Dr. Georg Brenneis

University of Vienna, Department Evolutionary Biology, Unit Integrative Zoology

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Professional career

08/2022-present: **University assistant (scientific staff)**
Integrative Zoology, University of Vienna, Austria

09/2018-07/2022: **Research associate (PI of third-party funded project)**
Zoological Institute and Museum, Greifswald University, Germany

03/2018-08/2018: **Short-term research scholar**
Neuroscience Program, Wellesley College, MA, USA

08/2017-01/2018: **Research associate**
Department of Comparative Zoology, Humboldt University Berlin, Germany

03/2015-07/2017: **Research associate**
Neuroscience Program, Wellesley College, MA, USA

05/2014-02/2015: **Research associate**
Department of Comparative Zoology, Humboldt University Berlin, Germany

05/2013-03/2014: **Guide coordinator, marine wildlife guide & reception manager**
Arctic Whale Tours, Stø, Norway

08/2010-03/2011: **Ph.D. short-term research scholar**
School of Biological and Behavioural Sciences, Queen Mary University, London, UK

09/2008-03/2013: **Research associate (Ph.D. student)**
Department of Comparative Zoology, Humboldt University Berlin, Germany

03/2008-08/2008: **Research associate**
Allgemeine und Spezielle Zoologie, Rostock University, Germany

Academic education

2013: **Dr. rer. nat. (Ph.D.)**, Humboldt University Berlin
(supervisor: Prof. Dr. Gerhard Scholtz; *summa cum laude*)

Title of thesis: "On the embryonic and post-embryonic development of *Pseudopallene* sp. (Arthropoda, Pycnogonida) with special focus on neurogenesis and nervous system differentiation"

2007: **Diploma in Biology**, Humboldt University Berlin (*passed with distinction*)

Title of thesis: "Aspects of the development of sea spiders (Arthropoda, Pycnogonida)"

2001-2007: **Studies of Biology**, Humboldt University Berlin (*passed with distinction*)

2004-2005: 2 semesters at Greifswald University, Germany

Extramural funding (incl. personal scholarships)

2020: **Secondary user grant for the Antarctic RV Polarstern expedition PS124 (9 weeks)**; German Research Vessels Portal (GPF) & Alfred-Wegener Institute (AWI); benthos sampling in the Weddell Sea

2019: **ASSEMBLE Plus Transnational Access project**; EU Horizon 2020 program; collection of sea spiders at Rothera Research Station, British Antarctic Survey, Antarctica

2019: **ASSEMBLE Plus Transnational Access project (3 weeks)**; EU Horizon 2020 program; sea spider collection and regeneration studies at Station Biologique de Roscoff, France

2018: **Postdoctoral research project (Eigene Stelle – 3.25 years)**; German Science Foundation (DFG); comparative studies on sea spiders in the group of Steffen Harzsch, Greifswald University

2017: **Postdoctoral fellowship (6 months)**; German Science Foundation (DFG); development of Antarctic sea spiders and regeneration in the group of Gerhard Scholtz, Humboldt University Berlin

2015: **Postdoctoral fellowship (2 years)**; German Science Foundation (DFG); comparative studies on adult neurogenesis in arthropods in the group of Barbara Beltz, Wellesley College, MA, USA

2010: **Short-term Ph.D. scholarship (5 months)**; German Academic Exchange Service (DAAD); gene expression studies in the group of Angelika Stollewerk, Queen Mary University of London, UK

2008: **Travel stipend (2 weeks)**, German National Academic Foundation; animal collection in Tasmania, Australia

2008: **Ph.D. scholarship (2 years – 6 months used)**; German National Academic Foundation

2006: **Travel stipend (1 week)**; German National Academic Foundation; animal collection at Station Biologique de Roscoff, France

2005: **Student scholarship (2.5 years)**; German National Academic Foundation

Awards from scientific societies

2008: **Poster prize** awarded by the Crustacean Society at the meeting "Advances in Crustacean Phylogenetics", Rostock, Germany

2007: **Katharina-Heinroth-Prize 2008** for an outstanding diploma thesis, awarded by the Gesellschaft Naturforschender Freunde zu Berlin

Memberships in scientific societies

Deutsche Zoologische Gesellschaft e.V. (DZG)
International Society for Invertebrate Morphology (ISIM)

Academic teaching and marine wildlife guiding

2020 – 2021: **Instructor**, "Zoological Exercises", practical laboratory course, Greifswald University, Germany

2019 - 2021: **Instructor**, "Marine Zoological Field Trip", practical field course in Helgoland, Greifswald University, Germany

2014-2015: **Instructor**, "Morphology, Phylogeny and Systematics of Animals", undergraduate laboratory course, Humboldt University Berlin, Germany

2014: **Instructor**, "Animal Ecology & Taxonomy", undergraduate field course, Humboldt University Berlin, Germany

2014: **Instructor**, "Animal Species Identification", undergraduate practical course, Humboldt University Berlin, Germany

2014: **Marine biological wildlife guiding**, Lobosonda Whale Watching, Calheta, Madeira (daily boat trips for 3.5 weeks)

2013-2014 **Marine biological wildlife guiding**, Arctic Whale Tours, Stø and Tromsø, Norway (daily boat trips for 6 months)

2005-2007: **Student tutor**, "Morphology, Phylogeny and Systematics of Animals", undergraduate laboratory course, Humboldt University Berlin, Germany

(Co-)Supervision of theses and advanced student projects

2020-2021: Karina Frankowski (B.Sc.): "MicroCT-based atlas of the central nervous system and midgut structure in all extent sea spider families", student project resulting in a publication

2019-2021: Laura Maaß (B.Sc.): "Studies on the regeneration abilities of sea spiders", student project, student project resulting in a publication

2019-2020: Amrei Gründer: "Comparing the ventral nerve cord anatomy among sea spiders (Chelicerata, Pycnogonida)", bachelor thesis

2016-2018: Vanessa Kelly: "Strengthening the relationship between the immune system and adult neurogenesis", student project and bachelor thesis

2015-2017: Megan McNeil: "RNAi of Ast1 and CHF: a molecular approach to exploring the connection between the innate immune system and adult neurogenesis in procambarid crayfish", student project and bachelor thesis

2015-2017: Kara Banson: "Treatment of cultured immature immune cells with accessory lobe homogenate enhances their attraction to the neurogenic niche in vitro", student project and bachelor thesis

2015-2016: Zena Chatila: "Lentiviral GFP transfection of the parthenogenic crayfish species *Procambarus fallax*: a tool for examining the source of neural precursor cells in crayfish", student project and bachelor thesis

Field work and collection trips

2022:	Benthos sampling during RV Helmer Hanssen cruise HHUMTL22, Barents Sea and Svalbard (1 week)
2021:	Benthos sampling during RV Polarstern cruise PS124 (COSMUS), Weddell Sea, Antarctica (9 weeks)
2019:	Research stay for sea spider and crustacean collection and regeneration studies on sea spiders at Station Biologique de Roscoff, France (3 weeks)
2019-2022:	Collection of sea spiders and crabs at Biologische Anstalt Helgoland, Alfred-Wegener-Institute, Germany (repeated 4-6 day trips)
2017:	Collection of sea spiders at Station Biologique de Roscoff, France (1 week)
2016:	Collection of cephalocarid crustaceans in coastal waters off New England, Sea Lab, New Bedford, MA, USA (3 days)
2015-2019:	Collection of sea spiders and hydrozoans in coastal waters off New England, USA (repeated 2-3 day trips)
2015:	Collection of sea spiders and bryozoans in Tasmania, Australia, incl. research stay at Queensland Museum, Brisbane (4 weeks)
2008, 2009:	Collection of sea spiders, crustaceans and bryozoans in Tasmania, Australia (2x 2 weeks)
2006-2012:	Collection of sea spiders, hydrozoans and anthozoans in coastal waters near Wilhelmshaven and Kiel, Germany (repeated 2-3 day trips)
2006:	Collection of sea spiders at Station Biologique de Roscoff, France (1 week)
2004:	Landscape ecological field excursion to Yakutia, Russia (3 weeks)

Peer-review activities for scientific journals

Acta Zoologica, Arthropod Structure and Development, Arthropod Systematics and Phylogeny, BMC Neuroscience, Developmental Neurobiology, Frontiers in Zoology, Helgoland Marine Research, Invertebrate Systematics, Invertebrate Zoology, Journal of Arachnology, JEZ Part B: Molecular and Developmental Evolution, Molecular Phylogenetics and Evolution, Journal of Crustacean Biology, Journal of Morphology, Marine Biodiversity, Palaeontology, PLoS One, Polar Biology, Proceedings of the Royal Society B, Zoosystematics and Evolution, Zootaxa

Reviewer activities for research funding agencies

German Research Foundation (DFG), German Research Vessels Portal (GPF)

Publications

Brenneis G, Wagner D (2023): "Mating observation of giant sea spiders (Pycnogonida: Colossendeidae)." *Marine Biodiversity* 53: 45.

Brenneis G, Frankowski K, Maaß L, Scholtz G (2023): "The sea spider *Pycnogonum litorale* overturns the paradigm of the absence of axial regeneration in molting animals." *Proceedings of the National Academy of Sciences U.S.A.* 120: e2217272120.

Frankowski K, Miyazaki, K, **Brenneis G** (2022): "A microCT-based atlas of the central nervous system and midgut in sea spiders (Pycnogonida) sheds first light on evolutionary trends at the family level." *Frontiers in Zoology* 19: 14.

Brenneis G (2022): "The visual pathway in sea spiders (Pycnogonida) displays a simple serial layout with similarities to the median eye pathway in horseshoe crabs." *BMC Biology* 20: 27.

Brenneis G, Schwentner M, Giribet G, Beltz BS (2021): "Insights into the genetic regulatory network underlying neurogenesis in the parthenogenetic crayfish *Procambarus virginalis." Developmental Neurobiology* 81: 939-974.

Brenneis G, Scholtz G (2021): "A postlarval instar of *Phoxichilidium femoratum* (Pycnogonida, Phoxichilidiidae) with an exceptional malformation." *Journal of Morphology* 282: 278-290.

Ballesteros JA, Setton EVW, Santibánez López, CE, Arango CP, **Brenneis G**, Brix S, Cano-Sánchez E, Dandouch M, Dilly GF, Eleaume MP, Gainett G, Gallut C, McAtee S, McIntyre L, Moran AL, Moran R, López-González PJ, Scholtz G, Williamson C, Woods HA, Wheeler WC, Sharma PP (2021): "Phylogenomic resolution of sea spider diversification through integration of multiple data classes." *Molecular Biology and Evolution* 38: 686-701.

Brenneis G, Arango CP, Sharma PP, Schwentner M (2020): "The more the merrier: unparalleled sympatric species richness in a sea spider genus (Pycnogonida, Callipallenidae, *Pallenella*) from Tasmanian waters." *Invertebrate Systematics* 34: 837-870.

Brenneis G, Beltz BS (2020): "Adult neurogenesis in crayfish: origin, expansion and migration of neural progenitor lineages in a pseudostratified neuroepithelium." *The Journal of Comparative Neurology* 528: 1459-1485.

Brenneis G, Arango CP (2019): "First description of epimorphic development in Antarctic Pallenopsidae (Arthropoda, Pycnogonida) with insights into the evolution of the four-articled sea spider cheliphore." *Zoological Letters* 5: 4.

Brenneis G, Scholtz G, Beltz BS (2018): "Comparison of ventral organ development across Pycnogonida (Arthropoda, Chelicerata) provides evidence for a plesiomorphic mode of late neurogenesis in sea spiders and myriapods." *BMC Evolutionary Biology* 18: 47.

Brenneis G, Bogomolova EV, Arango CP, Krapp F (2017): "From egg to "no-body": an overview and revision of developmental pathways in the ancient arthropod lineage Pycnogonida." *Frontiers in Zoology* 14: 6.

Beltz BS, **Brenneis G**, Benton JL (2016): "Adult neurogenesis: lessons from crayfish and the elephant in the room." *Brain Behavior and Evolution* 87: 146-155.

Scholtz G, **Brenneis G** (2016): "The pattern of a specimen of *Pycnogonum litorale* (Arthropoda, Chelicerata, Pycnogonida) with a supernumerary leg can be explained with the 'boundary model' of appendage formation." *The Science of Nature* 103: 13.

Brenneis G (2016): "Pycnogonida (Pantopoda)." Book chapter in *Structure and Evolution of Invertebrate Nervous Systems* (Eds: Schmidt-Rhaesa A, Harzsch S, Purschke G), Oxford University Press, 776 p.

Brenneis G, Scholtz G (2015): "Serotonin-immunoreactivity in the ventral nerve cord of Pycnogonida – support for individually identifiable neurons as ancestral feature of the arthropod nervous system." *BMC Evolutionary Biology* 15: 136.

Brenneis G, Scholtz G (2014): "The 'ventral organs' of Pycnogonida (Arthropoda) are neurogenic niches of late embryonic and post-embryonic nervous system development." *PLoS One* 9: e95435.

Stegner MEJ, **Brenneis G**, Richter S (2014): "The ventral nerve cord in Cephalocarida (Crustacea) – new insights into the ground pattern of Tetraconata." *Journal of Morphology* 275: 269-294.

Brenneis G, Stollewerk A, Scholtz G (2013): "Embryonic neurogenesis in *Pseudopallene* sp. (Arthropoda, Pycnogonida) includes two subsequent phases with similarities to different arthropod groups." *EvoDevo* 4: 32.

Arango CP, **Brenneis G** (2013): "New species of Australian *Pseudopallene* (Pycnogonida: Callipallenidae) based on live colouration, morphology and DNA." *Zootaxa* 3616: 401-436.

Brenneis G, Arango CP, Scholtz G (2011b): "Morphogenesis of *Pseudopallene* sp. (Pycnogonida, Callipallenidae) II: Postembryonic development." *Development, Genes and Evolution* 221: 329-350.

Brenneis G, Arango CP, Scholtz G (2011a): "Morphogenesis of *Pseudopallene* sp. (Pycnogonida, Callipallenidae) I: Embryonic development." *Development, Genes and Evolution* 221: 309-328.

Richter S, Loesel R; Purschke G, Schmidt-Rhaesa A, Scholtz G, Stach T, Vogt L, Wanninger A, **Brenneis G**, Döring C, Faller S, Fritsch M, Grobe P, Hausen H, Heuer CM, Kaul S, Møller OS, Müller CHG, Rieger V, Rothe BH, Stegner MEJ, Harzsch S (2010): "Invertebrate neurophylogeny: suggested terms and definitions for a neuroanatomical glossary." *Frontiers in Zoology* 7:29.

Brenneis G, Richter S (2010): "Architecture of the nervous system in Mystacocarida (Arthropoda, Crustacea) – an immunohistochemical study and 3D reconstruction." *Journal of Morphology* 271: 169-189.

Brenneis G (2010): "Implikationen der Nervensystem-Entwicklung bei Asselspinnen (Arthropoda, Pycnogonida) für die segmentale Zusammensetzung der Kopfregion." *Sitzungsberichte Gesellschaft Naturforschender Freunde zu Berlin (N.F.)* 47: 135-150.

Brenneis G, Ungerer P, Scholtz G (2008): "The chelifores of sea spiders (Arthropoda, Pycnogonida) are the appendages of the deutocerebral segment." *Evolution and Development* 10: 717-724.

Brenneis G, Richter S (2008): "Immunohistochemical study and 3D reconstruction of the central nervous system of Mystacocarida (Arthropoda, Crustacea)." *Journal of Morphology* 269: 1481-1482; published abstract.

Brenneis G, Scholtz G (2008): "Brain development in sea spiders (Arthropoda, Pycnogonida) and the segmental association of their head appendages." *Journal of Morphology* 269: 1465; published abstract.

Invited talks

Brenneis G: "When external morphology is not enough: the neuroanatomy of sea spiders illuminates in-group relationships and informs current debates on chelicerate phylogeny" Keynote at the 5th International Congress on Invertebrate Morphology. 2022. Vienna, Austria.

Brenneis G: "More than just four pairs of legs: studying sea spiders to shed light on chelicerate and arthropod evolution" AEB Departmental Seminar. 2022. University of Göttingen, Germany.

Brenneis G: "Hunting sea spiders in the Southern Ocean" PS124 - Scientific Seminar Series. 2021. PS124 Polarstern Expedition (COSMUS). Weddell Sea, Antarctica.

Brenneis G: "Sea spiders in the spotlight: a (more than) daily dose of Asselspinnerei" Zoologisches Institutssymposium. 2019. Greifswald University, Germany.

Brenneis G: "Nobodies or Somebodies? Exploring the unexplored potential of sea spiders (Pycnogonida) to inform arthropod evolution" Keynote at the 111th Annual Meeting of the German Zoological Society. 2018. Greifswald, Germany.

Brenneis G: "Adult neurogenesis in two distantly related arthropod groups: understanding the evolution of developmental processes underlying neural plasticity in Arthropoda" Departmental Seminar Neurobiology. 2018. Ulm University, Germany.

Brenneis G: "Nervous systems, niches and non-model organisms – what "nobodies" can tell about the evolution of arthropod neurogenesis" Neuro-Nite Lecture of the Neuroscience Program. 2015. Wellesley College, MA, USA.

Brenneis G: "When a "nobody" begs to differ – How sea spiders challenge current views on arthropod nervous system development and evolution" Departmental Seminar Integrative Zoology. 2014. University of Vienna, Austria.

Brenneis G: "Fitting pieces and further puzzles – What "nobody" can tell about the evolution of arthropod neurogenesis" Evolution and Development Seminar Series. 2012. University of Cambridge, UK.

Scholtz G, **Brenneis G**: "In search for enigmatic creatures of Tasmanian waters" Meeting of the Rotary Club of the Tasman Peninsula. 2008. Tasmania, Australia.

Brenneis G: "Aspekte der Neurogenese von Asselspinnen (Arthropoda, Pycnogonida)" Sitzung der Gesellschaft Naturforschender Freunde zu Berlin. 2008. Berlin, Germany

Conference contributions (talks)

Brenneis G, Frankowski K, Maaß L, Scholtz G: "The Old Men and the Sea ---Spider Anuses" 4th Young Researcher Meeting Morphology 2023. Göttingen, Germany.

Brenneis G, Frankowski K, Maaß L, Scholtz G: "Amputationen an Asselspinnen erbringen ersten Nachweis von posteriorer Rumpfregeneration bei Arthropoden" 20. Crustaceologentagung. 2022. Kiel, Germany.

Brenneis G, Arango, CP, Schwentner M: "The more the merrier - Untersuchungen zur sympatrischen Artenvielfalt der farbenprächtigen Asselspinnengattung *Meridionale*" 19. Treffen deutschsprachiger Crustaceologen. 2019. Munich, Germany.

Ballesteros JA, Arango CP, **Brenneis G**, Sharma PP: "A genomic timeline for the evolution and diversification of sea spiders (Arthropoda: Pycnogonida)" Annual Meeting of the Society of Molecular Biology and Evolution. 2018. Yokohama, Japan.

Brenneis G, Arango, CP: "New data on the development of Antarctic and tropical sea spiders: implications for the evolution of developmental pathways in Pycnogonida" 9th International Crustacean Congress. 2018. Washington, DC, USA.

Brenneis G, Schwentner M, Beltz BS: "First insights into the gene network governing adult neurogenesis in procambarid crayfish" 110th Annual Meeting of the German Zoological Society. 2017. Bielefeld, Germany.

Brenneis G: "First insights into the gene network underlying embryonic and adult neurogenesis in procambarid crayfish" The Benton Symposium. 2017. Wellesley College, MA, USA.

Brenneis G, Scholtz G, Beltz BS: "Life-long production of neural cells in the CNS of sea spiders (Pycnogonida) – evidence for an ancestral system of adult neurogenesis in Arthropoda?" 109th Annual Meeting of the German Zoological Society. 2016. Kiel, Germany.

Brenneis G, Scholtz G: "Serotonin-like immunoreactive neurons in the ventral nerve cord of Pycnogonida (Arthropoda) – putting a neurophylogenetic argument to the test" 3rd International Congress on Invertebrate Morphology. 2014. Berlin, Germany.

Arango CP, **Brenneis G**: "Defining species of sea spiders based on colour, DNA and morphology" 10th Invertebrate Biodiversity & Conservation Conference. 2011. Melbourne, Australia.

Brenneis G, Scholtz G: "Neurogenesis in sea spiders – a further step towards the euarthropod ground pattern?" 2nd International Congress on Invertebrate Morphology. 2011. Cambridge, MA, USA.

Brenneis G: "A nobody's contribution to nervous system evolution: Investigating neurogenesis in Pycnogonida" Symposium on the Evolution of the Arthropod Nervous System. 2009. Jena, Germany.

Brenneis G, Richter S: "3D reconstruction of the nervous system in Mystacocarida (Arthropoda, Crustacea)" Celebrating Darwin: From *The Origin of Species* to Deep Metazoan Phylogeny. 2009. Berlin, Germany.

Brenneis G, Scholtz G: "Brain development in sea spiders and the segmental affiliation of their head appendages" 1st International Congress on Invertebrate Morphology. 2008. Copenhagen, Denmark.

Conference contributions (posters)

Brenneis G, Schwentner M, Benton JL, Beltz BS: "First insights into the gene network governing embryonic and adult neurogenesis in procambarid crayfish"

Meeting of the Society for Neuroscience. 2017. Washington, DC, USA.
9th International Crustacean Congress. 2018. Washington, DC, USA.

Brenneis G, Schwentner M, Beltz BS: "First insights into the gene network underlying embryonic and adult neurogenesis in procambarid crayfish" Crustacean Models in Cross-Disciplinary Biological Research. 2017. Janelia Research Campus, VA, USA.

Stegner, MEJ, **Brenneis G**, Richter S: "Immunohistochemical survey on the central nervous system in *Hutchinsoniella macracantha* (Cephalocarida)" Celebrating Darwin: From *The Origin of Species* to Deep Metazoan Phylogeny. 2009. Berlin, Germany.

Brenneis G, Richter S: "Immunohistochemical study and 3D reconstruction of the central nervous system of Mystacocarida"

Advances in Crustacean Phylogenetics. 2008. Rostock, Germany
1st International Conference on Invertebrate Morphology 2008. Copenhagen, Denmark.

Brenneis G: "Phylogenetic and evolutionary implications of arthropod neurogenesis and neuroarchitecture" EMBO Practical Course: Molecular Approaches to Evolution and Development 2008. Kristineberg, Sweden.

Ungerer P, **Brenneis G**, Scholtz G: "Phylogenetic and evolutionary implications of sea spider development (Arthropoda, Pycnogonida)" The Evolution of the Animals: a Linnean tercentenary Celebration 2007. The Royal Society. London, UK.