

# Florian Wünnemann

POSTDOC IN THE GROUP OF DENIS SCHAPIRO

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**Research and scientific interests:** Spatial OMICS, Cardiovascular disease, Human genetics, Bioinformatics, Machine Learning, Computer vision

## 🧪 Research experience

### University Hospital Heidelberg

POSTDOC IN THE SCHAPIRO LAB

Heidelberg, Germany

Jan. 2022 - ongoing

- Defining and modulating cellular neighbourhoods in myocardial infarction models using spatial OMICS technologies

### Montreal Heart Institute

POSTDOC IN THE LETTRE LAB

Montreal, Canada

Aug. 2018 - Aug. 2021

- Projects focused on high-throughput CRISPR screens, polygenic risk scores, genetics of heart valve disease and development of single-cell screens to investigate human cellular traits.

### Universite de Sherbrooke

PROFESSIONNEL RECHERCHE NIV. II

Sherbrooke, Canada

Jan. 2019 - Jan. 2022

- Part of the GenAP initiative ([www.genap.ca](http://www.genap.ca)) as single-cell expert, to include single-cell tools into the GenAP2 platform. Development of Galaxy tools, Rshiny applications and docker containers for single-cell analysis.

### IEB, University of Münster

STUDENT RESEARCH ASSISTANT

Münster, Germany

Sep. 2011 - July 2012

- Acquisti group: Analysis of genomes and metagenomes in the context of nutrient limitation and fertilization.

### IEB, University of Münster

STUDENT ASSISTANT

Münster, Germany

Mar. 2011 - May 2011

- Bornberg-Bauer group

## 🎓 Education

### University of Münster / CHU Sainte Justine Research Center

PH.D. (DR.RER.NAT) - LIFE SCIENCES

Münster, Germany / Montreal, Canada

Apr. 2014 - Apr. 2018

- Thesis title: The role of genetic factors in pathogenesis and progression of cardiac malformations

### University of Münster

MSc IN LIFE SCIENCES

Münster, Germany

Oct. 2011 - Feb. 2014

- Thesis title: Functional and genetic characterization of a novel arrhythmic syndrome

### University of Münster

BSc IN LIFE SCIENCES

Münster, Germany

Oct. 2008 - Sep. 2011

- Thesis title: Impact of nutrient limitation in insects: Comparative genomics of the pea aphid and the human body louse

## 💰 Funding History

WALTER-BENJAMIN POSTDOCTORAL POSITION, DEUTSCHE FORSCHUNGSGEMEINSCHAFT (DFG)

2022 - ongoing

POSTDOCTORAL TRAINING SCHOLARSHIP (CANADIAN CITIZENS AND PERMANENT RESIDENTS), FOND DE RECHERCHE QUÉBEC

SANTÉ (FRQS)

2019 - 2021

## Achievements and Awards

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|---------|--|------------------|
| 2021/06 | Poster prize: Prix Fonds de recherche du Québec (FRQS) (Recherche fondamentale doctorale / Postdoc)              | Montreal, Canada |
| 2019/06 | Best oral presentation award, 22nd Montreal Heart Institute research day   | Montreal, Canada |
| 2017/05 | Best oral presentation award, 32nd student congress at the CHU Sainte-Justine                                    | Montreal, Canada |
| 2016/05 | Markwald award for best oral presentation, Weinstein Cardiovascular Development and Regeneration Conference 2016 | Durham, USA      |

## Invited Presentations

### Resolve Biosciences - Immersive Spatial Biology Experience

Heidelberg, Germany

MOLECULAR CARTOGRAPHY HELPS REVEAL IMMUNE CELL INFILTRATION ROUTES AND THEIR MICROENVIRONMENTS DURING ACUTE MYOCARDIAL INFARCTION.

26.09 - 26.09

## Presentations

### American Society of Human Genetics (ASHG) Meeting 2019

Houston, Texas, USA

PRIORITIZATION OF GENOMIC LOCI FOR CORONARY ARTERY DISEASE USING TARGETED CRISPR SCREENS FOR ENDOTHELIAL DYSFUNCTION

15.10.2019 - 19.10.2019

### XXIle Journée de la recherche ICM

Montreal, Canada

VALIDATION OF GENOME-WIDE POLYGENIC RISK SCORES FOR CORONARY ARTERY DISEASE IN FRENCH CANADIANS

06.06.2019 - 06.06.2019

### 7th annual MGSE Symposium

Münster, Germany

SINGLE CELL LANDSCAPE OF MAMMALIAN HEART MATURATION

21.03.2018 - 22.03.2018

### American Society of Human Genetics (ASHG) Meeting 2017

Orlando, Florida, USA

IDENTIFICATION OF A NOVEL MARKER FOR VALVE MATURATION: LOSS OF ADAMTS19 FUNCTION CAUSES PROGRESSIVE VALVE DISEASE IN MICE AND MEN

18.10.2017 - 18.10.2017

### Congrès de la recherche des étudiantes des cycles supérieurs et des post-doctorants en recherche au CHU Sainte-Justine

Montreal, Canada

HEART VALVE DYSFUNCTION IN MEN AND MICE IS CAUSED BY LOSS OF FUNCTION MUTATIONS IN ADAMTS19, A NOVEL MARKER FOR VALVULAR INTERSTITIAL CELLS

26.05.2017 - 26.05.2017

### Weinstein Cardiovascular Development and Regeneration Conference 2016

Durham, North Carolina, USA

LOSS OF ADAMTS19, A NOVEL MARKER FOR VALVULAR INTERSTITIAL CELL POPULATIONS DURING VALVE MATURATION, CAUSES AORTIC VALVE DYSFUNCTION

18.05.2016 - 21.05.2016

### Evolgen, collaborative meeting on genome evolution

Ciężka, Poland

ACTRANDB: AN ONLINE DATABASE FOR ACANTHAMOEBA CASTELLANI TRANSCRIPTS,

27.06.2012 - 28.06.2012

### 2nd Muenster graduate school evolution symposium

Münster, Germany

BIOGEOCHEMISTRY MEETS MOLECULAR EVOLUTION VIA METAGENOMICS: TRACING NITROGEN FLUXES FROM ECOSYSTEMS TO GENOMES IN MICROBIAL COMMUNITIES

18.06.2012 - 19.06.2012

## Poster presentations

### XXIIIe Journée de la recherche ICM

Montreal, Canada

CRISPR PERTURBATIONS AT MANY CORONARY ARTERY DISEASE LOCI IMPAIR VASCULAR ENDOTHELIAL CELL FUNCTIONS

17.06.2021 - 17.06.2021

### Cold Spring Harbor Laboratories: The Biology of Genomes

Virtual

CRISPR PERTURBATIONS AT MANY CORONARY ARTERY DISEASE LOCI IMPAIR VASCULAR ENDOTHELIAL CELL FUNCTIONS

11.05.2021 - 14.05.2021

### Weinstein Cardiovascular Development and Regeneration Conference

Nara, Japan

A SINGLE-CELL PERSPECTIVE ON GROWTH AND MATURATION PATHWAYS IN THE MOUSE HEART.

16.05.2018 - 18.05.2018

### American Society of Human Genetics (ASHG) 2014

San Diego, California, USA

DE NOVO MUTATION IN SOX18 CAUSES A NOVEL FORM OF HYPOTRICHOSIS-LYPHEDEMA-TELANGIECTASIA WITH SEVERE VASCULAR DEFECTS

18.10.2014 - 22.10.2014

### 42nd Annual Meeting of the Ecological Society of Germany, Austria and Switzerland 2012

Lueneburg, Germany

SOIL METAGENOMICS TO UNRAVEL THE SIGNATURE OF FERTILIZERS ON THE MOLECULAR COMPOSITION OF THE BACTERIAL RIBOSOME

10.09.2012 - 14.09.2012

1. Lavertu-Jolin, M., Chattopadhyaya, B., Chehraz, P., Carrier, D., Wünnemann, F., Leclerc, S., Dumouchel, F., Robertson, D., Affia, H., Saba, K.others. (2022). Enhancing adult neuroplasticity by epigenetic regulation of parvalbumin-expressing GABAergic cells. *bioRxiv*.
2. Creason, A. L., Watson, C., Gu, Q., Persson, D., Sargent, L. L., Chen, Y.-A., Lin, J.-R., Sivagnanam, S., Wünnemann, F., Nirmal, A. J.others. (2022). A web-based software resource for interactive analysis of multiplex tissue imaging datasets. *bioRxiv*.
3. Lerma-Martin, C., Badia-i-Mompel, P., Flores, R. O. R., Sekol, P., Hofmann, A., Thaewel, T., Riedl, C. J., Wünnemann, F., Ibarra-Arellano, M. A., Trobisch, T.others. (2022). Spatial cell type mapping of multiple sclerosis lesions. *bioRxiv*.
4. Wünnemann, F., Tadj, T. F., Beaudoin, M., Lalonde, S., Lo, K. S., & Lettre, G. (2021). CRISPR perturbations at many coronary artery disease loci impair vascular endothelial cell functions. *bioRxiv*.
5. Churakov, G., Kuritzin, A., Chukharev, K., Zhang, F., Wünnemann, F., Ulyantsev, V., & Schmitz, J. (2020). A 4-lineage statistical suite to evaluate the support of large-scale retrotransposon insertion data to reconstruct evolutionary trees. *bioRxiv*.

## Publications

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1. Kuppe, C., Ramirez Flores, R. O., Li, Z., Hayat, S., Levinson, R. T., Liao, X., Hannani, M. T., Tanevski, J., Wünnemann, F., Nagai, J. S., Halder, M., Schumacher, D., Menzel, S., Schäfer, G., Hoeft, K., Cheng, M., Ziegler, S., Zhang, X., Peisker, F., ... Kramann, R. (2022). Spatial multi-omic map of human myocardial infarction. *Nature*, 1–12. <https://doi.org/10.1038/s41586-022-05060-x>
2. Biermann, J., Melms, J. C., Amin, A. D., Wang, Y., Caprio, L. A., Karz, A., Tagore, S., Barrera, I., Ibarra-Arellano, M. A., Andreatta, M., Fullerton, B. T., Gretarsson, K. H., Sahu, V., Mangipudy, V. S., Nguyen, T. T. T., Nair, A., Rogava, M., Ho, P., Koch, P. D., ... Izar, B. (2022). Dissecting the treatment-naïve ecosystem of human melanoma brain metastasis. *Cell*, 185(14), 2591–2608.e30.
3. Heckel, E., Cagnone, G., Agnihotri, T., Cakir, B., Das, A., Kim, J. S., Kim, N., Lavoie, G., Situ, A., Pundir, S.others. (2022). Triglyceride-derived fatty acids reduce autophagy in a model of retinal angiomatic proliferation. *JCI Insight*, 7(6).
4. Audain, E., Wilsdon, A., Breckpot, J., Izarzugaza, J. M., Fitzgerald, T. W., Kahlert, A.-K., Sifrim, A., Wünnemann, F., Perez-Riverol, Y., Abdul-Khalik, H.others. (2021). Integrative analysis of genomic variants reveals new associations of candidate haploinsufficient genes with congenital heart disease. *PLoS Genetics*, 17(7), e1009679.
5. Wünnemann, F., Ta-Shma, A., Preuss, C., Leclerc, S., Vliet, P. P. van, Oneglia, A., Thibeault, M., Nordquist, E., Lincoln, J., Scharfenberg, F.others. (2020). Loss of ADAMTS19 causes progressive non-syndromic heart valve disease. *Nature Genetics*, 52(1), 40–47.
6. Gould, R. A., Aziz, H., Woods, C. E., Seman-Senderos, M. A., Sparks, E., Preuss, C., Wünnemann, F., Bedja, D., Moats, C. R., McClymont, S. A.others. (2019). ROBO4 variants predispose individuals to bicuspid aortic valve and thoracic aortic aneurysm. *Nature Genetics*, 51(1), 42–50.
7. Luyckx, I., Kumar, A. A., Reyniers, E., Dekeyser, E., Vanderstraeten, K., Vandeweyer, G., Wünnemann, F., Preuss, C., Mazzella, J.-M., Goudot, G.others. (2019). Copy number variation analysis in bicuspid aortic valve-related aortopathy identifies TBX20 as a contributing gene. *European Journal of Human Genetics*, 27(7), 1033–1043.
8. Wünnemann, F., Sin Lo, K., Langford-Avelar, A., Busseuil, D., Dubé, M.-P., Tardif, J.-C., & Lettre, G. (2019). Validation of genome-wide polygenic risk scores for coronary artery disease in french canadians. *Circulation: Genomic and Precision Medicine*, 12(6), e002481.
9. Preuss, C., Wünnemann, F., & Andelfinger, G. (2017). At the heart of a complex disease “molecular genetics of congenital heart disease.” *eLS*, 1–9.
10. Gillis, E., Kumar, A. A., Luyckx, I., Preuss, C., Cannaerts, E., Van De Beek, G., Wieschendorf, B., Alaerts, M., Bolar, N., Vandeweyer, G.others. (2017). Candidate gene resequencing in a large bicuspid aortic valve-associated thoracic aortic aneurysm cohort: SMAD6 as an important contributor. *Frontiers in Physiology*, 8, 400.

11. Wünnemann, F., Kokta, V., Leclerc, S., Thibeault, M., McCuaig, C., Hatami, A., Stheneur, C., Grenier, J.-C., Awadalla, P., Mitchell, G. A.others. (2016). Aortic dilatation associated with a de novo mutation in the SOX18 gene: Expanding the clinical spectrum of hypotrichosis-lymphedema-telangiectasia syndrome. *Canadian Journal of Cardiology*, 32(1), 135–e1.
12. Preuss, C., Capredon, M., Wünnemann, F., Chetaille, P., Prince, A., Godard, B., Leclerc, S., Sobreira, N., Ling, H., Awadalla, P.others. (2016). Family based whole exome sequencing reveals the multifaceted role of notch signaling in congenital heart disease. *PLoS Genetics*, 12(10), e1006335.
13. Wünnemann, F., & Andelfinger, G. U. (2016). Molecular pathways and animal models of hypoplastic left heart syndrome. In *Congenital heart diseases: The broken heart* (pp. 649–664). Springer, Vienna.
14. Chetaille, P., Preuss, C., Burkhard, S., Côté, J.-M., Houde, C., Castilloux, J., Piché, J., Gosset, N., Leclerc, S., Wünnemann, F.others. (2014). Mutations in SGOL1 cause a novel cohesinopathy affecting heart and gut rhythm. *Nature Genetics*, 46(11), 1245.

## Computational skills

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- **General:** GWAS analysis, Exome/Genome variant calling, Plink, bedtools, Image analysis (Fiji, Napari, QuPath)
- **R:** Rshiny application development, Rmarkdown, Package development, OMICS data analysis (RNA-seq, single-cell OMICS), reticulate
- **Python:** Jupyter notebooks, basic computer vision applications, single-cell OMICS analysis
- **Containers:** Docker container creation, Singularity usage, Nextflow workflow creation and execution
- **Galaxy project:** Creation of galaxy tools and wrappers, setup of <https://spatialomics.usegalaxy.eu/>

## Languages

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- German (mother-language)
- English (fluent)
- French (fluent)
- Spanish (Beginner)