David DUNEAU, PhD

Institute of Evolutionary Biology, Edinburgh, Scotland

: david.duneau@gmail.com

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

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

Total: 32 peer-reviewed publications of which 13 first author, 3 last and 13 *corresponding*
+ 3 in BioRxiv (2 first author, 1 last and 3 corresponding)
+ 2 thesis chapters (2 last and 1 corresponding)

Google scholar profile: https://scholar.google.fr/citations?user=VhsB4z0AAAAJ&hl=en

- H-index: 20
- Total citations: 1135

Publications († corresponding author; * equal contribution)

2020 to date:

1. **Duneau† D**, Buchon N (2022) *Gut cancer increases the risk for* Drosophila *to be preyed upon by hunting spiders*. Accepted in **Animal Behaviour** (Earlier version on BioRxiv: doi.org/10.1101/2020.07.01.182824)

Diseased individuals are more preyed upon than healthy individuals. Although this is intuitive, this conventional wisdom has been subjected more to speculation than to empirical study. To test the idea, we genetically induced colon cancer in *Drosophila* and found that cancerous flies are more frequently predated than healthy ones.

2. **Duneau† D**, Ferdy J-B (2022) *Pathogen within-host dynamics and disease outcome: what can we learn from insect studies?* Accepted in **Current Opinion in Insect Science** doi.org/10.1016/j.cois.2022.100925

I have been invited by Sophie Armitage (University of Berlin) and Barbara Milutinović (University of Münster) to review the latest knowledge on the connection between within-host pathogen dynamics and disease outcome.

3. Bonfini A, Dobson AJ, **Duneau D**, Revah J, Liu X, Houtz P, Buchon N (2021) *Diet composition plastically resizes the* Drosophila *midgut by affecting cell gain and loss, stem cell-niche coupling and enterocyte size.* **eLife** doi.org/10.7554/eLife.64125

We studied the phenotypic plasticity of *Drosophila* gut in response to glucose level in diet. Contribution: Performed the GWAS and all the statistical analyses of the paper.

4. Rodrigues YK, van Bergen E, Alves F, Beldade P*, **Duneau D*** (2021) *Additive and non-additive effects of day and night temperatures on thermally plastic traits in a model for adaptive seasonal plasticity.* **Evolution** evo.14271

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.

5. 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.

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

We evaluated the sexual dimorphism of *Drosophila* immune responses based on an exhaustive survey of studies on the immunity of this model. We highlighted that current theories are too generalist to have sufficient explanatory power, and so, generated a set of realistic, testable, hypotheses from which the NERC project derives.

7. 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/s41437020 -0332-x

Contribution: I discovered the alternative route of infection.

8. 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

Contribution: Helped in the analyses and writing as an evolutionary parasitologist knowing the immune system and the sexual dimorphism in diseases.

2019 and before:

9. 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

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

10. **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.

11. 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. Contribution: I supervised the genomic analysis and the validation of allele candidates with functional genetics.

12. **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

We showed that systemic infection with an extracellular bacterium can transverse life stages.

13. **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)

14. **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

We elucidated the mechanisms underlying the difference between sexes in infection outcome in *Drosophila*. We revealed that the Toll pathway, responsible for the sexual dimorphism in some human infectious diseases (e.g. HIV), also explains why female *Drosophila* are slower than males to control pathogen proliferation.

15. 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

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. Contribution: This manuscript is largely based on my PhD thesis.

16. **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 and concluded that *Daphnia* do not have immunological memory upon bacterial infections.

17. 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

Contribution: Showed with macrophotography that the inability of females to subsequently retain the ejaculate in their reproductive tracts after mating was frequent.

18. 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

Contribution: Designed and did most experiments together with the first author.

19. 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)

First times the genetic model of coevolution, the matching-allele model, was shown. Contribution: Performed all the attachment tests of this study (see Duneau et al. BMC Biol. 2011).

20. **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.

21. **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

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.

22. **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

We show that 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)

23. 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

Contribution: Performed all the attachment tests of this study Duneau et al. BMC Biol. 2011).

24. **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.

25. 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

Contribution: Participated in sampling and performed several experiments of the study.

26. 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

Contribution: Performed everything based on Sanger PCR.

27. **Duneau* D**, Ponton***** F, 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

We studied whether the juveniles of manipulated female *Gammarus* (i.e. with a high risk of predation) developed more rapidly in their mother's ventral pouch, a behaviour that could have been selected to reduce the juveniles' chances of predation; this is not the case.

28. **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 seabirds may be an important component in the global epidemiology and evolution of Lyme disease.

29. 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.

30. 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 the predators of their hosts. We show that the parasitic hairworm can escape from the predators of its hosts. Contribution: Performed all the experiments with frogs.

31. 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

Contribution: I designed the whole nursery for the hairworms and monitored all the mating to measure the fitness.

32. 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.

Publications in bioRxiv

33. **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

Our data from the field show that sexual selection is present in *Daphnia*, although it is mainly parthenogenetic, and that this selection probably manifests itself through a combination of female choice and male competition.

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

Based on a recent phylogeny, we identified that *Daphnia* had among the smallest recorded sperm and studied the evolution of sperm length in this clade.

35. Lafont P, Lauzeral P, Parthuisot N, Faucher C, Ferdy JB†*, **Duneau D†***. *A within-host infection model to explore tolerance and resistance*. doi.org/10.1101/2021.10.19.464998

By combining theoretical and empirical approach, we study within-host dynamics and provide an experimental way to decipher disease tolerance from resistance to explain individual differences in susceptibility to infection.

Thesis chapters or exist as draft

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. Contribution: 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 developed in Duneau et al. eLife 2017 with *Drosophila*, we studied the thermal phenotypic plasticity of the immune system of the butterfly *Bicyclus anynana*.