David DUNEAU, PhD

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: david.duneau@gmail.com
Languages: French (native speaker); English (Fluent); Portuguese (basic)

Research interests

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

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

Research positions

2020 to date: **Senior post-doctoral research associate**
Instituto Gulbenkian de Ciência, Portugal & Univ. Toulouse 3, France.

2015 - 2019: **Senior post-doctoral research associate**
Lab. Evolution and Biological Diversity (EDB) Univ. Toulouse 3.

2012 - 2015: **SNSF post-doctoral research associate**
Lazzaro Lab, Cornell University, USA.

2007 - 2011: **PhD student**
Ebert lab, Zoological Institute Basel, Switzerland.

2005 - 2006: **Master student**
Master 2: McCoy lab, Institute for Development Research (IRD), Montpellier.
Master 1: Thomas lab, Institute for Development Research (IRD), Montpellier.

Career break

2018 - 2019: Part-time parental leave (1 child now 5 years old)

Education

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

2005 - 2006: **Master in Ecology and Evolutionary Biology**, Montpellier Univ. (FR)

2003 - 2004: **Bachelor of Science in Organismal Biology**, Montpellier Univ. (FR)

Funding

- Fellowships (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 (294K€)
  - 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 (D. Duneau 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 Patricia Beldade (D. Duneau 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** of 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).
- Characterising the **genetic basis** of **insecticide resistance** (Duneau *et al.* G3 2018) and **phenotypic plasticity (**Lafuente *et al.* PLoS Gen. 2018).
- 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 18 Journals**
  ◘ Animal Behaviour ◘ Biology Letters ◘ 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.
- **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 S. Pinaud at Univ. Perpignan (France) supervised by B. Gourbal (2018)
  - Thesis committee M. Hanson at EPFL (Switzerland) supervised by B. Lemaitre (2018)

- **Management & Organisation**
  - Organisation of the National meeting of the French Network "Réseau Ecologie des Interactions Durables" (REID) (2017, Museum natural history of Toulouse).
  - Part of the scientific committee of the French Network "Réseau Ecologie des Interactions Durables" (REID) (2020-current).
  - Organisation of departmental seminars (2015 to 2017, University of Toulouse 3)

Teaching

- **Active learning grounded on evidence-based techniques of teaching**
  - Evaluation in "*Evolutionary biology and genetics*" (2017 & 2018) Level: 3rd higher undergraduates, 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 (*Fall 2009 and 2010). Level: Masters student, University of Basel. I developed the exercises based on concrete examples and used a lot a "think – pair – share" method, where students *think* for themselves for a minute, exchange with their neighbour (*pair*) and *share* with the class.
  - Teaching of *Introduction to biology* (Fall 2009). Level: groups 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.
- **Conventional**
  - Numerous participations to designing talk of PhD students from other laboratories.
  - 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.
  - Organisation of seminars aiming to present experiments or analyses before they were performed. (From fall 2009 to spring 2011, Zoological Institute Basel)
  - Tutor in student scientific projects (2008 to 2010). Level: 3rd year undergraduates, University of Basel.
  - Teaching assistant, *practical of Animal Biology (Embryology)* with Prof. Louis Du Pasquier (Spring 2009). Level: 3rd year undergraduates, University of Basel.
  - Teaching assistant, *practical of Animal Biology (Entomology)* with Prof. Dieter Ebert (Spring 2008). Level: 3rd year undergraduates, University of Basel

Student supervision **(1 thesis as co-director, 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 P. Beldade from Lisbon Univ.; 2015 - Oct. 2020)
- **Master 2 students**
  - Lafont P *A stochastic model for estimating immune parameters from the infection dynamics of a pathogen.* (co-supervision with JB Ferdy (EDB, Toulouse Univ.); 2019)

- Lemoine M *Ecological and evolutionary determinants of gut microbial communities in predatory insects.* (Co-supervision with L. Zinger (ENS Paris); 2017)
- Mazana V *Role of phenotypic switching in the division of labor during infection.* (2017)

- **Undergraduate students**

◘ Lafont P (2018) ◘ Kardacz M L3 (2017) ◘ Mazana V (2016) ◘ Kondolf H (2014, 2015) ◘ Ortiz G (2013 - 2015) ◘ Fox M (2012 - 2015) ◘ Chow C (2013) ◘ Edraki A (2013) ◘ Ruder L (2010) ◘ Eichin D. (2009) ◘ Gygli S. (2009) ◘ Hofer L. (2009, 2010)

Summary of publications [ORCID ID: 0000-0002-8323-1511]

Total: 28 publications of which 11 first author, 2 last and 11 *corresponding*

Google scholar profile: https://scholar.google.fr/citations?user=VhsB4z0AAAAJ&hl=en
- H-index: 16
- Total citations: 822
- 71% cited more than 10 times

Journal	Impact factor	Number	Author	Funding	
Nature	43	1	5/7		
Current Biology	9,2	1	3/4		
PLoS Biology	8,4	1	**First**		
eLife	7,5	1	**First**		
BMC Biology	6,7	3	**First**		
mBio	6.7	1	**Last**		
Frontiers Immuno.	6,4	1	**co-last**		
Molecular Ecology	6,1	1	5/7		
PLoS Genetics	5,5	1	2/3		
Evolutionary Applications	5	1	3/4		
Proceeding Roy. Soc. B	4,3	1	**First**		
Evolution	4,2	1	2/4		
Genetics	4,1	1	4/7		
Advances in Parasitology	4	1	2/7		
Heredity	3,8	2	3/4 ; 3/4		
Biology Letters	3,3	1	**First**		
Behavioral Ecol.	3,3	2	**Co-first;** 6/8		
Dev. Comp. Imm.	3,1	1	**First**		
G3	2,7	1	**First**		
Ecology and Evolution	2,5	1	6/11		
Inf. Gen. Evol.	2,5	1	**First**		
Parasitology	2,5	1	5/9		
Mar. Ecol. Prog. Series	2,3	1	4/5		
Acts of the BRG	NA	1	2/3		
	Median IF only corresponding: **6.7**	**28**			
BioRxiv		+ 4	3 as first / 1 as last		

SNSF (Cornell)
TULIP (Toulouse)
CEBA (Toulouse)
FCT (Toulouse)

Publications († corresponding author; * equal contribution)

2020 to date:

1. Faucher C, Mazana V, Kardacz M, Parthuisot N, Ferdy J-B, **Duneau**† **D**. (2021) *Step-specific adaptation and trade-off over the course of an infection by GASP-mutation small colony variants.* **mBio** doi.org/10.1128/mBio.01399-20

Within-host bacterial adaptations are generally focused on antibiotic resistance, rarely on the adaptation to the environment given by the host, and the potential trade-off hindering adaptations to each step of the infection are rarely considered. Using *Drosophila melanogaster* as host and the bacteria *Xenorhabdus nematophila*, we studied those trade-offs that are key to understand intra-host evolution, and thus the dynamics of the infection.

2. Belmonte RL, Corbally M-K, **Duneau D***†, Regan JC*† (2020) *Sexual dimorphisms in innate immunity and responses to infection in Drosophila melanogaster*. **Frontiers in Immunology** doi.org/10.3389/fimmu.2019.03075

We reviewed the sexual dimorphism of *Drosophila* when facing infections.

3. Bento G, Fields P, **Duneau D**, Ebert D. (2020) *An alternative route of bacterial infection is associated with a polymorphism at an alternative resistance locus.* **Heredity** doi.org/10.1038/s41437-020-0332-x

To understand the mechanisms of antagonistic coevolution, it is crucial to identify the genetics of parasite resistance. Using QTL approach, we discovered a second *P. ramosa* attachment site and a novel host-resistance locus, with implications for both for the coevolutionary dynamics (e.g., Red Queen and the role of recombination), and for the evolution and epidemiology of the infection process. I discovered the alternative route of infection.

4. Pineaux M, Merkling T, Danchin E, Hatch S, **Duneau D**, Blanchard P, Leclaire S. (2020) *Sex and hatching order modulate the association between MHC-diversity and fitness in early-life stages of a wild seabird.* **Molecular Ecology** doi.org/10.1111/mec.15551

We found that, in black-legged kittiwake (*Rissa tridactyla*) chicks, associations between MHC class-II diversity and fitness vary with sex and hatching order. I helped in the analysis and writing as an evolutionary parasitologist knowing the immune system and the sexual dimorphism in diseases.

2019 and before:

5. Corse E, Tougard C, Archambaud G, Agnèse J-F, Messu Mandeng FD, Bilong Bilong CF, **Duneau D**, Zinger L, Chappaz R, Xu CCY, Méglecz E, Dubut V (2019) *One-locus-several-primers: a strategy to improve the taxonomic and haplotypic coverage in diet metabarcoding studies.* **Ecology & Evolution** doi.org/10.1002/ece3.5063

I sampled spider webs in the tropical rainforest of French Guyana to show that we used them as DNA traps to describe biodiversity with metabarcoding.

6. **Duneau D**†*, Sun H*, Revah J, San Miguel K, Kunerth HD, Caldas IV, Messer PW, Scott JG, Buchon N. (2018) *Genome wide analysis of resistance to an organophosphate and a pyrethroid insecticide*. **G3: Genes|Genomes|Genetics** doi.org/10.1534/g3.118.200537

Using GWAS with the Drosophila Reference Genetic Panel (DGRP) found the genetic basis of the resistance to Parathion and Deltamethrin, two commonly used insecticides.

7. Lafuente E, **Duneau D**, Beldade P. (2018) *Genetic basis of thermal plasticity variation in* Drosophila melanogaster *body size*. **PLoS Genetics** doi.org/10.1371/journal.pgen. 1007686

Using GWAS in *Drosophila*, we determined the genetic basis of thermal plasticity of thorax and abdomen size. Variations of plasticity between those body parts were explained by completely different set of genes. I supervised the student for the genomic analysis and for the validation of allele candidate with functional genetics.

8. **Duneau**† **D**, Lazzaro B. (2018) *Persistence of an extracellular systemic infection across metamorphosis in a holometabolous insect* **Biology Letters** doi.org/10.1098/rsbl.2017.0771

Distinct life stages can represent drastically different environments for parasites especially when larval and adult life stages are bridged by a complete metamorphosis. We showed that systemic infection with an extracellular bacterium can transverse life stages.

9. **Duneau**† **D**, Ferdy JB, Revah J, Kondolf HC, Ortiz GA, Lazzaro BP, Buchon N. (2017) *Stochastic variation in the initial phase of bacterial infection predicts the probability of survival in* D. melanogaster. **eLife** doi.org/10.7554/eLife.28298 (Score 8 in F1000Prime RECOMMENDED)

A central problem with biomedicine is to understand why two individuals exposed to seemingly identical infections may have radically different clinical outcomes. Using the *Drosophila melanogaster* model, we analyse in depth, both through functional genetics and mathematical modelling, the main determinants that underlie the stochastic outcome of infection. ("Highlight" by Graham and Tate eLife 2017 6:e32783)

10. **Duneau**† **D**, Kondolf HC, Im JH, Ortiz GA, Chow C, Fox MA, Eugénio AT, Buchon N, Lazzaro BP. (2017) *The Toll pathway underlies host sexual dimorphism in resistance to both Gram-negative and positive-bacteria in Drosophila* **BMC Biology** doi.org/10.1186/s12915-017-0466-3

Our work has elucidated the mechanism of the difference between males and females *Drosophila melanogaster* in terms of susceptibility to infection. Altogether, our data demonstrate that Toll pathway activity differs between male and female *D. melanogaster* in response to bacterial infection, thus identifying innate immune signalling as a determinant of sexual immune dimorphism.

11. Ebert D, **Duneau D**, Hall M, Luijckx P, Andras J, Du Pasquier L, Ben-Ami F. (2016) *A population biology perspective on the stepwise infection process of the bacterial pathogen* Pasteuria ramosa *in* Daphnia. **Advances in parasitology** doi.org/10.1016/bs.apar.2015.10.001

By focusing this review on the biology of the bacterial parasite *Pasteuria ramosa* and its aquatic crustacean host *Daphnia*, we demonstrate that a population biology approach taking into consideration the natural genetic and environmental variation at each step of the infection can greatly aid our understanding of the evolutionary processes shaping disease traits. This manuscript is largely based on my PhD thesis.

12. **Duneau**† **D**, Ebert D, Du Pasquier L. (2016) *Infections by* Pasteuria *do not protect its natural host* Daphnia magna *from subsequent infections* **Developmental & Comparative Immunology** doi.org/10.1016/j.dci.2015.12.004

We tested immune priming in *Daphnia* and our results support the conclusion that there is no immunological memory to *Pasteuria ramosa* infections.

13. Avila F, Cohen A, Ameerudeen F, **Duneau D**, Suresh S, Mattei A, Wolfner M. (2015) *The D*rosophila *mating plug protein, PEBme, is required to maintain the ejaculate within the female reproductive tract at the termination of copulation.* **Genetics** doi.org/10.1534/genetics.115.176669

Seminal fluid proteins coagulate inside the female *Drosophila* into a structure known as the mating plug. We found PEBme knockdown in males compromised mating plug coagulation in their mates and I showed with macrophotography that the inability of females to subsequently retain the ejaculate in their reproductive tracts after mating was frequent. Our set of results highlight the importance of the posterior mating plug in reproduction.

14. Luijckx P, **Duneau D**, Andras J, Ebert D (2014) *Cross-species infection trials reveal cryptic parasite varieties and a putative polymorphism shared among host species* **Evolution** doi.org/10.1111/evo.12289

Successful infection depends on the outcome of multiple steps and only some steps of the infection process may be critical in determining a parasites host range. We found that while parasite attachment was possible across several host species (suggesting that alleles on the locus controlling attachment are shared among different host species that diverged 100 million years), proliferation occurred only in the native host species. Host range was therefore limited by one step of the infection.

15. Luijckx P, Fienberg H, **Duneau D**, Ebert D (2013) *A matching-allele model explains host resistance to parasites* **Current Biology** doi.org/10.1016/j.cub.2013.04.064
(Score 2 in F1000Prime RECOMMENDED)

For host-parasite coevolution to lead to an ongoing advantage for rare genotypes, parasites should infect specific host genotypes and hosts should resist specific parasite genotypes. Using the crustacean *Daphnia magna* and its parasitic bacterium *Pasteuria ramosa*, we described for the first time the genetics model capturing best such specificity, the matching-allele models (MAMs). I performed all the attachment tests of this study.

16. **Duneau**† **D**, Ebert D (2012) *Host sexual dimorphism and parasite adaptation* **PLoS Biology** doi.org/10.1371/journal.pbio.1001271

In this "essay" we propose for the first time the idea that the sexual dimorphism of diseases may be the result of the specific adaptation of parasites to the sex of their host. Similarly, as organisms adapt to the environment to which they are most frequently exposed, parasites can adapt to the sex they encounter most frequently (e.g., either because males and females are exposed differently, or because one sex is more easily infected than another due to immune differences). As a result, parasites behave differently depending on the sex they infect.

17. **Duneau**† **D**, Luijckx P, Ruder L, Ebert D (2012) *Sex-specific effects of a parasite evolving in a female-biased host population* **BMC Biology** doi.org/10.1186/1741-7007-10-104

Because they reproduce parthenogenetically, *Daphnia* are predominantly female. The parasites in these populations therefore necessarily evolve more often in females than male hosts. We have shown here that a parasite can be better adapted to the sex it encounters most frequently, empirically supporting the hypothesis proposed Duneau & Ebert PLoS Biology 2012.

18. **Duneau**† **D**, Ebert D (2012) *The role of molting in parasite defense* **Proceedings of the Royal Society of London B** doi.org/10.1098/rspb.2012.0407

The penetration of parasites into the host is a key step for a successful infection and the epithelium is the first line of host defence. We used the crustacean *Daphnia magna* to show that moulting influences the likelihood of infection by the bacterium *Pasteuria ramosa*. Hence, moulting is not only a weakness but can be beneficial to prevent infection by shedding bacteria. (Covered by: Le Figaro (https://bit.ly/2tbIPUk) & Live Science (https://bit.ly/37aT6Po)

19. Luijckx P, Fienberg H, **Duneau D**, Ebert D (2011) *Resistance to a bacterial parasite in the crustacean* Daphnia magna *shows Mendelian segregation with dominance* **Heredity** doi.org/10.1038/hdy.2011.122

We use a classical genetics approach to examine the mode of inheritance of infection outcome in the crustacean *Daphnia magna* when exposed to the bacterial parasite *Pasteuria ramosa*. We find host genotypes were either completely resistance or completely susceptibility to given parasite genotypes, that resistance is dominant, and inherited in a pattern consistent with Mendelian segregation of a single-locus with two alleles.

20. **Duneau**† **D**, Luijckx P, Ben-Ami F, Laforsch C, Ebert D (2011) *Resolving the infection process reveals striking differences in the contribution of environment, genetics and phylogeny to host-parasite interactions* **BMC Biology** doi.org/10.1186/1741-7007-9-11

Investigate the mechanism of infection underlying coevolution between a host (*Daphnia magna*) and his parasite (*Pasteuria ramosa*). We found that the specificity depends on the capacity of the parasite to attach or not to the host oesophagus. We published here the “attachment test” method which is used to quickly determine the ability of the bacteria of a given genotype to infect a given host genotype.

21. Ponton F, Otalora-Luna F, Lefevre T, Guerin PM, Lebarbenchon C, **Duneau D**, Biron DG, Thomas F (2011) *Water-seeking behavior in worm-infected crickets and reversibility of parasitic manipulation* **Behavioral Ecology** doi.org/10.1093/beheco/arq215

We studied the mechanisms hairworms use to increase the encounter rate between their host and water. We showed that hairworm infection modifies cricket behaviour by inducing directed responses to light, a condition from which they mostly recover once the parasite is released. This parasite adaptation may be the best way to find a body of water in a forest. I participated in sampling and performed several experiments of the study.

22. Gómez-Díaz E, Doherty P Jr, **Duneau D**, McCoy KD (2010) *Cryptic vector divergence masks vector-specific patterns of infection: an example from the marine cycle of Lyme borreliosis.* **Evolutionary Applications** doi.org/10.1111/j.1752-4571.2010.00127.x

We combine site-occupancy modelling and molecular assays to evaluate patterns of infection in the marine cycle of Lyme borreliosis. Our results show that bacterial detection varies strongly among tick races leading to vector-specific biases if raw counts are used to calculate *Borrelia* prevalence. Overall prevalence is higher than suspected and certain vector–host combinations likely contribute more than others to the local dynamics and large-scale dispersal of *Borrelia* spirochetes. I performed everything based on Sanger PCR.

23. Ponton***** F, **Duneau* D**, Sanchez M, Courtiol A, Terekhin A, Budilova EV, Renaud F, Thomas F (2009) *Effect of parasite-induced behavioral alterations on juvenile development.* **Behavioral Ecology** doi.org/10.1093/beheco/arp092

Many trophically transmitted parasites alters the behaviour of their intermediate host to favour transmission to definitive hosts. Shrimp juveniles remain inside the female marsupial brood pouch and are subject to the same risk of predation as their mothers. We explored the idea that juveniles from parasitized females would accelerate their development, or exit the marsupium at an earlier stage, to avoid predation by birds. But juveniles from parasitized females exited the marsupial brood pouch significantly later. This is the result of the equivalent to a honour thesis.

24. **Duneau D**, Boulinier T, Gomez-Diaz E, Petersen A, Tveraa T, Barrett RT, McCoy KD (2008) *Prevalence and diversity of Lyme borreliosis bacteria in marine birds* **Infection, Genetics and Evolution** doi.org/10.1016/j.meegid.2008.02.006

We studied the diversity of *Borrelia spp*. circulating in seabirds. Our findings indicate that Lyme disease spirochetes circulating in the marine system are more diverse than previously described and support the hypothesis that seabirds may be an important component in the global epidemiology and evolution of Lyme disease.

25. McCoy KD, **Duneau D**, Boulinier T (2008) *Spécialisation de la tique des oiseaux marins et diversité des bactéries du complexe* Borrelia burgdorferi sensu lato, *agents de la maladie de Lyme : effets en cascade dans les systèmes à vecteur.* **Les actes du BRG** 277-291 (french publication with reviewing committee)

Summary of the work in Duneau et al IGE 2008 for the colloquium BRG.

26. Ponton F, Lebarbenchon C, Lefèvre T, Biron DG, **Duneau D**, Hughes DP, Thomas F (2006) *How parasitic Gordian worms cut the Gordian knot: a novel solution to predation upon the host.* **Nature** doi.org/10.1038/440756a

As prisoners in their living habitat, parasites should be vulnerable to destruction by the predators of their hosts. We show that the parasitic hairworm is able to escape from the predators (fish or frog) of its insect hosts. I performed all the experiments with the frogs.

27. Ponton F, Lebarbenchon C, Lefèvre T, Thomas F, **Duneau D**, Marché L, Renault L, Hughes DP, Biron DG (2006) *Hairworm anti-predator strategy: a study of causes and consequences* **Parasitology** doi.org/10.1017/S0031182006000904

Following the ingestion of the insect host by fish or frogs, the parasitic hairworm is able to actively exit both its host and the gut of the predator. Using proteomics tools, we described the physiological basis of this anti-predator response. We also showed that the escaped response does not have a fitness cost.

28. Ponton F, Biron DG, Joly C, **Duneau D**, Thomas F (2005) *Ecology of populations parasitically modified: a case study from a gammarid (*Gammarus insensibilis*)-trematode (*Microphallus papillorobustus*) system.* **Marine Ecology-Progress Series** doi.org/ 10.3354/meps299205

We studied the consequence of behavioural manipulation by parasites on the ecology of host populations. We compared several biological characteristics of two discrete subpopulations, one living at the surface (infected individuals) and the other living near the bottom (uninfected individuals). Infected gammarids are not simply normal hosts with an aberrant behaviour, they are more deeply modified in ways that may substantially alter host population ecology.

Publications in BioRxiv

29. Rodrigues YK, van Bergen E, Alves F, **Duneau D***, Beldade P*. *Complex effects of day and night temperature fluctuations on thermally plastic traits in an experimental model of adaptive seasonal plasticity.* BioRxiv) (*equal contribution) doi.org/10.1101/207258

We tested the effects of circadian temperature fluctuations on a series of thermal plasticity traits in a model of adaptive seasonal plasticity, the *Bicyclus anynana* butterfly. The comparison of phenotypes of individuals reared under two types of fluctuations (warmer days with cooler nights, and cooler days with warmer nights) and those reared under a constant temperature of the same daily average allowed us to identify complex models of response to "day" and "night" temperatures. We found additive type effects (for body size), but also different types of "dominance" type effects where a particular period of the light cycle (for development time) or a particular extreme temperature (for wing spot size) had a relatively greater contribution to phenotype expression. We refute the hypothesis that thermal plasticity during development time is the reason for the thermal plasticity of other traits. I am co-director of this thesis, in particular for the data analysis.

30. **Duneau**† **D**, Altermatt F, Ferdy J-B, Ben-Ami F, Ebert D. *Estimation of the propensity for sexual selection in a cyclical parthenogen*. doi.org/10.1101/2020.02.05.935148.

Cyclic parthenogenesis, a strategy whereby organisms go through several cycles of clonal reproduction before a sexual event, is a very common form of reproduction. Although often ignored, sexual reproduction plays an important role in the evolution of cyclic parthenogenetic organisms. *Daphnia* is one such parthenogenetic organism in which sexual reproduction is rare in most populations. We have studied the sexual process in *Daphnia* natural populations. Our data clearly show that sexual selection is present in this species, although it is mainly parthenogenetic, and that this selection probably manifests itself through a combination of female choice and male competition.

31. **Duneau**† **D**, Möst M, Ebert D. *Evolution of sperm morphology in* Daphnia *species.* doi.org/10.1101/2020.01.31.929414

We measured the sperm of several species of *Daphnia*. We found that they have among the smallest sperm cells ever recorded. Based on a recent phylogeny, we showed that larger sperm seems to have evolved twice independently leading eventually in some clades to the loss of the encapsulation allowing for condensed cells in the spermiduct.

32. **Duneau**† **D**, Nicolas Buchon. *Gut cancer increases the risk for* Drosophila *to be preyed upon by hunting spiders*. doi.org/10.1101/2020.07.01.182824

We genetically induced colon cancer in Drosophila and found that cancerous flies are more predated by spiders than healthy ones.

Thesis chapters

1. Lafuente E, **Duneau D**, Beldade P. *Genetic architecture of plasticity for pigmentation components in* Drosophila melanogaster.

Using GWAS in *Drosophila*, we determined the genetic basis of thermal plasticity of body pigmentation. I supervised the student for the genomic analysis and for the validation of allele candidate with functional genetics.

2. Rodrigues YK., Duneau D†*, Beldade P†*. *Seasonal and sexual dimorphism in immunity in a thermal plasticity model.*

Using methods used in Duneau et al. eLife 2017 with *Drosophila*, we studied the phenotypic plasticity of the immune system of the butterfly, *Bicyclus anynana*. We found that as expected, females from winter morphs, that need to wait in nature for months before laying their eggs, are more resistant to bacterial infections than those of the summer morphs. The immune system of the males, who do not need to wait to fertilize females, was not phenotypic plastic.

Scientific communications

- **Invited talks**

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**
  - 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 Immuninv2017, 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

- 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*
- **Documentaire scientifique** (52min) « *Toto le nemato.* », Price Buffon 2008 « Festival Paris science »