

David DUNEAU, PhD

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Languages: French (native); English (fluent); Portuguese (basic); R (fluent)

Research interests

My research asks *why individuals vary in their responses to environmental challenges* with a focus on the challenges imposed by parasites. I test evolutionary and ecological concepts in model invertebrates by integrating experimental approaches such as functional genetics with statistical modelling, genomics (GWAS), and transcriptomics.

- Host-parasite interaction ■ co-evolution ■ sexual dimorphism ■ phenotypic plasticity
- genetic basis of quantitative traits ■ within-host dynamics
- bacteria ■ *Drosophila*

Research positions

01/10/2021 to present:

Visiting researcher

Institute of Evolutionary Biology, Edinburgh, Scotland.

01/01/2020 to 31/10/2020 & 01/01/2021 to 30/06/2021:

Independent researcher, *Laboratoire International Associé* programme

Instituto Gulbenkian de Ciência, Portugal & University Toulouse 3, France.

01/04/2015 to 31/10/2017 & 01/09/2019 to 31/10/2019:

Senior post-doctoral research associate

Lab. Evolution and Biological Diversity (EDB) University Toulouse 3.

01/11/2011 – 22/12/2014:

SNSF post-doctoral research associate

Lazzaro Lab, Cornell University, USA.

Career break

01/11/2017 to 31/08/2019: ~2 years parental leave (1 child now 6 years old)

Education

2007 – 23/09/2011: **PhD student in Evolutionary parasitology** Basel Univ. (CH) (Sept 23, 2011)
'Evolutionary and proximate mechanisms shaping host-parasite interactions: The case of Daphnia magna and its natural bacterial parasite Pasteuria ramosa.'

2004 - 2006: **Masters in Ecology and Evolutionary Biology**, Montpellier Univ. (FR)

2001 - 2004: **Bachelor of Science in Organismal Biology**, Montpellier Univ. (FR)

Funding

- Own postdoc salary (278K€)
 - Fellowship from Gulbenkian Foundation in Lisbon (2020 & 2021; 30K€)
 - Post-doctoral '*Prestigious and Marie Curie Fellowship*' (2017; 51K€)

- Post-doctoral fellowship from LabEx TULIP (2015; 112K€)
- Post-doctoral fellowship from Swiss NSF (2011 & 2013; 76K€)
- Fellowship from the Emilia Guggenheim-Schnurr foundation in Basel (2009; 9K€)
- **Grants**
 - PI David Duneau and Lucie Zinger: Disentangling the factors shaping gut microbiota diversity across arthropod predators (EDB Toulouse Univ. funded by LabEx CEBA; 2016; 20K€)
 - PI Jean-Baptiste Ferdy (Duneau D. co-PI, 15%-time allocation): Pathogens adaptation to their host's microbiome (EDB Toulouse Univ., funded by "New frontiers" LabEx TULIP project; 2016; 82K€)
 - PI Patrícia Beldade (Duneau D. co-PI, 20%-time allocation): Adaptive Developmental Plasticity: genetic and environmental components of phenotypic variation (FCT Portugal; 2016; 192K€)
- 5 Travel grants to attend conferences.

Main scientific accomplishments

My research has contributed to:

- **Parasite manipulating host behaviour** can escape from the predators (frog) of their host (Ponton *et al.* Nature 2006).
- Determining the mechanism responsible for the **coevolution between a host and its parasite** (Duneau *et al.* BMC Biol. 2011).
- Describing **sexual dimorphism in responses to infections** in *Drosophila* (Belmonte *et al.* Front. Imm. 2020) and uncovering **mechanisms driving dimorphism** (Duneau *et al.* BMC Biol. 2017).
- Proposing (Duneau & Ebert PLoS Biol. 2012), and demonstrating (Duneau *et al.* BMC Biol. 2012), that **parasites can adapt specifically to the sex of the host** they encounter the most often.
- Understanding the link between **within-host dynamics and infection outcome** (Duneau *et al.* eLife 2017, invited review in Current Opinion Insect Science 2022).
- Characterising the **genetic basis of insecticide resistance** (Duneau *et al.* G3 2018) and **phenotypic plasticity** (Lafuente *et al.* PLoS Gen. 2018, Bonfini *et al.* eLife 2021).
- Showing that the distinct **steps of infection impose trade-offs to bacterial within-host evolution** (Faucher *et al.* mBio 2020).
- Showing that **cancer can increase the risk of being predated** (Duneau *et al.* BioRxiv 2020).

Academic leadership

- **Reviewer for 21 Journals**
 - Animal Behaviour ■ Applied Environmental Microbiology ■ Biology Letters ■ BMC Biology ■ BMC ecology ■ BMC Evolutionary Biology ■ Coevolution ■ Ecology and Evolution ■ Evolution ■ Epidemiology and Infection ■ Heredity ■ Invertebrate Biology ■ Invertebrate Survival Journal ■ Nature Communications ■ Oecologia ■ Oikos ■ Phil. Transactions of the Royal Society ■ PLoS ONE ■ PNAS ■ Proceedings of the Royal Society B ■ Journal of Animal Ecology.
- **Reviewer for 4 funding agencies**
 - Sigma Xi awards research grants program ■ National Commission for Scientific and Technological Research of Chile ■ National Fund for Scientific Research of Belgium (NFWO) ■ European Research Council (ERC).
- **Thesis committee and jury**
 - Examiner for Pinaud S at Univ. Perpignan (France) supervised by Gourbal B (2018)

- Thesis committee Hanson M at EPFL (Switzerland) supervised by Lemaitre B (2018)
- **Administrative & organisational roles**
 - Part of the scientific committee of the French Network "Réseau Ecologie des Interactions Durables" (REID) (2020-current).
 - Organisation of the National meeting of the French Network "Réseau Ecologie des Interactions Durables" (REID) (2017, Museum natural history of Toulouse).
 - Organisation of departmental seminars (2015 to 2017, University of Toulouse 3)
 - Organisation of seminars aiming to present experiments or analyses before they were performed. (From fall 2009 to spring 2011, Zoological Institute Basel)

Teaching

I aim at sharing my love for quantitative ecology and experimental design with students afraid by thinking quantitatively (e.g. early year students and, students from molecular biology backgrounds). My biggest achievement in teaching was to break the fear of statistics and use R.

- **Active learning grounded in evidence-based techniques of teaching**
 - Evaluation in "Evolutionary biology and genetics" (2017 & 2018) Level: 3rd year undergraduate, University of Toulouse 3. We used a role play method to evaluate their understanding of concepts in evolutionary biology (example of questions: "What is death in an evolutionary biology context?", "What is the cost of sex?").
 - Teaching assistant, practical in *Ecological and Evolutionary Genetics* (2009 and 2010). Level: Masters student, University of Basel. I developed exercises based on real examples and employed a "think – pair – share" method, where students *think* for themselves, exchange with their neighbour (*pair*) and *share* with the class.
 - Teaching of *Introduction to biology* (2009). Level: group of ~10 1st year undergraduates, University of Basel. I put the students at the centre of the teaching by asking them to respond to a set of concept inventory questions before the lecture (at home) and, after having established the students who knew the answer, I asked those students to participate in the teaching by explaining concepts to their classmate. This method has then influenced other PhD students teaching this course.
- **Conventional**
 - Numerous and continual participation in mock panels and presentation critique for PhD students approaching their defence.
 - Invited lecture on host-parasite coevolution (2017). Level: high school teachers.
 - Summer school LabEx TULIP (2015) on Integrative Ecology and Biology "Biological interactions from genes to ecosystems". Level: from 4th year undergraduates to Postdoc.
 - Departmental workshop on statistical analysis of experimental data. Level: Postgraduates (2014).
 - Tutor in student scientific projects (2008 to 2010). Level: 3rd year undergraduate, University of Basel.
 - Teaching assistant, *practical of Animal Biology (Embryology)* with Prof. Louis Du Pasquier (2009). Level: 3rd year undergraduates, University of Basel.
 - Teaching assistant, *practical of Animal Biology (Entomology)* with Prof. Dieter Ebert (2008). Level: 3rd year undergraduates, University of Basel

Student supervision (1 thesis as co-supervisor, 3 Master 2, 12 undergrads)

- **PhD student**

- Yara Santos Rodrigues *Regulation and evolution of developmental plasticity in insect pigmentation: temperature and immunity interactions*. (Co-supervision with Beldade P from Lisbon Univ.; 2015 - Oct. 2020)

- I have been strongly involved in the supervision of 5 PhD students:

One at the University of Toulouse (Piotr Michalak, 2021 - 2024); 2 at the University of Lisbon (Elvira Lafuente, 2013 – 2017 & Priscilla Akyaw, 2020 – 2024); 2 at the University of Edinburgh (Rebecca Belmonte, 2019 – 2023 & Mary-Kate Corbally, 2019 - 2022).

- **Undergraduate students**

I have supervised 13 undergraduate students since 2009. Eight have been associated to publications, two of those students are first author of publications where I am last and corresponding author.

Scientific communications

- **Invited talks (18)**

2020:

- Seminar at the Institute of Biology - Zoology, Freie Universität Berlin, 11/2020 (online talk; invited by Olivia Judson, Jens Rolf and Sophie Armitage)
- Seminar New voices in Infection Biology, Max Planck Institute for Infection Biology, Berlin, 10/2020 (online talk; invited by Igor Iatsenko) **Recording at:** <https://youtu.be/e0N7eg-U0hI>
- Seminar at Department DGIMI, Montpellier University, 10/2020 (online talk; invited by Alain Givaudan)

2019 and before:

- Innsbruck University, Innsbruck, Austria- 11/2019 (talk; invited by Markus Möst)
- Edinburgh University, Edinburgh, UK - 06/2018 (talk; invited by Sarah Reece)
- EPFL, Lausanne, Switzerland -04/2018 (talk; invited by Bruno Lemaitre)
- University of Burgundy, Dijon, FR - 12/2017(talk; invited by Thierry Rigaud)
- University of Montpellier (SEEM), Montpellier, FR - 12/2017(talk; invited by Karen McCoy)
- Insect Biology Research Institute, Tours, FR - 10/2017 (talk; invited by Joel Meunier)
- CNRS, Gif-sur-Yvette, FR - 04/2016 (talk; invited by Frédéric Mery)
- Centre Biologie du Développement, Toulouse, FR - 04/2016 (talk; invited by Alain Vincent)
- Conference LabEx TULIP, Toulouse, FR - 03/2016 (talk; invited by Etienne Danchin)
- Institute for advanced study, Toulouse, FR - 06/2015 (talk; invited by Arnaud Togneti)
- Seminar at the Center for infectious disease dynamics, PennState University, University Park, PA, USA - 04/2014 (talk; invited by David Hughes)
- Seminar at the department of Evolution, Ecology and Genetics, Australian National University, Canberra, Australia - 02/2014 (talk; invited by Hanna Kokko).
- Seminar at the department of Ecology and Evolutionary Biology, Rochester University, Rochester, USA - 11/2013 (talk; invited by John Jaenike).
- Department of Evolutionary Biology of Cornell University, Ithaca, USA - 2012 (talk)

- Institute for Development Research (IRD), Montpellier, FR - 2010 (talk; invited by Karen McCoy)
- **Conferences (15)**
 - Conference ESEB (2nd joint congress), Montpellier, FR - 08/2018 (Poster)
 - Conference Jacques Monod "Open questions in ecology and evolution in infectious diseases: from fundamental research to evolutionary medicine" - Roscoff Biological Station, FR - 10/2017 (Poster)
 - Conference Immuniv2017, Lyon, FR - 06/2017 (Contributed talk)
 - REID Annual Conference, Poitiers, FR - 03/2016 (Contributed talk)
 - Conference 15thESEB, Lausanne, Switzerland - 08/2015 (Contributed talk)
 - Conference Jacques Monod, "Infectious diseases as drivers of evolution: the challenges ahead" - Roscoff Biological Station, FR - 09/2014 (contributed talk)
 - Drosophila research conference, San Diego, USA - 03/2014 (poster)
 - Conference 14th ESEB, Lisbon, Portugal - 08/2013 (poster)
 - Drosophila research conference, Washington DC, USA - 03/2013 (poster)
 - Conference ESEB (joint congress), Ottawa, Canada - 08/2012 (contributed talk)
 - Conference 13th ESEB, Tubingen, Germany - 08/2011 (contributed talk)
 - Conference Swiss-Russian Seminar, Freiburg, Switzerland - 2010 (contributed talk)
 - Conference 16th EMPSEB, Wierzba, Poland - 2010 (contributed talk)
 - Conference 12 ESEB, Turin, Italy - 2009 (contributed talk)
 - Conference 15th EMPSEB, Shoorl, Netherlands - 2009 (contributed talk)

Scientific outreach

- What is COVID? (2020) Talk for primary school kids and their parents, online USA & online Italy
- De Dinechin D, Deguine JP, **Duneau D** (2006) *L'Homme de Florès. La découverte d'une nouvelle espèce humaine*. Annales de la Société d'Horticulture et d'Histoire Naturelle de l'Hérault 146 : 38-45
- **Duneau D**, Deguine JP, De Dinechin M, Blondel J (2006) *L'homme de Flores. Nanisme et gigantisme insulaire*. Annales de la Société d'Horticulture et d'Histoire Naturelle de l'Hérault 146 : 57-66
- Deguine JP, De Dinechin M, **Duneau D** (2006) *L'Homme de Florès. L'évolution de l'Homme et Homo floresiensis*. Annales de la Société d'Horticulture et d'Histoire Naturelle de l'Hérault 146 : 87-94
- **Epidemiology Fact Sheets** *Mosquito Biology for the Homeowner*
- **Scientific documentary** (52min) « *Toto le nemato.* », Price Buffon 2008 « Festival Paris science »