ECR Spotlight-Arion Pons

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ECR SPOTLIGHT

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ECR Spotlight is a series of interviews with early-career authors from a selection of papers published in Journal of Experimental Biology and aims to promote not only the diversity of early-career researchers (ECRs) working in experimental biology but also the huge variety of animals and physiological systems that are essential for the 'comparative' approach. Arion Pons is an author on 'Causal models of rate-independent damping in insect exoskeleta', published in JEB. Arion is an assistant professor at Chalmers University of Technology, Sweden, investigating biomechanics of insects and the design of insect-inspired robots.

Arion Pons

How did you become interested in biology?

After a stint in more-or-less mainstream mechanical engineering, bordering applied mathematics, I first started to do actual biological – at least, biomechanical – work in my postdoc with Tsevi Beatus at the Hebrew University. I'd grown up in New Zealand with a lot of sheep, birds and sandflies, and I'd been wanting to do animal biomechanics for a while; after veering through bio-inspired robots in my PhD I finally had the opportunity and independence to work on insects. From there I didn't really look back: in my new group at Chalmers, we still do a bit of bio-inspired engineering, but more and more we are working on the biomechanics of insects.

Describe your scientific journey and your current research focus

I started off research deep down the rabbit hole of classical mechanics. In my undergraduate and master's degrees at the University of Canterbury (New Zealand), I was working on connections between aeroelastic instabilities and an obscure – but interesting! – branch of the theory of eigenvalue problems. In my PhD at the University of Cambridge (UK), I started to get to more practical subjects, working on bio-inspired aircraft, but it became clear to me during that process that a lot of related biological (and biomechanical) topics were understudied. A postdoc at the Hebrew University (Israel) dropped me in the deep end of insect biomechanics, and since then this has been my main research focus. I am now the PI for the Interdisciplinary Flight Group at Chalmers University of Technology (Sweden), which is like a detritivore of experimental biology: we analyse a lot of open data, and other reports, to build up better integrative models – and integrative simulations – of the biomechanics of insect flight.

How would you explain the main findings of your paper to a member of the public?

To walk, jump or fly, insects must spend energy. Where does the energy go? Among many losses, energy is lost to several sources of friction: friction from the air, and friction within their bodies. We want to understand how friction works within the body of an insect, in order to better understand how insects spend their energy; but, as one might imagine, the friction inside the complicated body of an insect is itself quite complex! In this paper, I developed mathematical models for the internal friction within an insect, and show how the amount of friction can be estimated from various forms of experimental data.

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Why did you choose JEB to publish your paper?

I really wanted to try JEB's new Theory & Modelling section. I think this section could be a great outlet for our community working on insect biomechanics – an area in which I think modelling can add a lot of value to experimental data. For my own research, I feel like JEB is a good connection point between the kind of math-heavy work I tend to do and the wider entomology community. In any case, I spend a lot of time extracting data from other works in JEB, some of which can be found in this paper! And finally, amid the abrasiveness of wider academic publishing, it's always so nice to publish in a well-focused independent journal like JEB. The whole publication process is so smooth, the reviewers are insightful, and it just makes publication a good experience.

What is the most important piece of equipment for your research, what does it do and what question did it help you address?

A computer! It is endlessly fascinating to me that, with the accumulated study of many disciplines, we can begin to encode the principles of lift itself – even if only roughly – into a lump of inert silicon. This is what I (and my new group) am trying to do with insects. We think that there are a lot of insights that we could gain by creating a digital insect and performing digital experiments, or

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During flight testing of an insect-inspired robot.

augmenting real-world experiments. In this paper, I take a little step toward building this digital insect, resolving one troublesome topic in structural models of insect exoskeleta: how exoskeleta dissipate energy through internal structural damping. I applied mathematical techniques that were originally developed to understand the structural damping of buildings during earthquakes to insect exoskeleta, and developed (openly available!) code to simulate these structural damping models within an insect, and to identify the level of structural damping from various different types of real-world experimental data. There is a lot of foundation-building work to do in creating a digital insect, but this work in JEB is a step forward, and one that I hope will help others working toward this goal.

Do you have a top tip for others just starting out at your career stage?

Perhaps this isn't a good tip for everyone, but don't be afraid to do something completely wacky. At the very least, you'll be totally unique, and you might be very successful! Now I can't really claim to be the latter, but I have found that, while it's a bit of a learning curve to pass through different topics or disciplines, on the other side you find yourself doing things that no one else is doing. For me, it's true that the engineers in my department tend to find the obsession with insects a little strange, and the entomologists at conferences find the applied math a bit dense, but, at least with my background, the foundations of insect biomechanics are a niche that is full of opportunity.

What do you like to do in your free time?

A cocktail of hiking, cooking, recreational mathematics, reading The Lord of the Rings on repeat, and looking after three extremely entitled cats. Though really, the cats count as a second job, the math counts as my actual job, and the hiking counts as math if you're thinking about it. So that leaves cooking and The Lord of the Rings, which are matters of essential corporeal and emotional sustenance. Not to be that type of academic, but free time is kind of an illusion.

Reference

Pons, A. (2025). Causal models of rate-independent damping in insect exoskeleta. *J. Exp. Biol.* **228**, jeb249940. doi:10.1242/jeb.249940