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**DEPARTMENTAL SEMINAR  
INTEGRATIVE ZOOLOGY  
Winter Term 2014**

**Programme and Abstracts**

Tuesdays, 10-11:30 hrs

SR 3, UZA1, Althanstraße 14, 1090 Wien





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## **When a ‚nobody‘ begs to differ - How sea spiders challenge current views on arthropod nervous system evolution and development**

**Georg Brenneis**

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Nervous system investigations on many arthropod taxa have revealed several striking similarities and differences not only in the adult anatomy but also in the underlying developmental processes. Among others, these findings have contributed important arguments in the debate on the phylogenetic relationships of the major extant groups (Chelicerata, Myriapoda, Hexapoda and crustaceans) – which in turn has led to the revival of the catchy term ‘neurophylogeny’ for comparative nervous system studies seeking to shed light on arthropod relationships.

I investigated the nervous system and its development in Pycnogonida (sea spiders or ‘nobodies’). The phylogenetic position of this understudied group of bizarre marine arthropods has been subject of intense debate but nowadays they are most frequently considered as the basal-most branch within Chelicerata. Owing to this basal position, they are pivotal study objects when trying to assess whether certain neural features are representative for the entire chelicerate lineage – as so far assumed in ‘neurophylogenetic’ scenarios on arthropod relationships.

Here, I will address the following three topics:

- (1) Embryonic neurogenesis of the pycnogonid CNS – a ‘mixed mode’ with similarities to chelicerates and some mandibulates.
- (2) Post-embryonic neurogenesis of the pycnogonid CNS – a life-long neurogenic system with astounding correspondences to decapod crustaceans?
- (3) Serotonin-like immunoreactivity in the adult ventral nerve cord – the chelicerate-unlike pattern of individually identifiable neurons in Pycnogonida.

I will discuss the impact of the new pycnogonid data on current 'neurophylogenetic' views and briefly outline the necessary focus of future investigations, which should help to fill remaining gaps of knowledge.

## **The japanese bryozoan safari 1**

**Thomas Schwaha**

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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. The Phylactolaemata are a comparatively small group of 80 species living solely in freshwater habitats. The internal phylogeny of this group has been controversially discussed. Based on the morphology of their dormant stages, the statoblasts, the large gelatinous forms have been considered as more derived and the simple chitinous to sand-encrusted forms as early branching. Newer, molecular phylogenies consider the gelatinous forms as more basal. Despite these differences, 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. This species is a local Japanese species and has actually not been properly analysed in previous investigations. In order to obtain samples from this species, I travelled to Japan in april. This presentation summarizes my observations in Japan and the research purposes I intend to conduct with the material.

## **Ichthyological collection in the Macarena Region, Colombia, 2014**

**Anton Lamboj**

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The Macarena in Central Colombia, of which the central part is a low table mountain, has not been explored since more than 50 years, due to the civil war in this country and the block of the region by guerilla troupes. Since 2013, opening of these territories occurred in cause of an ongoing peace process in the country. The field survey and collection presented herein, which has been organized via a cooperation with an ichthyologist of the Javiera University of Bogota, is the first one after all these years and it presents an overview about the region as well as the diversity of fishes in waters within the Macarena and surrounding regions.

Water parameters have been taken, showing the rivers and creeks originating in the Macarena being different in some chemical characters from Andean rivers. 551 different samples (species per locality) of fish have been collected, with a total of 132 different species, of which a number of about 37–49 seem to be undescribed, what indicates a high number of endemism for the region. Additional collections of terrestrial invertebrates, mainly spiders and scorpiones, have shown similars result of new and possibly endemic species.

Hopefully following works, focussed on descriptions of new species and general biodiversity of the region, will lead to an ongoing cooperation with Colombia.

## **Palaeo-Evo-Devo: What fossilised development can tell us about the evolution of arthropods.**

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In modern biology, the analysis of developmental patterns and their evolutionary changes is an important field of research. We additionally study the development of extinct organisms, mainly arthropods, to get a more complete picture of the history of life on earth. For this so-called 'Palaeo-Evo-Devo' approach, we make use of exceptionally well-preserved organisms from famous deposits, such as Burgess Shale, Rhynie Chert, or Solnhofen limestones, which provide (almost) the same information as their living counterparts. Our investigations often reveal morphological details bridging the gap between derived modern groups, which allows us to explain how the often extreme modern morphologies and developmental patterns evolved.

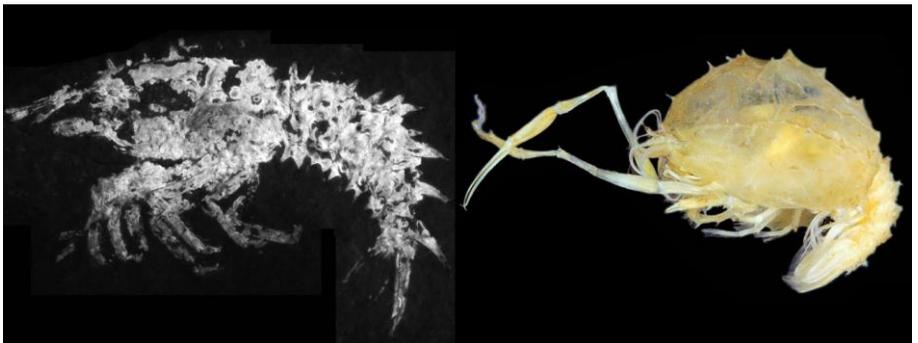


Figure: Fossil (left, 900 million years old) and extant (right) larva of polychelid lobster

## **Does the head anatomy of Evanioidea clarify the phylogenetic placement of aculeate wasps?**

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The phylogenetic relationships of Hymenoptera are well resolved and many clades well supported, but some problematic areas remain. One of the latter is the position of the aculeate wasps, including such well known insects as hornets, bees and ants. Traditionally, they have been regarded as the sister group of the Ichneumonoidea, one of the largest parasitic wasp taxa. In a new hypothesis, the Aculeata are placed as the sister group of the Evanioidea, a comparatively small and heterogenous assemblage comprising parasitoids of woodliving insects (Aulacidae), bee nest ‘cuckoos’ (Gasteruptiidae), and cockroach egg capsule predators (Evaniiidae). The Aculeata-Evanioidea relationship is moderately supported by molecular data, but not by any known morphological character. The aim of this project is to address this hypothesis by exploring the internal head anatomy.

Hitherto three characters relevant in the described context could be recognized: 1. a structure in the inner skeleton of the insect head, which is present in Evanioidea and Aculeata, but also, though slightly modified, in Ichneumonoidea; 2. a muscle of the salivarial system, which is present in Evanioidea and Aculeata, but is also described for a very basal hymenopteran; and 3. a gland of the digestive system which is common in Aculeata and is newly found (solely) in the family Evaniiidae. The characters and their conflicts are discussed.

## **Shedding light into the evolution of an enigmatic fish Comparative analyses of cavernicolous and surface- dwelling populations of *Garra barreimiae*.**

**Sandra Kirchner**

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*PhD Student*

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Many cave-dwelling vertebrates display the same morphological modifications, such as eye regression and loss of pigmentation. It is still unclear how these regressive traits are genetically determined and whether phenotypic plasticity plays an important role.

The cyprinid barb *Garra barreimiae* is endemic to the southeastern Arabian Peninsula, where it inhabits regularly desiccating water bodies. Since a hypogean population with troglomorphic traits is conspecific with the “normally” developed surface population, *Garra barreimiae* seems to be a perfect organism to study the effects of cave life and the origin of troglomorphic characters. Previous genetic analysis of mtDNA (Kruckenhauser et al. 2011) revealed that individuals from the cave population are genetically differentiated from the adjacent surface populations. However some individuals from surface populations near the cave entry possess haplotypes characteristic for the cave population. As those individuals mostly display an intermediate phenotype, it is reasonable to assume that hybridization still occurs and that the populations have separated quite recently.

In this project funded by the uni:docs fellowship for Doctoral candidates (University of Vienna) I want to answer the question whether and to what extent hybridization between cave and surface populations occurs by analysing microsatellite markers (Kirchner et al. 2014). To evaluate the consequences of light exposure during development and crossbreeding between individuals from cave and surface populations I will examine if offspring display different development of eyes and pigmentation in the presence or absence of light. For the first time extensive morphometric and morphological analyses will be conducted with *G. barreimiae*. This will include

histology of eye development and various distance measurements and shape analyses. By comparing size and shape of the

different species of the genus and subspecies of *G. barreimiae* I want to evaluate if status of these species and the subspecies is justified. In order to explain how the current distribution patterns of the species emerged, I will investigate the phylogeography by analysing several mitochondrial and nuclear markers. The analyses of an extensive data set will be necessary to clarify the question whether the species *G. barreimiae*, as currently defined, is a monophyletic group. The combined results shall help to draw a conclusive picture of the evolution of this interesting species and to obtain new insights into mechanisms leading to the transition to troglobiotic life style in general.

### **References:**

Kirchner S., Weinmaier T., Rattei T., Sattmann H., Kruckenhauser L., 2014. Characterization of 19 new microsatellite loci for the Omani barb *Garra barreimiae* from 454 sequences. BMC Research Notes, 7, 522.

Kruckenhauser L., Haring E., Seemann R., Sattmann H., 2011. Genetic differentiation between cave and surface-dwelling populations of *Garra barreimiae* (Cyprinidae) in Oman. BMC Evolutionary Biology, 11, 172.

# **Einfluss von Haltungsbedingungen auf die Gesundheit und das Verhalten von Pferden.**

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Das Pferd ist ein hochspezialisiertes Steppen-, Herden- und Fluchttier. Vor über 5000 Jahren wurde es domestiziert, trotzdem haben sich artspezifische Verhaltensweisen und daraus entstandene Bedürfnisse gegenüber dem Wildpferd kaum verändert. Artgerechte Pferdehaltung hat daher die Aufgabe diesen Erfordernissen zu entsprechen. Aber die Häufigkeit des Auftretens von gesundheitlichen Beeinträchtigungen und Verhaltensstörungen zeigt, dass den Bedürfnissen der Pferde oft nur unzureichend nachgegangen wird. Diese Arbeit hat sich das Ziel gesetzt, den Zusammenhang zwischen Haltungsbedingungen und dem Gesundheitszustand bei Pferden zu untersuchen und daraus Empfehlungen abzuleiten. Ausgehend von der These, dass eine möglichst naturnahe Haltung zu einer Reduktion von gesundheitlichen Beeinträchtigungen führt, wird sowohl ein Überblick über bisherige Studien und Forschungsergebnisse gegeben, als auch eine empirische Untersuchung mittels Fragebogen durchgeführt. Der Begriff „naturnahe Haltung“ wird dabei durch die tägliche Weidezeit in Stunden, die Auslaufgröße in m<sup>2</sup> und Gruppen- bzw. Einzelhaltung, definiert. Daten von 241 Fragebögen bilden die Basis für eine statistische Auswertung, welche mittels SPSS-Statistik-Programm durchgeführt wird. Signifikante Ergebnisse finden sich im Zusammenhang zwischen Weidezeit und gesundheitlichen Beeinträchtigungen, wobei die Zahl der gesundheitlichen Beeinträchtigungen mit zunehmender Weidezeit abnimmt. Die Verknüpfung von Auslaufgröße und gesundheitlichen Beeinträchtigungen zeigt keine signifikanten Ergebnisse. Demnach kann durch vorliegende Arbeit gezeigt werden, dass auch mit einer kleinen und kostengünstigen Maßnahme wie der Erhöhung der Auslaufzeit, eine deutliche Verbesserung der Pferdegesundheit möglich wäre. Für die Auswirkung auf die psychische Gesundheit von Pferden sind weitere Studien notwendig.

## **Behavioural flexibility and strategic planning in anuran parental care: Tadpole transport logistics in the poison frog *Allobates femoralis*.**

**Eva Ringler**

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*Post Doc*

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The evolutionary transition from aquatic to terrestrial egg deposition has enforced the development of various parental behaviours, in order to protect eggs from external threats and ensure the final development of aquatic larvae. Poison-dart frogs have evolved a remarkable variation in courtship and parental behaviours, and forms of parental care are present in almost the entire family. Beside the knowledge that tadpole transport is obligatory in almost all dendrobatid frogs, very little is known about spatial and temporal patterns of tadpole transport and the possible existence of behavioural plasticity on the individual level. We investigated the tadpole deposition behaviour in a natural population of the poison frog *A. femoralis* in French Guiana over five years, and used microsatellite markers to identify the actual parents of the transported larvae. Our results suggest a strong selective pressure on males to shift the time invested in tadpole transport to periods of low intra-specific competition. The number of tadpoles on the back of the males significantly correlated with displacement distance from the respective home territories, indicating a strategic non-random tadpole transport rather than random search for suitable tadpole deposition sites during tadpole transport. We observed 7.8% of tadpole transport performed by females, which we could link to the absence of the respective fathers. In the following removal experiment under laboratory conditions, all tested *A. femoralis* females flexibly took over parental duties when their mates were missing. Our findings provide evidence for compensatory flexibility in a species with uni-sexual parental care. Contrary to the view of amphibian parental care as being stereotypical and fixed, these results

demonstrate behavioral flexibility as an adaptive response to environmental and social uncertainty. We further investigated whether *A. femoralis* males distribute their tadpoles across several waterbodies. To this end we sampled 30 artificial water bodies for tadpoles, which we genotyped at seven highly polymorphic microsatellite loci. Based on the reconstructed pedigree we show that *A. femoralis* males distribute larvae of single and successive clutches across several waterbodies. The number of pools used correlated significantly with the number of clutches per male. Given the threats from predation and pool desiccation, we interpret this behaviour as a bet-hedging strategy against total offspring loss.

## **Tissue Characterization and Classification with Examples from Prostate Whole-mount H&E Slides**

**Matthew D. DiFranco**

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H&E-stained whole-mount prostate histology slides are used for pathological cancer assessment following radical prostatectomy. Pathologists assess tumor burden, disease extent and assign a tumor grade based on the morphology-based Gleason scale. Computational imaging techniques applied to high-resolution digital images of these slides have show promise for automation of this assessment This talk focuses on a machine learning workflow for tumor detection in digital prostate pathology

### **Bio:**

Matthew DiFranco earned his PhD in Computer Science from University College Dublin in 2010. His thesis focused on machine

learning in medical imaging, with an emphasis on automated cancer detection in prostate digital pathology. Following his doctoral studies, Matthew spent 1.5 years at Innsbruck Medical University developing an internal reference device for electromagnetic image-guided surgery.

Matthew began a two-year Marie Curie Intra-European Fellowship (IEF) to carry out research in multi-modal bone imaging at the Computational Imaging Research (CIR) , Department of Biomedical Imaging and Image-guided Therapy, Medical University of Vienna . In May 2014, Matthew joined the Center for Medical Physics and Biomedical Engineering at the Medical University of Vienna to focus on computational methods in multi-modal biomedical imaging, including PET/MR, PET/CT, and digital pathology.

diversity in Austria, it will also boost research in many fields of biology and increase public perception and valuation of biodiversity.

## **Tracking toxins in neglected venomous invertebrates**

**Ronald A. Jenner**

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Venoms have evolved many times independently in the animal kingdom in the service of predation, defense, competition and communication. Yet, the rampantly convergent evolution of venom toxins is not capricious. Animals as dissimilar as the duck-billed platypus, stonefish and bloodworms show some surprisingly deep similarities in their venom composition. However, our understanding of animal venoms is widely uneven. The main empirical pillars of comparative venomomics research are disproportionately grounded in only four venomous taxa—cone snails, snakes, spiders and scorpions. Although the study of these taxa has yielded a wealth of insights, only

a much more widely cast taxonomic net can capture the general principles of venom biology and evolution. My talk will discuss how recent results from our work on neglected venomous invertebrates, notably remipede crustaceans and polychaete annelids, confirm and challenge ruling ideas in comparative venomics.

## **Anatomy of the feeding apparatus of *Euproctus platycephalus* with implications to its feeding kinematics.**

**Stefanie Jernej**  
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*Advisors: Josef Weisgram, Christian Beisser*

## **The role of learning in the spatial behavior of a Neotropical territorial frog, *Allobates femoralis***

**Andrius Pašukonis**  
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*PhD Student, PhD Programme "Cognition and Communication"*  
*Advisor: Walter Hödl*

Spatial learning has been well studied in mammals, birds and insects, and has become one of the most comparative fields in animal cognition. However, cold-blooded vertebrates, especially amphibians, have been neglected in this field, at least in part because they were not considered to have advanced learning abilities.

At the same time, directed, long distance movements, such as mass spring migration to breeding ponds in temperate-region amphibians, has

drawn attention to amphibian orientation. Several authors have suggested that learned local cues might be important for amphibian way-finding, but empirical evidence is lacking. Furthermore, orientation has been mostly studied in temperate-region amphibian, while most complex spatial behaviors are found in tropical amphibians such as the dendrobatid frogs. Dendrobatidae (poison frogs) routinely shuttle tadpoles on their back from the terrestrial clutches to suitable deposition sites, many of which are temporary and widely dispersed.

We investigated the role of spatial learning on movements of a dendrobatid frog, *Allobates femoralis*, in the field. We manipulated artificial tadpole deposition sites and experimentally displaced males from their territories. We quantified movement patterns by telemetry and focal following. We found that males return to their home territories via direct route from several hundred meters but only from potentially familiar areas. We also found that tadpole-transporting individuals arrive to the exact locations of deposition sites even after they have been removed. Taken together, our results demonstrate that learning plays a major role in *A. femoralis* spatial behavior. They suggest a formation of a large-scale spatial map but the exact landmarks being used remain unknown.

## **Costs and benefits in the settlement decisions of the Eurasian Kestrel (*Falco tinnunculus*) in human altered landscapes**

**Petra Sumasgutner**

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*PhD Student*

*Advisors: Harald Krenn, Anita Gamauf*

At the start of my PhD work I initiated the ‘Vienna kestrel project’ in an attempt to understand the high breeding density of kestrels in the centre of Vienna, Austria. Between 2010 and 2012 I monitored a substantial proportion of the urban kestrel population, simultaneously collecting

data on the composition of the landscape and the structure of buildings at the nest sites. I used the varying extent of sealed soil between the city centre and the peripheral areas to define an urban gradient and related all breeding parameters to this environmental scale. The focus of the work was to investigate whether kestrels are attracted to the city centre by favourable living conditions, such as the ready availability of suitable nest sites or good levels of potential prey, or are pushed out of rural areas by unfavourable conditions there. The breeding data were analysed with regard not only to the habitats and nest sites chosen by the birds but also to the availability of prey and the composition of the birds' diets. We performed a survey of small mammals in Vienna and as part of a long-term collaboration with BirdLife Austria we collected data on the abundance of prey-sized birds in urban Vienna.

The results showed that high breeding densities in urban habitats do not necessarily correlate with high quality of the habitat, either in terms of prey availability or with regard to the reproductive success of the birds that nevertheless choose to breed in the city centre. A comparison of breeding sites (landscape composition and building structure) with random control points revealed that birds in the centre benefit from the presence of more cavities suitable for breeding but suffer from having to fly further to their hunting grounds. The lack of large open green spaces in the centre, combined with the lower availability of diurnal rodents, leads to a shift in the main categories of prey from small mammals in the periphery to avian prey in the centre. The shift was demonstrated by analysis of the birds' pellets and the results were confirmed by video monitoring of selected nests.

For the final part of my PhD I was granted access to a long term dataset of settlement decisions for kestrels in a Finnish population. In an experimental nest-box setup, breeding cavities were randomly cleaned of pellets and other prey remains or left un-cleaned. The experiment was undertaken to assess the use of public information in the settlement decision: prey remains represent a visual sign of previous breeding success at the site. The non-random distribution of breeding kestrels in my urban study system could in principle be partially explained by the use of public information or by conspecific attraction. The field experiment allowed these possibilities to be distinguished. I complemented the existing study of the Finnish research team by testing the 'ectoparasite avoidance hypothesis', which predicts different results from those predicted by the public information hypothesis. We found

that kestrels first occupied un-cleaned nest boxes: eggs were laid earlier in un-cleaned nest boxes than in cleaned ones. This confirms that remains of prey are indeed used as public information. Nevertheless, breeding in un-cleaned nest boxes was connected to higher levels of infestation of young nestlings with ectoparasites, indicating that the settlement decision is associated with some costs. The breeding success, calculated as the total number of fledglings, was equal for un-cleaned and cleaned nest boxes.

In conclusion, although kestrels are city-dwelling raptors and the species seems to be exploiting the urban environment, it does not profit from highly urbanized areas and does not breed more successfully in the centre of cities. The finding is problematic for conservation measures and is indicative of the emergence of an ecological trap. Finally, by means of an experimental approach I was able to substantiate the use of public information in the settlement decision of Eurasian kestrels.

### **Short CV - Petra Sumasgutner**

Petra's diploma studies focused on raptor research and conservation biology. She has recently submitted her PhD thesis at the University of Vienna, Austria. The project entitled 'Costs and benefits in the settlement decisions of the Eurasian Kestrel (*Falco tinnunculus*)' was a collaboration between the Department of Integrative Zoology, the bird collection at the Natural History Museum, Vienna and the Section of Ecology at the University of Turku, Finland.

After research in urban ecology and in remote areas in northern Europe, in 2014 Petra migrated south and joined the FitzPatrick Institute as a PostDoctoral Fellowship. She joins the Raptor Research group supervised by Dr Arjun Amar. The project aims to understand the establishment of urban raptor populations. On the Cape Peninsula, urban breeding Peregrine Falcons (*Falco peregrinus minor*) and Black Sparrowhawks (*Accipiter melanoleucus*) have been monitored since their colonisation. Petra will analyse that comprehensive data set to address factors underlying the expansion of both urban raptor populations.

## **Genus *Gibbula* - Genetic and Morphometric approaches to Species Delineation and Characterisation.**

**Susanne Affenzeller and Nicole Haar**

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*MSc Students*

*Advisor: Gerhard Steiner*

Within the vetigastropod family Trochidae, the genus *Gibbula* poses problems regarding the identification and delineation of some of the constituent species. We attempt to resolve some of the complexities of the genus using a dual method approach, DNA barcoding and geometric morphometrics. Both methods yield significant results. The COI gene phylogenetic reconstruction is a powerful tool for separating most species. Although the genetic signal is sufficient for most parts of the tree, some species groups could not be delineated unambiguously. In these cases, the morphometric method is a useful aid in separating clades, especially as some confusing identification characters such as shell sculpture are not required. Thus, combining both methods seems to be the most stable approach to identifying species and resolving the phylogeny of this genus. We also address taxonomic issues regarding the status of *Phorcus* and the potential para-/polyphyly of *Gibbula*. However, a more complete taxon sampling is required to resolve this problem.





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