

NEWS

Announcing the 2019 Journal of Experimental Biology Outstanding Paper Prize shortlist and winner

Kathryn Knight*

Some of our greatest discoveries have come from the minds of young people. The theory of special relativity, the structure of DNA and our current understanding of insect flight were all driven by researchers early in their careers. With the aim of encouraging young scientists embarking on a career in research, Journal of Experimental Biology established the JEB Outstanding Paper Prize in memory of Bob Boutillier (JEB Editor-in-Chief 1994–2003) in 2005. ‘We want to support young scientists who take it on themselves to do exciting research’, says Hans Hoppeler, current Editor-in-Chief. Since the award was launched, more than 100 papers have been shortlisted and we are delighted to announce the 11 papers that have been nominated by the journal Editors for the 2019 award.

‘We had a great selection of papers this year’, says Hoppeler, who chose Patrick Green’s study investigating whether large and small mantis shrimp can fine tune their hammer blows depending on their size and the size of the object that they are attacking, be it an opponent or a snail (jeb198085). In another biomechanics study, Elliot Hawkes and colleagues analysed the impact of a springy ankle tether on human running, during his postdoc at Stanford University, USA (jeb202895). Deputy Editor-in-Chief Andrew Biewener describes how this paper ‘nicely integrated an experimental approach with musculoskeletal modelling’, adding that the shift of focus from body weight support to assisting leg movement could inspire new designs to help patients relearn how to walk.

Two of the shortlisted papers investigated the strategies used by animals to breathe in unconventional circumstances. Tessa Blanchard and colleagues from the University of Guelph, Canada, and the University of California Davis, USA, examined how amphibious fish adjust to breathe out of water (jeb186486), while Kephra Beckett, Anne Robertson and Philip Matthews from the University of British Columbia, Canada, discovered that spittlebugs snorkel to breathe when enclosed by a cocoon of cuckoo spit (jeb191973). Katie Gilmour, who oversaw peer review of Blanchard’s study, recalls that it was extremely creative, integrating gene expression, morphology and whole-animal performance measures. Editor Julian Dow also describes Beckett and Robertson’s approach to their original question as ‘elegantly novel’.

Continuing the theme of insect comparative analysis, Blanca Arroyo-Correa, Ceit Beattie and Mario Vallejo-Marín conducted an investigation into the buzzing behaviour of four bumblebee species, which stimulates flowers to release pollen (jeb198176). Another member of the editorial team, Michael Dickinson, felt the paper was noteworthy, ‘for trying to gain insight into the tricky problem of co-evolution of bees and the plants they pollinate’. Meanwhile, Alexandra Batchelor and Rachel Wilson from Harvard Medical School, USA, discovered that tiny *Drosophila melanogaster* steer away from the antenna that picks up the strongest vibrations, in their

shortlisted paper (jeb191213), nominated by Sheila Patek. ‘The integration of elegant and clever experimental design with a fundamental question about sound localisation yielded an exciting discovery’, says Patek.

Red-eyed tree frog embryos also respond to vibrations in order to escape when attacked by predatory snakes, and Karen Warkentin, with graduate student Julie Jung and undergraduates Su Jin Kim and Sonia Pérez Arias, from Boston University, USA, and Smithsonian Tropical Research Institute, Panama, confirmed that the embryos begin reacting to vibrations when their otoconial organs develop (jeb206052). ‘A fascinating finding, carefully planned experiments and very well written up’, says nominating Editor Almut Kelber.

Another family of tropical frogs, the poison dart frogs, protect themselves from predation by ingesting poisons from their diet, but Editor Trish Schulte says, ‘The ability of poison frogs to take up and use a toxin that should kill them is a real biological mystery’. In their study, which took the first steps toward understanding this puzzle, Stephaine Caty and Lauren O’Connell from Stanford University, USA, with colleagues from Ecuador and Harvard University, USA, compared the gene expression patterns of wild and detoxified frogs (jeb204149). They identified two proteins – Hsp90 and the toxin carrier saxitoxin – which are likely key players in toxin transport. In contrast, Julia Gauberg and colleagues from the University of Queensland, Australia, and York University, Canada, revealed in their shortlisted paper how amphibian skins are vulnerable to the *Batrachochytrium dendrobatidis* fungus, which is spreading an epidemic of chytridiomycosis across the planet (jeb192245). Praising the study, Pat Wright, who oversaw peer review of the article, adds, ‘This clear-cut paper identified the mechanism that allows a lethal fungal pathogen to disrupt skin integrity’.

An additional threat facing all ectothermic animals is that of rising temperatures. However – in the research article nominated by Craig Franklin – Timothy Healy, Antonia Bock and Ronald Burton from the Scripps Institution of Oceanography, USA, recently



Kephra Beckett and Anne Robertson, winners of the 2019 Journal of Experimental Biology Outstanding Paper Prize.

*Author for correspondence (kathryn.knight@biologists.com)

Box 1. 2019 Journal of Experimental Biology Outstanding Paper Prize shortlist

Arroyo-Correa, B., Beattie, C. and Vallejo-Marín, M. (2019). Bee and floral traits affect the characteristics of the vibrations experienced by flowers during buzz pollination. *J. Exp. Biol.* **222**, jeb198176.

Batchelor, A. V. and Wilson, R. I. (2019). Sound localization behavior in *Drosophila melanogaster* depends on inter-antenna vibration amplitude comparisons. *J. Exp. Biol.* **222**, jeb191213.

Beckett, K. I. S., Robertson, A. B. and Matthews, P. G. D. (2019). Studies on gas exchange in the meadow spittlebug, *Philaenus spumarius*: the metabolic cost of feeding on, and living in, xylem sap. *J. Exp. Biol.* **222**, jeb191973.

Blanchard, T. S., Whitehead, A., Dong, Y. W. and Wright, P. A. (2019). Phenotypic flexibility in respiratory traits is associated with improved aerial respiration in an amphibious fish out of water. *J. Exp. Biol.* **222**, jeb186486.

Caty, S. N., Alvarez-Buylla, A., Byrd, G. D., Vidoudez, C., Roland, A. B., Tapia, E. E., Budnik, B., Trauger, S. A., Coloma, L. A. and O'Connell, L. A. (2019). Molecular physiology of chemical defenses in a poison frog. *J. Exp. Biol.* **222**, jeb204149.

Day, N. F., Saxon, D., Robbins, A., Harris, L., Nee, E., Shroff-Mehta, N., Stout, K., Sun, J., Lillie, N., Burns, M., Korn, C. and Coleman, M. J. (2019). D2 dopamine receptor activation induces female preference for male song in the monogamous zebra finch. *J. Exp. Biol.* **222**, jeb191510.

Gauberg, J., Wu, N., Cramp, R.L., Kelly, Scott P. and Franklin, C. E. (2019). A lethal fungal pathogen directly alters tight junction proteins in the skin of a susceptible amphibian. *J. Exp. Biol.* **222**, jeb192245.

Green, P. A., McHenry, M. J. and Patek, S. N. (2019). Context-dependent scaling of kinematics and energetics during contests and feeding in mantis shrimp. *J. Exp. Biol.* **222**, jeb198085.

Healy, T. M., Bock, A. K., Burton, R. S. (2019). Variation in developmental temperature alters adulthood plasticity of thermal tolerance in *Tigriopus californicus*. *J. Exp. Biol.* **222**, jeb213405.

Jung, J., Kim, S. J., Pérez Arias, S. M., McDaniel, J. G., and Warkentin, K. M. (2019). How do red-eyed treefrog embryos sense motion in predator attacks? *J. Exp. Biol.* **222**, jeb206052.

Simpson, C. S., Welker, C. G. Uhlrich, S. D., Sketch, S. M., Jackson, R. W., Delp, S. L., Collins, S. H., Selinger, J. C. and Hawkes, E. W. (2019). Connecting the legs with a spring improves human running economy. *J. Exp. Biol.* **222**, jeb202895.

revealed that the temperatures experienced by developing *Tigriopus californicus* copepods can improve their resilience later in life (jeb213405). ‘This paper highlights the importance of developmental thermal plasticity’, explains Franklin, while the final shortlisted paper, from Melissa Coleman’s team of undergraduate researchers at the Claremont Colleges, USA, reports how a neurotransmitter targeting a specific receptor in the brains of zebra finch females is essential for the birds to learn to recognise their mates’ songs (jeb191510). Explaining that other species also depend on the same endocrine circuit when selecting a partner, Hoppeler exclaims, ‘Who could not be interested in this?’

After considering all of the outstanding shortlisted papers, the editors selected Studies on gas exchange in the meadow spittlebug, *Philaenus spumarius*: the metabolic cost of feeding on, and living in, xylem sap (jeb191973) from Philip Matthews’ University of British Columbia lab as the winner of the 2019 JEB Outstanding Paper Prize. Admitting that he was surprised and delighted by the news, Matthews adds that he was very pleased that Kephra Beckett and Anne Robertson have been recognised for their contributions so early in their careers. Describing Beckett and Robertson as talented students, Matthews says, ‘Not only were they inventive in the techniques that they brought to bear on the spittlebugs but they were both instrumental in pushing the experimental work further, trying multiple approaches to find the best ways to measure the gas exchange and metabolic rates of some pretty tiny insects. The quality and quantity of data that they collected was outstanding’.

Reflecting on this year’s shortlist and the overall winner, Hoppeler says, ‘I was pleased to see the high class of manuscripts covering almost all areas of the Journal using a broad array of techniques, from classical physiology and biomechanics to molecular physiology and genetics. I feel that it is this breadth of organisms and scientific approaches that makes JEB so special’. And we wish all of the early career researchers that chose to send their first papers to JEB – and those who do so in the future – exciting and successful careers. ‘We want to support young scientists in their pursuit of excellence’, says Hoppeler.