization of corneal nerves in horses. Healthy and also diseased corneas will be obtained from horses of different ages (young, middle- aged and geriatric) which, for various reasons, had to be euthanized. Whole mount corneas will be stained with panneuronal and fiber quality specific antibodies. Fiber qualities and nerval distribution will be examined under a fluorescence microscope and compared to each other specifically taking into account possible age and disease related changes. Afterwards corneas will be dissected and examined under a fluorescence microscope a 2nd time for more precise images of deeper localized nerves.

Life in a tube: Morphology of *Hypophorella expansa* (Bryozoa, Ctenostomata).

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Bryozoans are a large lophotrochozoan clade of colonial aquatic filter-feeders. *Hypophorella expansa* is a boring ctenostome bryozoan originally described by Ehlers in 1876 that has not been investigated for nearly 140 years. As a ‘stoloniferan’ ctenostome its colony is composed of elongated, branch-like stolons and autonomous autozooids. *Hypophorella expansa* is unique in that its colonies inhabit parchment-

like tubes of polychaetes. Originally found in tubes of *Lanice conchilega*, it was also reported to occur in the tubes of *Chaetopterus* sp. Last summer live colonies were encountered in the tubes of the latter. In order to gain more insight into adaptations and peculiarities of this unique bryozoan, immunocytochemical stainings combined with CLSM and 3D-reconstruction techniques and TEM are used.

The colony forms elongated branch-like stolons and laterally attached autozooids. This resembles the general bauplan of a 'stoloniferan' ctenostome. The stolons show regular wrinkles in their cystid wall; a feature not known from any other stolonate ctenostome. Autozooids possess two fronto-lateral spherical structures that may provide space for the autozooid between the polychaete tubewall layers. No muscular or nervous elements could be found in them. In between of the spheres lies the apertural area which bears a boring apparatus that possibly facilitates movement/penetration of the tubes. At the lophophoral base *Hypophorella* possesses a basal transversal muscle that was not known for ctenostomes until now. The anus is situated at the vestibular region which differs from other ctenostomes. The nervous system has its center in the cerebral ganglion at the lophophoral base from which 4 tentacle sheath nerves traverse distally. It also innervates the tentacles that appear to only possess lateral and no frontal cilia. Proximally from the ganglion a prominent mediovisceral nerve traverses through the pharynx. The final studies will particularly focus on the wrinkled stolons and the fronto-lateral spheres using TEM. This study confirms many findings of Ehlers and due to new methods used today it also provides new data about this ctenostome bryozoan.

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