

## NEWS

# Announcing the 2020 Journal of Experimental Biology Outstanding Paper Prize shortlist and winner

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With the Covid-19 pandemic continuing to rage, labs closed and field seasons cancelled, many early-career researchers need the community's support more than ever. Journal of Experimental Biology has a history of taking its responsibilities toward this key group of scientists seriously. Every year since the JEB Outstanding Paper Prize was launched in 2004, in memory of the late Bob Boutilier (JEB Editor-in-Chief 1994–2003), the journal has acknowledged the seminal contributions of young scientists at the beginning of their careers. 'The Editors take great delight in recognising the exceptional research that is being conducted by early-career researchers', says current Editor-in-Chief Craig Franklin, adding, 'We feel it is important to showcase, share and acknowledge the work of the next generation of experimental biologists'. The Editors are now pleased to announce the 12 papers that have been nominated for the 2020 award.

Reflecting on his own shortlist nomination, Franklin recalls Joshua Hall and Daniel Warner's (Auburn University, USA) thought-provoking investigation comparing the physiological impacts of eight different temperature simulations, ranging from a single temperature to complex reconstructions of daily temperature variations, on the development of brown anole (*Anolis sagrei*) embryos in the lab (jeb231902). Publishing their discovery that the hatchlings and young lizards that developed in the most realistic scenario had the best chances of survival, Franklin was impressed by the duo's demonstration of the 'importance of "playing-back" natural environmental conditions when examining thermal developmental plasticity in reptiles'.

Deputy Editor-in-Chief Pat Wright's nomination also considered early life stage physiology, but this time in sea urchin larvae (jeb222844). 'Meike Stumpp and colleagues outlined a clear hypothesis and designed a series of very nice experiments', Wright says. Testing whether the larvae's extremely alkaline midgut protects them from bacterial infection, the team from Christian-Albrechts University of Kiel, Germany, and Academia Sinica, Taiwan, discovered that the pH of the midgut began fluctuating between 8.8 and 9.25 when the larvae were at risk of infection. 'The authors ... provided strong evidence for the role of the alkaline gut in inhibiting pathogen infections', says Wright.

While continually varying aquatic environments challenge species that reside in water, annual killifish embryos suffer the most extreme environmental disruption when the ephemeral ponds in which they develop dry out. Yet, the extraordinary embryos withstand dehydration and anoxia for months. Working with Jason Podrabsky at Portland State University, USA, Danial Zajic found that the inhibitory neurotransmitter  $\gamma$ -aminobutyric acid (GABA) is an essential component of the embryo's anoxia-tolerance strategy (jeb229716). Trish Schulte, the Editor who oversaw peer review of the paper, praises the research. 'Unlike many studies of biochemical mechanisms in non-model organisms that rely on correlative data, this



Adam Hardy, winner of the 2020 Journal of Experimental Biology Outstanding Paper Prize.

study directly manipulated the levels of GABA to test the functional significance of this mechanism', she says.

Continuing the aquatic theme, Angelina Dichiera and Andrew Esbaugh at The University of Texas at Austin Marine Science Institute, USA, published their shortlisted paper in November on the role of carbonic anhydrase in red blood cell oxygen delivery in a game fish, red drum (jeb232991). 'The authors developed a clever experimental approach that provided new and important data on the role of carbonic anhydrase in oxygen delivery to tissues such as the retina and swimbladder', says Editor Katie Gilmour. Explaining that the enzyme acidifies red blood cells to enhance O<sub>2</sub> unloading at tissues that require surplus oxygen, she adds that the study provides insight into the long-standing question of why carbonic anhydrase appears to be present in red blood cells at higher levels than is required simply for CO<sub>2</sub> excretion.

Julian Dow's short-listed nomination, by Hamish Charlton and David Merritt from The University of Queensland, Australia, also investigated a physiological role for CO<sub>2</sub>, this time in the eerie glow produced by the Malpighian tubules of *Arachnocampa* larvae in dank rainforest caves (jeb225151). Knowing that the gas was thought to deactivate the off switch that was believed to suppress bioluminescence by day, thereby allowing the larvae to glow at night, the duo discovered instead that CO<sub>2</sub> directly triggers Malpighian tubule light production. Listing the key components of the investigation, from Malpighian tubules to the discovery of a

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### Box 1. 2020 Journal of Experimental Biology Outstanding Paper Prize shortlist

**Bagheri, Z. M., Jessop, A.-L., Kato, S., Partridge, J. C., Shaw, J., Ogawa, Y. and Hemmi, J. M.** (2020). A new method for mapping spatial resolution in compound eyes suggests two visual streaks in fiddler crabs. *J. Exp. Biol.* **223**, jeb210195. doi:10.1242/jeb.210195

**Capshaw, G., Soares, D. Christensen-Dalsgaard, J. and Carr, C. E.** (2020). Seismic sensitivity and bone conduction mechanisms enable extratympanic hearing in salamanders. *J. Exp. Biol.* **223**, jeb236489. doi:10.1242/jeb.236489

**Caron, D. P., Rimniceanu, M., Scibelli, A. E. and Trimmer, B. A.** (2020). Nociceptive neurons respond to multimodal stimuli in *Manduca sexta*. *J. Exp. Biol.* **223**, jeb218859. doi:10.1242/jeb.218859

**Charlton, H. R. and Merritt, D. J.** (2020). Carbon dioxide-induced bioluminescence increase in *Arachnocampa* larvae. *J. Exp. Biol.* **223**, jeb225151. doi:10.1242/jeb.225151

**Crane, R. L. and Denny, M. W.** (2020). Mechanical fatigue fractures bivalve shells. *J. Exp. Biol.* **223**, jeb220277. doi:10.1242/jeb.220277

**Dichiera, A. M. and Esbaugh, A. J.** (2020). Red blood cell carbonic anhydrase mediates oxygen delivery via the Root effect in red drum. *J. Exp. Biol.* **223**, jeb232991. doi:10.1242/jeb.232991

**Hall, J. M. and Warner, D. A.** (2020). Ecologically relevant thermal fluctuations enhance offspring fitness: biological and methodological implications for studies of thermal developmental plasticity. *J. Exp. Biol.* **223**, jeb231902. doi:10.1242/jeb.231902

**Hardy, A. R. and Hale, M. E.** (2020). Sensing the structural characteristics of surfaces: texture encoding by a bottom-dwelling fish. *J. Exp. Biol.* **223**, jeb227280. doi:10.1242/jeb.227280

**Stumpp, M., Petersen, I., Thoben, F., Yan, J.-J., Leippe, M. and Hu, M. Y.** (2020). Alkaline guts contribute to immunity during exposure to acidified seawater in the sea urchin larva. *J. Exp. Biol.* **223**, jeb222844. doi:10.1242/jeb.222844

**Tapper, S., Nocera, J. J. and Burness, G.** (2020). Heat dissipation capacity influences reproductive performance in an aerial insectivore. *J. Exp. Biol.* **223**, jeb222232. doi:10.1242/jeb.222232

**Zajic, D. E. and Podrabsky, J. E.** (2020). GABA metabolism is crucial for long-term survival of anoxia in annual killifish embryos. *J. Exp. Biol.* **223**, jeb229716. doi:10.1242/jeb.229716

**Závorka, L., Koeck, B., Armstrong, T. A., Sođanci, M., Crespel, A. and Killen, S. S.** (2020). Reduced exploration capacity despite brain volume increase in warm-acclimated common minnow. *J. Exp. Biol.* **223**, jeb223453. doi:10.1242/jeb.223453

new mechanism in a tiny cave-dwelling gnat, Dow says that the exciting paper ticked all of the boxes for him.

Dining on other airborne insects, tree swallow parents work hard to raise their young, but Simon Tapper and Gary Burness from Trent University, Canada, with Joseph Nocera from the University of New Brunswick, Canada, wondered whether the risk of overheating restricts the new parents' exertions (jeb222232). When the team trimmed a small patch of the mothers' feathers, they found that the birds that could keep cool on hot days, thanks to their bald patch, were able to feed their chicks faster than those with a full set of feathers. The shortlisted paper confirms that the parents' exertions are limited by their ability to keep their body temperature down and Franklin warns, 'This may limit the reproductive performance of some birds in the face of current and future climate warming'.

Reviewing his nomination for the Outstanding Paper Prize shortlist, Andrew Biewener says 'Rachel Crane and Mark Denny nicely reveal how history-dependent loading patterns might impact

the ability of mussels to resist fracture and survive' (jeb220277). Describing how the bivalves can withstand forces up to 23,000 times their own weight, Biewener adds, 'the authors provide important evolutionary context for how the shape and thickness of the bivalve shell improve its resistance to fatigue fracture'.

In the first shortlisted paper to be published in 2020, Zahra Bagheri and colleagues from The University of Western Australia reported a new approach for mapping the spatial resolution of compound eyes (jeb210195). 'It is a methodological tour de force', enthuses Editor Almut Kelber, describing how the team's patience and diligence was rewarded by the unexpected discovery that the eyes of fiddler crabs are equipped with two visual streaks – instead of the usual one – located just above and below the visual horizon. 'A truly outstanding paper', Kelber extols.

Neuroethology also features in a further three of the shortlisted papers. Discussing how tobacco hornworms sense heat and painful contact (jeb218859), Editor Sanjay Sane says, 'I think the paper by Daniel Caron and colleagues [Tufts University, USA], is interesting because of the finding of multimodal sensitivity'. Sane was also intrigued by Adam Hardy and Melina Hale's recent discovery, made at The University of Chicago, USA, that round goby fins are as touch sensitive as primate fingertips (jeb227280). 'Both referees immediately liked it and it was clear that they rated it highly', he endorses. The third nominated paper in the neuroethology category, by Grace Capshaw from University of Maryland, College Park, USA, with an international team of colleagues, discussed the mechanism that allows salamanders with no middle ear to hear by picking up vibrations through the bones of the skull (jeb236489). Recalling Capshaw's analysis, Editor Sheila Patek says, 'This is a wonderful example of integrative and experimental comparative physiology', adding that the discovery offers insight into the evolutionary history of hearing.

The concluding shortlisted paper of 2020 reported the discovery by Libor Závorka and colleagues from Shaun Killen's lab at the University of Glasgow, UK, that the brains of minnows that develop at predicted future climate temperatures are larger than those of modern fish (jeb223453). However, it seems that the better endowed fish are not as smart as modern minnows and struggle to navigate in unfamiliar environments. 'As the temperatures we experience are increasing, it is important to understand the consequences this may have on the brain of an ectotherm', says Editor Ken Lukowiak, adding, 'warming trends may have consequences for cognitive ability'.

Considering this year's short list, Franklin says that the papers collectively 'reflect the diversity of subject areas that JEB publishes within comparative physiology and biomechanics, but also highlight remarkable discoveries that are intriguing and thought provoking'. And after reviewing the merits of each of these exceptional articles, the Editors are delighted to announce that Adam Hardy is the winner of the 2020 JEB Outstanding Paper Prize for 'Sensing the structural characteristics of surfaces: texture encoding by a bottom-dwelling fish' (jeb227280). Thanking the Editors for their recognition, PI Melina Hale recalls the challenges overcome by Hardy during the study. 'He had to take methodologies and tools that are used in human and primate fingers, bring them to our lab and get them to work on fish fins, which have different tissue properties, underwater. A remarkable feat!' she exclaims. 'It took a while to really dig in and understand what the data could say', she adds. Reacting to the news, Hardy says that it put a smile on his face for the rest of the day; 'I was very thankful', he remembers. Thinking of the future, the new postdoc says, 'I'm currently exploring my career options, but hope to stay in a STEM-related field with a focus on education and teaching'.