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# NEWS

## Nicole George wins 2012 JEB Outstanding Paper Prize

The Editors of *The Journal of Experimental Biology* are pleased to announce that Dr Nicole George is the winner of this year's JEB Outstanding Paper Prize. Awarded in memory of Bob Boutillier (JEB Editor in Chief 1994–2003), the prize recognises the junior author who made the most significant contribution to an outstanding paper. Explaining that the winning paper was selected by the Editors from a short list of eight articles (available at the end of the article), Hans Hoppeler – JEB Editor-in-Chief – adds, 'The Outstanding Paper Prize showcases the kind of research that we love best at the journal.'

George published her award-winning paper, 'Temperature gradients drive mechanical energy gradients in the flight muscle of *Manduca sexta*' with Simon Sponberg and Tom Daniel in the third issue of 2012 (George et al., 2012). Considering the current winner, Hoppeler says, 'The journal's editorial policy asks for hypothesis-driven research aimed at elucidating novel physiological principles and Nicole George's article falls exactly into that category.'

Describing her reaction to the news, George says, 'I was surprised; definitely it was very exciting. It's a paper that's dear to my heart but you never know how other people feel about it, so this was confirmation that this is exciting science.' And Hoppeler comments, 'This article stands out because it shows that a physiological system that everybody seems to understand, the flight muscle of *Manduca sexta*, behaves in a complex fashion based on physical constraints that had not been taken into account previously.'

Nicole George, winner of the 2012 JEB Outstanding Paper Prize.

George joined the Daniel lab in 2008 after majoring in integrative biology at University of California Berkeley, USA. After spending a year in Mimi Koehl's lab as a post-baccalaureate research assistant, George says, 'It was wonderful because it gave me the experience I needed to know that I really wanted to go into this field as a grad student.' Having joined Daniel's University of Washington lab, she was also awarded a prestigious National Science Foundation Graduate Research Fellowship. Explaining that the success rate for applicants is extremely low, Daniel says, 'The NSFGRF program gives students an amazing amount of freedom to pursue research that isn't tied to an existing grant.' And George grasped this opportunity with both hands. Daniel recalls, 'When Nicole joined my lab she said, "I don't want to just do a dotting 'i' and crossing 't' type of project, I want to do something where there is a conceptual advance", and we had this temperature gradient in *Manduca* muscle as a back-burner project and that is where Nicole took off.'

'The concept of a temperature gradient arose from the idea that if you have a muscle contracting and producing heat with convective cooling on the surface then presumably there should be a temperature gradient throughout the muscle', explains George. 'I started the thesis by really honing in on whether the temperature gradient exists', she adds. Measuring the temperature at a series of locations in the main flight muscles (the dorsolongitudinal muscles) of tethered flying *Manduca sexta*, George measured a 5.6°C temperature difference between the top and bottom of the flight muscle because the muscle segments in the insect's back were cooled by the passing air flow. And when George measured how the top and bottom portions of the muscle contracted at the same temperature, she could see that both sections contracted at the same rates. However, the rates of contraction differed significantly when the portions were at different temperatures, forcing the cooler sections to contract at a lower rate than the warmer sections, suggesting that the cooler top segments would produce significantly less mechanical power (George and Daniel, 2011). In other words, a muscle with a temperature gradient could serve multiple functions.

Intrigued by the physiological implication, George embarked on stage two of her thesis. 'We wanted to look at what consequence this would have for mechanical power output as a function of the muscle temperature, and that is what led to the 2012 paper', she says. Working with postdoc Simon Sponberg, George ironed out all of the technical challenges that she faced before measuring the power generated by the muscle over temperatures ranging from 25 to 40°C. She found that the muscle produced impressive power outputs – in the region of 100 $W\,kg^{-1}$ – at the highest temperatures. However, as the temperature dropped, so too did the power output, until at 30°C, the power output became negative. The cool muscle was either storing or absorbing energy, which didn't make sense. 'It doesn't help the moth to fly', says George. And when she repeated the experiments with the top and bottom sections of the muscle, she found that the warm bottom segment – which produces positive power – could power flight by pulling on the thorax cuticle to push the wing down during the first half of the wing beat. However, the cooler, slowly contracting top segment could be acting as a damper – to stabilize the system – or as an elastic energy storage system – to help raise the wing during the relaxation portion of the contraction cycle at the end of a downbeat. 'All at once you have multiple functions within one single muscle because of the temperature gradient', explains George.

Outlining George's commitment to the demanding work, Daniel says, 'I have a slide about every student that defends their thesis in my lab that has three words that I think characterise the student, and the three words for Nicole are: diligence, focus and creative spark.' Giving an example of her impressive work ethic, Daniel describes George's ability to focus, regardless of distraction. 'Nicole would come into the lab and – you know, you have the usual coffee clutch around – but Nicole walks up and she just starts working.' He adds, 'But all the focus in the world isn't useful if there isn't a creative spark there, and Nicole has that too.'

Following on from her thesis research, George is continuing her work in Daniel's lab as a postdoc where she is preparing to analyse the muscle structure of tethered moths in flight using X-ray diffraction at the Argonne National Laboratory. However, George's career choice is not quite as conventional as it might at first seem. George says, 'I have always enjoyed science and I want to continue working in science, but I have always been interested in how to enact change on a global level and how science can be used to do that.' This led her to take this summer out from research and accept an internship at the Paul G. Allen Family Foundation, a philanthropic organisation supporting a wide range of community and environmental projects in the Pacific Northwest. However, since returning to the lab, George has maintained contact with the foundation, where she is continuing to advise their scientific program. 'I am looking at the field of ocean health, analysing opportunities for success. It's very fun and I get to learn a lot of new things', George smiles.

Reflecting on the muscle project's achievements, Daniel says, 'When you work with really great grad students and postdocs like Nicole and Simon, their discoveries open your eyes and it's usually their fresh views that make you go, "Ha, I wonder why it's like that?" They don't have the biases built in', he chuckles, adding, 'we will all be going out to celebrate Nicole's success.'

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## Outstanding Paper Prize Short List, 2012

**Anyon, M. J., Orchard, M. J., Buzza, D. M. A., Humphries, S. and Kohonen, M. M.** (2012). Effect of particulate contamination on adhesive ability and repellence in two species of ant (Hymenoptera; Formicidae). *J. Exp. Biol.* **215**, 605-616.

**Biju Sam Kamalam J., Medale, F., Kaushik, S., Polakof, S., Skiba-Cassy, S. and Panserat, S.** (2012). Regulation of metabolism by dietary carbohydrates in two lines of rainbow trout divergently selected for muscle fat content. *J. Exp. Biol.* **215**, 2567-2578.

**Crait, J. R. Prange, H. D., Marshall, N. A., Harlow, H. J., Cotton, C. J. and Ben-David, M.** (2012). High-altitude diving in river otters: coping with combined hypoxic stresses. *J. Exp. Biol.* **215**, 256-263.

**George, N. T., Sponberg, S. and Daniel, T. L.** (2012). Temperature gradients drive mechanical energy gradients in the flight muscle of *Manduca sexta*. *J. Exp. Biol.* **215**, 471-479.

**Kloepper, L. N., Nachtigall, P. E., Donahue, M. J. and Breese, M.** (2012). Active echolocation beam focusing in the false killer whale, *Pseudorca crassidens*. *J. Exp. Biol.* **215**, 1306-1312.

**Kuo, T.-H., Yew, J. Y., Fedina, T. Y., Dreisewerd, K., Dierick, H. A. and Pletcher, S. D.** (2012). Aging modulates cuticular hydrocarbons and sexual attractiveness in *Drosophila melanogaster*. *J. Exp. Biol.* **215**, 814-821.

**Parker, M. R. and Mason, R. T.** (2012). How to make a sexy snake: estrogen activation of female sex pheromone in male red-sided garter snakes. *J. Exp. Biol.* **215**, 723-730.

**Stamper, S. A., Madhav, M. S., Cowan, N. J. and Fortune, E. S.** (2012). Beyond the Jamming Avoidance Response: weakly electric fish respond to the envelope of social electrosensory signals. *J. Exp. Biol.* **215**, 4196-4207.

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