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**zoologie**

**DEPARTMENTAL SEMINAR  
INTEGRATIVE ZOOLOGY  
Winter Term 2013**

**Programme and Abstracts**

Tuesdays, 10-11:30 hrs

SR 3, UZA1, Althanstraße 14, 1090 Wien





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## **Molecular mechanisms underlying sipunculan bodyplan formation**

**Alen Kristof**

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*Posdoc*

*Lise-Meitner-Project M1523: Molecular mechanisms underlying sipunculan bodyplan formation.*

*Workgroup: Andreas Wanninger*

Sipunculans (or peanut worms) lack any obvious signs of segmentation in their adult body and their origin and relation to segmented worms have been highly debated. Recent morphological studies have suggested traits of segmentation during their development (Kristof et al. 2008, 2011, Wanninger et al. 2009). Interestingly, this segmental organisation is lost as the animals approach metamorphosis, thus suggesting that (1) sipunculans stem from a segmented ancestor as do the Annelida, and (2) that body segmentation is more evolutionary labile than previously thought. Whether or not this cryptic segmentation during sipunculan ontogeny can be confirmed on a molecular level will be investigated in the proposed project. Therefore, an expressed sequence tags (ESTs) library will be generated and screened for genes known to play crucial roles in the segmentation process of the well-studied annelid, arthropod and chordate model organisms. Thus, the main objective of the project is to analyse gene expression during development of a model sipunculan, *Themiste pyroides*, which I have shown to be ideally suited for these kinds of studies (preliminary data in my PhD thesis, Kristof 2011).

The project will mostly take place in Univ.-Prof. DDr. Andreas Wanninger's group, with its newly established molecular laboratory at the Department of Integrative Zoology, University of Vienna, Austria. A detailed analysis of the transcriptome datasets including the necessary bioinformatics will take place in collaboration with Christoph Bleidorn's Molecular Evolution and Animal Systematics group at the University of Leipzig, Germany. *In situ* probes of developmental genes will be generated from the transcriptome library and/or, if necessary, by PCR screenings. Expression analysis of developmental genes (e.g., *hairy*, *notch*, *delta*, *wingless*, *labial*, *caudal*, *engrailed*, *even-skipped*) - which

are known to be involved in the segmentation in annelids, arthropods and chordates - during sipunculan development will provide important insights into their role in sipunculan body patterning. Moreover, the current establishment of large-scale EST libraries and expression analysis of “segmentation genes” in two aculiferan molluscs, *Wirenia argentea* (Solenogastres) and *Ischnochiton hakodadensis* (Polyplacophora), in the laboratory of A. Wanninger will enable comparative analysis of “segmentation” and other body patterning genes across vermiform lophotrochozoan phyla. This comparative approach should provide important insights into the evolution of segmentation, which is considered one of most fundamental questions in the field of evolution and development.

## **Hox and ParaHox gene expression pattern in Polyplacophora (Mollusca)**

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DFG Forschungsstipendium FR3392/1-1

*Supervisor: Andreas Wanninger*

According to recent molecular analyses, mollusks are composed of two clades: Aculifera (Aplacophora and Polyplacophora) and Conchifera (e.g. gastropods and cephalopods). Thus a hypothetical ancestral mollusk could have either carried a single shell, serial shell plates, or numerous spicules. The body organization of Polyplacophora is of particular interest, as they appear to have a combination of both basal and evolutionary derived features. Comparative gene expression analyses show that Hox and ParaHox genes play a crucial role in body plan formation. This project aims at elucidating expression patterns of Hox and ParaHox genes in developmental stages of the polyplacophoran *Acanthochitona crinitus* (Pennant, 1777). By comparing these expression patterns to already existing data on gastropods and cephalopods, new

insights will be gained into the role of Hox and ParaHox genes during molluscan ontogeny. This project will be a significant contribution to the evolutionary understanding of the extremely variable body organization within Mollusca and the functions of developmental genes that govern this process.

## **Pollination Biology of the Orchid Genus *Ophrys*: Hunting for Pollinators**

**Hannes Paulus**

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*em.Univ.Prof., formerly head of the Evolutionary Biology  
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*Several FWF projects: Pollination biology in *Ophrys**

During the last years we investigated the sexual deception phenomenon in orchids. Sexual deception is mimicking a sexual partner. So far sexual deception for pollination is only known in orchids. In the tropics exist many genera (Australia, South Africa etc.), but in Europe only *Ophrys* (all species) and newly discovered in *Serapias lingua*. The pollinators are mainly different species of the Apoidea: in only few species pollinators are Specidae, Scoliidae or even Coleoptera.

An *Ophrys* flower must imitate all signals involved in sexual behaviour to be successful in attraction a female seeking male: Sexual pheromones (long distance attraction), visual cues (short distance attraction) and tactile cues in connection of possibly tactile-chemoreception (after landing on the flower). As sexual pheromones are always species-specific their imitation should also result in a species-specific attraction of pollinator males. An important consequence is that each *Ophrys* species should have only one pollinator male species. We investigated the chemical mimicry, the visual cues and the effectiveness of the tactile cues. As the visual system in insects (faceted eyes) is not evolved to see sharp images in the sense of the primate visual system, visual cues of flowers should

only be more general. Tactile cues should mainly come from body hairs of the female bee („lie of the hair“ directed from head to the abdomen).

This specificity of attraction has important consequences for systematics of the genus:

Each *Ophrys*-species has only one pollinator species because of the highly specific mimicry system. In some (rare) cases one or more near related pollinator species are attracted (e.g. *Ophrys lutea*-complex). As this pollinator transfers the pollen only within a given *Ophrys*-species population, it acts as pregame isolation mechanism. The pollinator is an indicator for the biospecies status. Species building is in any case a consequence of changing the pollinator. From this finding, an unknown *Ophrys* taxon can be experimentally tested, to prove if this sip is a species for its own in the sense of a biological species or not.

To investigate the pollination biology of more species of the more than 280 present known species within the genus, we are going every year in the Mediterranean area, mainly to many of the Aegean islands. This kind of expedition is mainly hunting and seeking new pollinator relationships with experimental prove of the specificity of attraction by choice tests. As an example, the deeper investigation on the island of Crete with discovering several new *Ophrys* species in connection with their integrative investigations of chemical mimicry, optical cues and population genetics.

I have to thank my earlier co-workers Prof. Manfred Ayasse (now in Ulm), Prof. Florian Schiestl and Dr. Philipp Schlüter (both now in Zürich), Prof. Johannes Spaethe (now in Würzburg) and Dr. Martin Streinzer, Dr. Johannes Stökl (now in Jena), Kerstin Stejskal and Demetra Rakosy (both actual PhD students in Vienna).

## **Anatomy and development of the pallial margin in scallops (Bivalvia: Pectinidae)**

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*Master's Thesis*  
*São Paulo, Brasil*  
*Advisors: Sonia Lopes, Andreas Wanninger*

The mantle margin has particular roles in the life of bivalves, interacting with the environment and playing several different functions. Generally, this region is comprised of three distinct folds with large morphological diversity in Bivalvia. In adult Pectinidae, the mantle edge is especially complex, with tentacles and pallial eyes scattered all over both margins, and a large curtain-like fold called velum. Although pectinids are a well-studied group, there are no specific studies performed on pallial development and mantle edge differentiation. Moreover, little information on pallial structures' morphogenesis is available for the family. How does the formation of these complex traits occur? Which tissues and anatomical changes are involved during ontogeny? These are important questions in need to be answered. In this context, this Master's research project contributes with detailed anatomical information on the mantle edge at larvae, post-larvae, juvenile and adult stages of *Nodipecten nodosus* (Linnaeus, 1758), by means of combined microscopy techniques. So far, important histological and SEM data were obtained to mantle description for all stages. The greatest changes in the mantle edge design occur during and after metamorphosis, with the differentiation of the pallial folds prior to the establishment of subsequent pallial structures. In addition, histochemical techniques are being applied in attempt to clarify the functional roles of mantle organs, as well as TEM for a better comprehension of pallial ultrastructure. Since remarkable changes along this process remain scarcely studied, e.g., musculature modifications, the short internship at the Integrative Zoology Department aims at understanding the organization of nervous and muscular system during scallop ontogeny, thus contributing to the

characterization of mantle development. Finally, we expect these results on pallial margin differentiation in Pectinidae provide a basis for broad comparisons of mantle development across major bivalve taxa.

## **The evolution of annelids**

**Christoph Bleidorn**

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Using transcriptome data it was possible to retrieve a solid backbone for annelid phylogeny by phylogenomic analyses. Most recent families are included in the reciprocal monophyletic sister taxa Errantia and Sedentaria, with latter also including Clitellata, Siboglinidae and Echiura. Interestingly, Oweniidae and Magelonidae can be found in a basal position, as sister taxon of all other annelids. Chaetopteridae, Sipuncula and Amphinomida represent further basal branching taxa.

Using this backbone, the evolution of organ systems in Annelida is discussed. Considering the age of the early annelid radiation and that in this time span several mass extinctions are recorded, it might come without surprise that we can only observe a patchwork of morphologies and life modes of recent taxa branching off from the basal part of the annelid tree.

## **Reproduction and population biology in *Hyalinobatrachium valerioi* (Centrolenidae).**

### **Genetic mating system in the glass frog *Hyalinobatrachium valerioi***

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*Master's Thesis*

*Advisors: Walter Hödl, Eva Ringler, Max Ringler*

The Neotropical frog *Hyalinobatrachium valerioi* deposits clutches on leaves overhanging streams during prolonged breeding periods. Males and females in this frog species have evolved highly contrasting reproductive strategies where males show a high degree of site fidelity and attend up to seven clutches simultaneously, and where females actively approach their mating partners without providing further parental care. The aim of this study was to characterize the genetic mating system in *H. valerioi* by integrating behavioural observations from the field and molecular parentage analyses. We continuously monitored and sampled a natural population of *H. valerioi* in south western Costa Rica over a period of 101 days (Aug-Nov 2012). We collected tissue samples of 93 males, 48 females and 374 larvae out of 193 clutches. We identified the mating system in our study population of *Hyalinobatrachium valerioi* to be highly polygynandrous, comprising sequential and simultaneous polygyny and sequential polyandry. Our data support random mating rather than selective female choice and sexual selection appears to be low within successful reproducers.

## **Individual and genetic distribution in *Hyalinobatrachium valerioi***

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*Master's Thesis*

*Advisors: Walter Hödl, Eva Ringler, Max Ringler*

The Reticulated Glass Frog *Hyalinobatrachium valerioi* (Centrolenidae) is a small leaf breeding frog in tropical rainforests of Central and northern South America. The species typically occurs in small aggregations of breeding individuals along forest streams. While some studies have investigated the reproductive behavior of this frog species, nothing is known about gene flow between such patches, relatedness within population and individual action ranges of the adults.

In our investigation we took a closer look at these aspects and monitored a population of the *H. valerioi* at the tropical lowland stream Quebrada Negra near La Gamba, Costa Rica, during their reproductive season between August and December 2012. We recorded precise spatial locations of all frogs and clutches, took dorsal pictures of all frogs for individual identification, and collected tissue samples from the adults and clutches for subsequent molecular analyses of highly polymorphic microsatellite loci. Along a 400 m river transect we identified three spatially clustered patches of males. While males showed a small home range and site fidelity, the action range of the females was significantly higher; some females moved between two patches. Molecular analyses showed that the patches are genetically highly connected. Male full-sibs were located in same as well as in different patches.

## **Endemic flower visiting crickets and their radiation on islands of the Indian Ocean**

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## **Identification of North Atlantic Siphonodentaliidae (Scaphopoda, Mollusca) using shell morphometrics and radula morphology**

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*Master's Thesis*

*Advisor: Gerhard Steiner*

Scaphopoda live in all marine types of sediment, from the intertidal down to the abyssal depths. With close to 600 recent species, the "tusk shells" are among the less diverse major taxa of the Mollusca. The oldest undoubted scaphopod fossils date back to the Carboniferous. Their shells are of tubular, conical shape with a more or less strong curvature and openings at both ends. The foot and the captacula extend through the anterior shell opening for locomotion and prey capture, respectively. Respiratory water currents enter the mantle cavity through the posterior or apical aperture.

The Scaphopoda comprise two orders, Dentaliida and Gadilida. The family Siphonodentaliidae belong to the latter and comprise several genera with the greatest shell diameter not at but just behind the anterior opening. The aim of this study is the identification of species of Siphonodentaliidae collected with the BIOICE project around Iceland, using shell morphometrics and radula morphology. Morphometric

methods include both direct metric measurements and geometric approaches. The latter use landmarks (identical biological reference points) and semilandmarks (sliding landmarks describing curves). All parameter sets will be subjected to multivariate statistics such as Principle Component Analysis, Discriminant Analysis and Thin Plate Splines.

There are about a dozen poorly known deep-water species of *Siphonodentalium* and *Polyschides* reported from the North Atlantic Ocean between the Caribbean and the Arctic Sea. Their distinguishing features are shell form and the shape and number of the apical lobes, which are frequently eroded. A preliminary separation of the BIOICE material yielded five morphotypes. Measurements from original illustrations and, if available, of type specimens of previously described species will be included in the morphometric analyses. This will help determining whether names are available for these morphotypes or whether they represent undescribed species.

## **The Anatomy of the Nervous System of *Paludicella articulata* (Ctenostomata, Ectoprocta)**

**Anna Weber, BSc**

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*Master's Thesis*

*Advisors: Andreas Wanninger, Thomas Schwaha*

Ectoprocta or Bryozoa is a large lophotrochozoan phylum of approximately 6000 extant species. Comparatively little recent data employing modern methods (ICC/CLSM/TEM) are available concerning the structure of the adult nervous system in these animals. The data currently available stem from the basal Phylactolaemata and the late-branching Cheilostomata. These studies have shown that the ectoproct nervous system mainly consists of a cerebral ganglion at the base of the lophophore, a circum-oral nerve ring, nervous innervation of the tentacles and several nerve fibers projecting to the gut and to the body wall. In contrast to all other ectoprocts, the cerebral ganglion of

phylactolaemates contains a centrally located fluid filled lumen surrounded by a neuroepithelium. Preliminary observations have shown a small lumen within the cerebral ganglion of the ctenostome *Paludicella articulata*. Ctenostome-grade ectoprocts are generally considered to be of phylogenetic relevance since they are considered to have basal features. Therefore, the ctenostome *Paludicella articulata* was analyzed in order to contribute to the organization of the ctenostome nervous system and the Ectoprocta in general. Thereby, the presence of a lumen and a neuroepithelial organization of the nerve cells within the cerebral ganglion are confirmed. The expansion of the lumen depends on whether the polypide is retracted or protruded. Four tentacle nerves project from the cerebral ganglion into each tentacle. Three of the tentacle nerves (one abfrontal and two latero-frontal nerves) have an intertentacular origin, whereas the medio-frontal nerve arises from the cerebral ganglion. This corresponds to the situation found in other ctenostomes and supports the notion that four tentacle nerves are the basal configuration in Ectoprocta and not six as proposed earlier. The lumen within the cerebral ganglion in *P.articulata* could be rudimentary structure, since it occurs in the ontogeny of all ectoprocts investigated so far. Alternative explanations include loss of the lumen in all other taxa or that it has been overlooked in earlier studies due to its small size in retracted specimens.

## **Neurogenesis in the invasive zebra mussel *Dreissena polymorpha* (Mollusca: Bivalvia)**

**Anna Pavlicek**

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*Master's Thesis*

*Advisors: Andreas Wanninger*

Bivalves are the second largest class of molluscs. Although they are primarily marine, some lineages have colonized freshwater habitats. The zebra mussel *Dreissena polymorpha* is an interesting model for evolutionary and developmental studies because, as an invasive

species, it has secondarily colonized freshwater habitats, albeit having retained a free-swimming pelagic larva. Due to its high reproductive success, native bivalve populations may be affected and serious economic damage due to biofouling may occur. The existing data on *Dreissena polymorpha* include gross morphological analyses of the adult as well as ecological and economic research, but except for a few classical studies little is known concerning organogenesis including neurogenesis. In this study the development of serotonin-, FMRFamide- and tubulin- like immunoreactive (lir) components are examined using immunocytochemical methods and confocal laserscanning microscopy (CLSM). Larvae were reared under laboratory conditions and fixed in regular intervals during their larval period. Larvae from the early trochophore to the late veliger stage were examined. Preliminary CLSM studies reveal the first immunopositive serotonin-lir signal in the early trochophore stage, while the FMRFamide-lir signal occurred considerably later and in distinct regions of the larva. The first serotonin-lir cells are located in the anterior part of the larva and they contribute to the apical organ. The number of neurons and commissures in the apical organ increases rapidly during the short trochophore stage and at the early veliger stage the anlagen of the paired cerebropleural ganglia form. Slightly later the anlagen of the visceral and pedal ganglia develop and connectives between the anlagen of the cerebropleural and visceral ganglia occur. These changes and modifications of the nervous system from the early trochophore to late veliger stage will be more intensively investigated and compared with existing literature during this project. The data generated herein will significantly contribute to our understanding concerning the evolution of the bivalve and molluscan nervous system.

## **Phylogeography of the Golden Eagle (*Aquila chrysaetos*): Palearctic homogeneity and a distinct Mediterranean haplogroup**

**Nebel Carina**

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*Master's Thesis*

*Advisors: Frank Zachos, Anita Gamauf*

Although a widely distributed and charismatic species, little is known about the genetic structure of the European golden eagle. Furthermore, the consequences of a population breakdown due to human persecution in the 19th and early 20th century are still unclear. This study's aim is not only to reveal the phylogeography of the golden eagle across its distribution range (but with a focus on Europe), but also to investigate possible genetic consequences (loss of diversity) of the species' bottleneck by comparing the historical and modern golden eagle populations. This combination of geographical and temporal data offers a unique perspective of population dynamics and anthropogenic influences. The control region, a section of the mitochondrial DNA, is highly variable and therefore a suitable tool to study intraspecific short-term changes in animal populations. Especially in regard to the time comparison, it will be of interest if the number or frequency of observed haplotypes has changed through the increased genetic drift during the time of population decline. Preliminary results show that there is a clear genetic separation of the golden eagles living in the north (Scotland and Norway) and in the south (Mediterranean region and the Alps). Notably, some „northern” haplotypes have been found in the Alpine region. This suggests, at least in rare cases, long-distance migration between the two regions.

## Current development in microscopy and imaging

**Thomas Schwaha**

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*Post Doc*

*Workgroup: Andreas Wanninger*

Several hundred years ago, scientists or naturalists began to discover the broad usage of certain glass lenses in order to magnify smaller structures. This was the onset of what we call microscopy today which in the past two centuries has experienced continuous improvements in lens quality, reproducibility of results as well as photographic documentation. Even in our days, this progress yields new innovations in microscopic imaging. In this talk I present some selected examples. The first topic is super-resolution imaging which in past ten years has significantly improved. The resolution of standard light microscopy is limited to 250 nm in lateral and 500 nm in axial direction. Super-resolution such as STED or STORM overcome these limits and yield resolutions in the lateral axis below 100 nm. The second topic is the more frequent use of high dynamic range imaging (HDR). HDR imaging combines several images with different exposure times into a single image. Consequently, a more complete image can be generated without any part being over- or underexposed. The third topic in microscopy improvement is selective (or single) plane illumination microscopy which utilizes a microscope objective to illuminate a thin focused sheet that is imaged by a second objective that is perpendicular to the first one. The light sheet can be moved within the sample to capture the fluorescence signal of the whole sample. This approach is particularly fast, has low phototoxicity and is the future choice for developmental imaging. The fourth topic deals with the combination of several imaging or microscopic techniques into a single scenery. This approach is termed correlative microscopy. One of the examples given in the presentation is the combination of micro-CT, serial semithin section reconstruction and TEM of the same individual into one 3D environment. The last topic concerns the development of clearing methods. In the past years several new protocols have been established to make biological tissues, especially nervous tissue, optically transparent to allow deeper laser penetration and thus imaging.

## **Adaptation to laboratory conditions, improvements in mass rearing methodologies and pre-zygotic and post zygotic isolation studies on the olive fruit fly *Bactrocera oleae* (Rossi) (Diptera: Tephritidae) as it relates to sterile insect technique (SIT) for area-wide pest management**

**Sohel Ahmad**

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*PhD Thesis*

*Advisor: Hannes Paulus*

The olive fly, *Bactrocera oleae* Gmelin (Diptera: Tephritidae), is considered an ideal candidate for control by the sterile insect technique (SIT) because it attacks only olives and does not naturally disperse great distances. One major constraint in the development of a successful SIT programme for olive fly is the production of high quality mass-reared flies at a cost that is acceptable for SIT programs. Researchers at the FAO/IAEA Insect Pest Control Laboratory (IPCL) in Seibersdorf, Austria are assessing all aspects of mass rearing. The aim of this research is to produce standard protocols for mass rearing and quality control for adoption by SIT operational programs.

Establishment of new colony material is the first step in developing a mass rearing protocol. During the establishment of these colonies, a novel method for collecting eggs was developed using table grapes as a surrogate for olive fruits. Hybridization with established laboratory strains was examined. Adaptation of wild strains to different mass rearing oviposition devices was also studied. Four new colonies have been established successfully, originating from wild flies collected in Italy, France, Spain and Croatia. These new colonies are being used as a valuable source of materials for behavioral and molecular studies, and to investigate the effect of geographic isolation in reproductive behavior of this insect.

The development of an optimal system for mass rearing olive fly is difficult. There are complex interrelationships between fertile egg

production and a range of other mass rearing issues such as larval diet (e.g. its pH interacts with contamination by antagonistic micro-organisms, its components may seriously affect eggs and larvae and their beneficial micro-organisms), egg handling methods, temperature, lighting, ventilation within rearing rooms and many others. The IPCL is testing each of these components and their effects on total pupal recovery, pupal weight and adult emergence, as well as the costs of equipment, labor and consumables.

Many aspects of mass rearing were investigated including cage density of adult flies and size and style of the adult oviposition cage and egg collection methods. ICPL staffs have developed a flat eggging panel which saves on labor costs and allows the collection of acceptable egg production volumes. When harvesting olive fly eggs for mass production it is important to collect as many as possible but also maintain a high level of fertility. Researchers at the IPCL are now assessing production parameters and expense of mass rearing olive fly in large cages (0.4m<sup>3</sup>) formerly used for mass rearing of Mediterranean fruit fly (*Ceratitis capitata*). Preliminary data show that these cages are producing between 2 and 4 eggs/female/day with 4.0m<sup>3</sup>/fly and 3.0m<sup>3</sup>/fly respectively. Unexpectedly, in these experiments, adult food was consumed prematurely. More research is underway to optimize adult density and volume of adult food for optimal egg production. Results from the work so far have been very encouraging. The IPCL is now rearing olive fly in cages that are more acceptable for cost-effective mass rearing of this insect.

Also during the course of this research, the establishment of a protocol to test for sexual compatibility was developed. If olive fly strains from different geographic areas prove to be sexually compatible when tested versus a mass-reared hybrid strain, this will enhance the potential for one productive and competent strain to be used in SIT programs. Mating performance tests have showed a higher rate of mating compatibility and competitiveness. Furthermore, the analysis of the dissected spermathecae from the mated females proved that in all mating combination, effective sperm transfer did occur. Also the pre- and post-zygotic isolation studies have showed that there is no isolation among the flies from different regions

## **Public information revealed by prey remains in nest-sites is more important than ecto-parasite avoidance in the settlement decisions of Eurasian kestrels**

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*PhD Thesis*

*Advisors: Harald Krenn, Anita Gamauf, Erkki Korpimäki*

Animals constantly need to acquire information about the environment for settlement decisions, either by using a trial-and-error strategy or by using public information by monitoring conspecifics. We used a nest-box population of Eurasian kestrels *Falco tinnunculus* in western Finland to test the hypothesis on the use of pellets and other prey remains accumulated on the bottom of nest-boxes as public information of successful nesting attempt in settlement decisions. During 2002-2013, 35 to 119 nest-boxes were randomly cleaned (treatment) or left un-cleaned (control) in each study year. It is possible that kestrels reuse nest-boxes which include information of successful nesting attempt (i.e. have not been cleaned) because they indicate previous breeding success at the site. At the same time this decision may entail costs because of blood-sucking ecto-parasites like *Carnus hemapterus* overwintering in the layer of prey remains. First, we found that egg-laying date was significantly earlier and clutches larger in un-cleaned control boxes than in treatment boxes, indicating the use of public information in the settlement decision. Additionally, partners of +1-year old males started egg-laying earlier than those of yearling males indicating a crucial role of male age, since the male provides food to the female during courtship and egg-laying period. Second, the ecto-parasite burden of nestlings was significantly higher in un-cleaned control nest-sites, without however having any obvious influence on breeding success. In conclusion, the use of prey remains revealing successful breeding attempt of the previous year as public information appeared to be important in the settlement decision of kestrels, whereas no obvious evidence was found for the ecto-parasite avoidance hypothesis.

## **Lab Safety**

**Livia Rudoll**

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*Technician*

*Histology Lab and Lab Safety*

Corresponding to the "General Laboratory and Workshop Regulation of the University of Vienna" it is prohibited to work in a lab without prior instructions. The safety instructions must be given before starting to work or before changing methods and must be repeated at least once a year.

At the Department of Integrative Zoology these instructions are initially given on-site in the lab and are annually repeated by a departmental seminar presentation. Specific instructions for handling sensitive or dangerous devices (e.g. confocal laser scanning microscope) are given by authorized members of the department. These instructions encompass First Aid in the lab, behavior in case of fire, emergency and escape routes, protective devices, behavioral code for safety and danger awareness, warning and danger signals, the use of dangerous materials, Personal Protective Equipment (PPE), the use of instruments and devices, prevention of accidents, behavior during accidents. All department members are individually responsible to receive an instruction before starting to work or before changing methods.

## **Functional morphology of feeding behaviour in the crested newt *Triturus dobrogicus*, Kiritzescu 1903 (Urodela, Salamandridae)**

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*Diploma Thesis*

*Advisor: Josef Weisgram*

The crested newt *Triturus dobrogicus* (Kiritzescu, 1903) occurs from the Austrian Danube Floodplains up to the Danube Delta. The kinematic of aquatic suction feeding was studied by means of high-speed videography. 6 coordinate points were digitized from video records of prey capture. Maximal values and movement courses of selected feeding movements were analysed to describe the quality of the suction feeding process in this species. 13 time- and velocity-determined variables were evaluated, and a principal component analysis was conducted to quantify prey capture behaviour. All specimens follow a typical inertial suction feeding process, where rapid hyoid depression expands the buccal cavity. Generated negative pressure within the buccal cavity causes influx of water into the mouth, along with the prey item. Maximal distance values of gape and hyoid depression are greater in animals of smaller size. In accordance to the assumptions of Hill's model, movement durations scale in positive proportion to increasing size. The extent of behavioural variability was examined; and in one specimen feeding behaviour was found to be highly stereotyped. Additionally, cranial morphology was examined by means of dissection and  $\mu$ CT-investigation. Minor deviations to typical salamandrid morphology were found, regarding characteristics of the hyobranchial apparatus and the insertion of the musculus geniohyoideus as well. To summarize, *Triturus dobrogicus* is a typical inertial suction feeder in regard to kinematic and morphology, although some characteristics were identified that are contrary to existing literature.

## **The Bumblebees of Vorarlberg (Austria)**

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*Diploma Thesis*

*Advisors: Harald Krenn*

Large areas of Vorarlberg (Austria) are underrepresented with reference to research on bumblebees. About 5,000 individuals belonging to 34 *Bombus* species (of 46 species all over Austria) had been collected in Vorarlberg at 371 localities, mainly below 2,000 m a.s.l.. The aim of this study was to complement the distribution data of the bumblebees of Vorarlberg. In addition, a survey of different ecological factors was conducted. During the period from 1 July to 30 August 2012, more than 3,500 individuals belonging to 27 species of the genus *Bombus* were documented in Vorarlberg. The individuals were collected at 407 localities at altitudes ranging from 400 to 2,780 m a.s.l., using a transect method. Based on the collected data, an analysis of altitudinal preferences, habitat preferences, flower visiting habits and associations of the different bumblebee species was conducted. The data shows the highest abundance of bumblebees within the altitudinal range from 1,000 to 2,400 m a.s.l.. Furthermore, some species can be classified as lowland species (*B. pascuorum* and *B. hypnorum*), some as alpine species (*B. monticola*, *B. mendax*, *B. mucidus*, *B. pyrenaicus*, *B. sichelii*) and others as generalist concerning altitudinal distribution (e.g. *B. hortorum*, *B. soroeensis* and *B. wurflenii*). By far, tall herbaceous vegetation represents the habitats with the highest bumblebee abundance. Diversity indices were calculated for different altitudinal levels and habitat type groups, using the Shannon-Wiener index. The highest diversity could be observed at altitudes of 1000-2400m a.s.l.. Humid habitats show the lowest bumblebee diversity of all habitat type groups. According to the data, the most frequently visited flowering plant taxa are *Aconitum* sp., *Cirsium spinosissimum* and *Trifolium pratense*. An analysis of flower visits with reference to functional floral types reports that composite and lipped floral types were most often visited by bumblebees. The oligophagous species *B. gerstaeckeri*, which actually only visits the genus *Aconitum* could also be documented on *Cirsium spinosissimum*. Distribution maps

are provided for all species, also talking into account historical data. Furthermore, a Canonical Correlation Analysis (CCA) dealing with altitudinal and habitat preferences was conducted for the most frequent species. The first record of *Bombus alpinus* in Vorarlberg since 1931 is remarkable.

## **The Ecology of the Common House Martin (*Delichon urbicum*) in Vienna**

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*Diploma Thesis*

*Advisor: Harald Krenn*

The Common House Martin (*Delichon urbicum*) is one of Austria's most common breeding birds, although over the last year there seems to be a decreasing trend in the population. Originally a cliff and cave nester, the House Martin now largely uses human structures such as bridges and buildings and can be found even in urban areas and cities. In Vienna the House Martin colonies can be found in the outskirts of the city along bigger bodies of water such as the Danube, the Danube canal, the Marchfeldkanal and the rivers Liesing and Wien. A survey in 2000 identified 344 breeding pairs, it was estimated that the population counts up to 400 pairs in Vienna. A recent mapping in 2013 of the known and a few newly discovered colonies showed that the number had been reduced to 163 breeding pairs, the number of nests dropped from 1010 to 496 nests (excluding rims and offprints.) The main reasons for this loss have been renovations of the buildings, but also destruction of nests by inhabitants as well as soil sealing, which makes it harder for the House Martin to find proper nesting material, might play a role. Installing nesting aids after the renovation process helped to increase the chances of the House Martin repopulating the colony. Besides the number of breeding pairs also the condition, the location and the cardinal direction of the nests were recorded. More the half of the nests that had been found were only rims and offprints of former nests. Only a third of the nests

were intact and less than half of them were occupied. The increasing use of artificial nests could be shown as well. In 2000 only 5 pairs were using nesting aids, in 2013 already 23 pairs were nesting in them. Overall the situation of the House Martin in Vienna seems to be critical and conservation measures will have to be applied to avoid a further decline in the population.

## **Computer Animation and Mite Visualization**

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*PhD Thesis*

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Computer animation can show cinematic details, that are not visible with the naked eye. Aesthetic and entertaining pictures of microscopic sceneries are possible. Furthermore, a very new point of view of animals of the mesofauna can be obtained. These new looks of a tiny world can awaken the interest of people that normally will not be into mites or other small animals. Computer animation helps to show animals, which will be disturbed or killed while filming, because of light, temperature or preparation for the microscope. The presentation will focus on the work in progress of motion capturing locomotion and computer animation of mites.

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