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Communications

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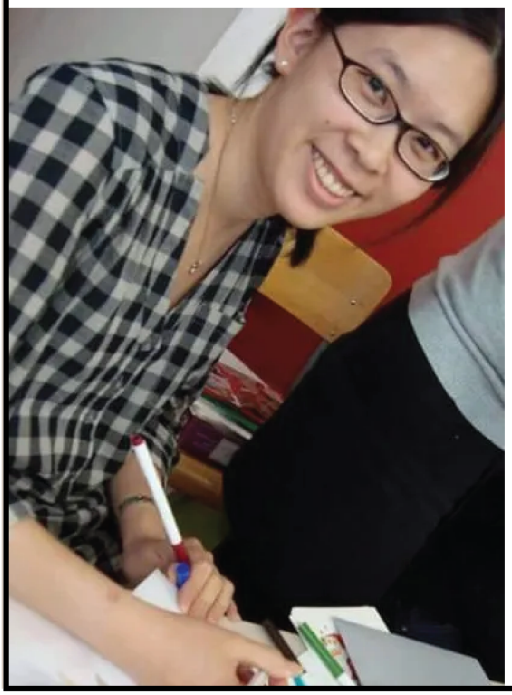
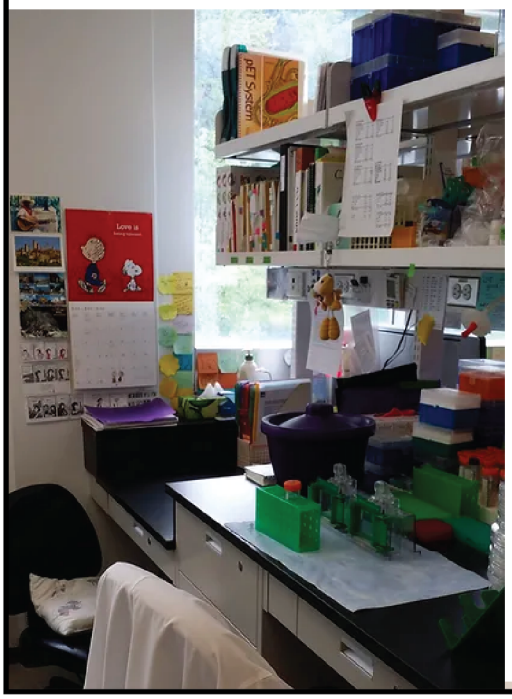


Events

Event Organizer

Research

Molecular Biologist & Biochemist



EDLYN WU • *Portfolio*

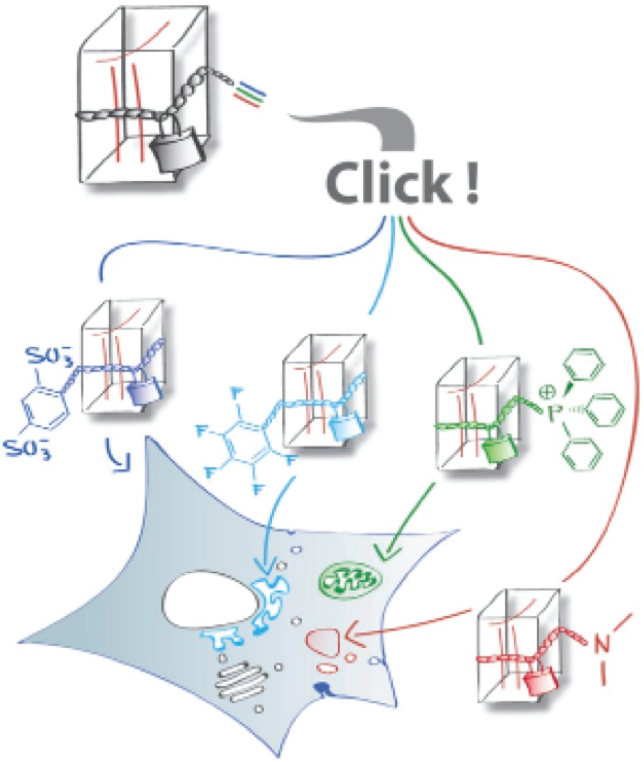
Communications

- Press releases & Newspieces
- Newsletter articles
- Website (blogs, visuals)
- Teaching

04.10.2018

Click, Light, Action!

"Click Cage" - A new tool for controlling lipid levels



© Wagner et.al. / MPI-CBG

The inside of our cells is organized into many different compartments, called organelles, each carrying out special functions. Most of these structures are separated by membranes from the cytosol. Lipids are the main building blocks of membranes. They can also act as chemical messengers between cells and organelles, causing functions like cell growth or stress responses. To study lipid function, caged lipids have been particularly useful for scientists. This method involves attaching a chemical group ("cage") to the native lipid that can be cleaved off ("uncaged") when activated by light, thereby releasing the lipid from the membrane and into the cell. A major limitation in this design is that lipid uncaging affects all membranes. Therefore, if one wants to study lipids in a particular compartment inside the cell, there's no existing approach to do this via lipid uncaging.

In their study published in Angewandte Chemie International Edition, the journal of the German Chemical Society (Gesellschaft Deutscher Chemiker), the research group of ▸**André Nadler** at the Max-Planck-Institute of Molecular Cell Biology and Genetics (MPI-CBG) has now developed a new tool that allows for the uncaging and release of lipids in specific organelles. With this new "Click Cage" tool, scientists can attach (or "click") a functional group targeting an organelle-of-interest to the existing caged lipid. Now, when this clicked and caged lipid is loaded to cells it accumulates in the respective organelle where the native lipid can be liberated for further action. What type of action? Together with ▸**Doris Höglinger** at the ▸**Heidelberg University Biochemistry Center** (BZH), they showed that this targeted uncaging of lipids is followed by a direct effect on intracellular calcium levels. "We can now control where in the cell lipids can be uncaged, look at the type of signal it can trigger, such as calcium response, and directly compare the calcium levels after a concentration burst of a native lipid in different compartments of a cell", says Nicolai Wagner, the first author of this study.

The "Click Cage" represents a major step to study lipid function in cellular processes with great precision. "This method is beneficial for researchers that want to study signaling lipids in living cells," says Andre Nadler. "With this tool, we and others can continue to shine the spotlight on lipids."

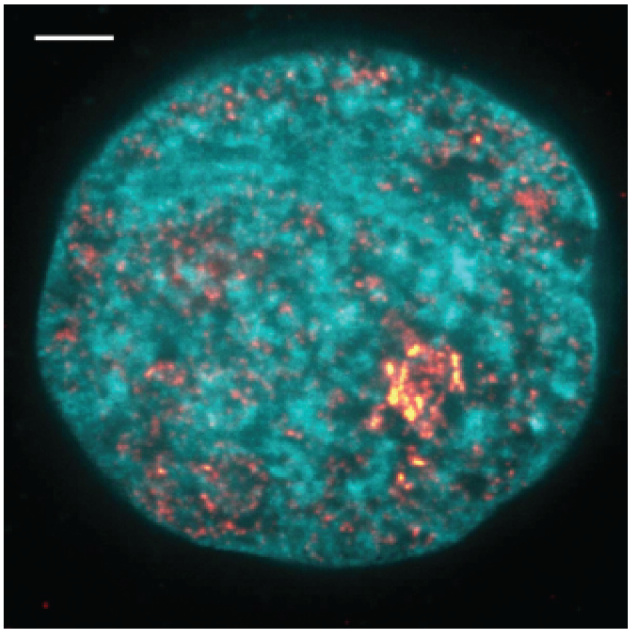
Original Publication

Nicolai Wagner, Milena Stephan, Dr. Doris Höglinger, Dr. André Nadler: ▸**A Click Cage: Organelle-Specific Uncaging of Lipid Messengers**. Angewandte Chemie International Edition, 26 July 2018

02/03/2021

Organizing genetic material into pockets

International research team identifies how the cell nucleus structures active and inactive DNA.



Super-resolution microscopy image of the transcribing nucleus. DNA and transcribing polymerases are shown in blue yellow colors respectively. Scale bar 2 microns. © Hilbert et al. / MPI-CBG

All life begins with one cell. During the development of an organism, cells divide and become specialized, yet each cell nucleus contains the same hereditary material. Our DNA is tightly packed to fit into the nucleus of every cell. From our genetic library, products like RNA and proteins are made and they serve as molecular machines and structural components for many processes happening inside our cells. The first step towards these products is a process called transcription, by which the instructions in our DNA are used to construct a functional product. So far it was not clear how places for transcription activity in the cell nucleus are established. The international collaborative research team of the Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG), the Max Planck Institute for the Physics of Complex Systems (MPI-PKS) and the Center for Systems Biology (CSBD), all located in Dresden, together with Tokyo Institute of Technology in Japan, led by Nadine Vastenhouw and Vasily Zaburdaev, now found how the genetic material gets organized into active and inactive pockets within the nucleus, how those pockets for transcription are established and how this pattern can be explained by a physical model.

In eukaryotes, the genetic material stored in DNA is packaged inside cell nuclei. In a process known as transcription, which also happens in nuclei, pieces of DNA are copied and transcribed into RNA, or transcript, that carries the information needed to build a protein. Transcription is a basic cellular process in gene expression and requires tight control to produce functional products at the appropriate place and time for proper cell function and development of an organism. It has been known for a long time that there are defined areas in the nucleus containing either transcriptionally active or inactive DNA. However, it was unknown so far how the genetic material, the DNA, is being sorted into active and inactive areas and how those areas of gene expression activity are established.

An international research team from the MPI-CBG, the ▸MPI-PKS, the ▸CSBD and the ▸Tokyo Institute of Technology in Japan worked together to investigate this unsolved question and published their results in the journal Nature Communications. They took an interdisciplinary approach, combining cutting-edge super-resolution microscopy and theoretical models that allowed the researchers to go deep into the zebrafish cell nucleus and observe DNA and RNA transcripts in time and nuclear space during the transcription process. They saw that the DNA, which is initially evenly distributed in the cell nucleus, established a finely structured pattern in the nucleus with the appearance of RNA transcripts. Nadine Vastenhouw, who supervised the study explains: "When the cell goes from a state of no transcription activity to an active state, we saw distinct areas of highly compacted DNA. In addition, we also saw pockets with almost no DNA which were instead occupied with RNA that was created during transcription. This emerging pattern means that the RNA made through transcription can organize DNA into an "active" pocket, such that inactive DNA is pushed out." The transcription process prevented the full separation of these pockets though. ▸Vasily Zaburdaev, the co-supervising author and now located at the ▸Friedrich-Alexander-Universität Erlangen-Nürnberg and the ▸Max-Planck-Zentrum für Physik und Medizin, adds: "To us it looked as if DNA and RNA tried to avoid each other, just like water and oil do not like to mix. The two phases are connected by the active DNA. Just like soap added to a mixture of oil and water would cause the formation of multiple small bubbles, known as an emulsion."

The first author of the study, Lennart Hilbert, was formerly a postdoctoral researcher in the groups of Nadine Vastenhouw (MPI-CBG) and Vasily Zaburdaev (MPI-PKS) and is now located at the ▸Karlsruhe Institute of Technology (KIT). He explains: "Our work, in the language of theoretical physics, now could explain how the cell nucleus sorts active and inactive genes into different compartments, a phenomenon known to cell biologists for several decades. The collaborative environment at the Dresden institutes was decisive in this endeavor, allowing us to apply some of the most advanced microscopy techniques to zebrafish embryos, and combine them with biophysical model simulations."

▸Nadine Vastenhouw, now located at the ▸University of Lausanne in Switzerland, gives an outlook: "Transcription is a fundamental process in biology. To ensure that our genome is properly read and the right products are made, the genome and the machinery needed at each step have to be highly organized in nuclear space. Our study provides an important step towards understanding how DNA and transcription activity is organized, so that the appropriate products are made, cells take up the right fate and collectively become the right tissue, and the organism can develop normally."

Original Publication

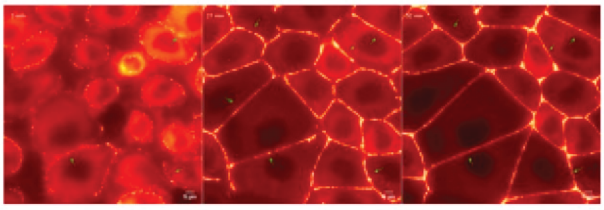
Lennart Hilbert, Yuko Sato, Ksenia Kuznetsova, Tommaso Bianucci, Hiroshi Kimura, Frank Jülicher, Alf Honigmann, Vasily Zaburdaev, &, Nadine L. Vastenhouw: ▸"Transcription organizes euchromatin via microphase separation", Nature Communications, 01. March 2021.

▸Doi: 10.1038/s41467-021-21589-3

05/11/2019

How cells stick together tightly

Dresden researchers uncover self-organization of tight junctions, the glue between cells.



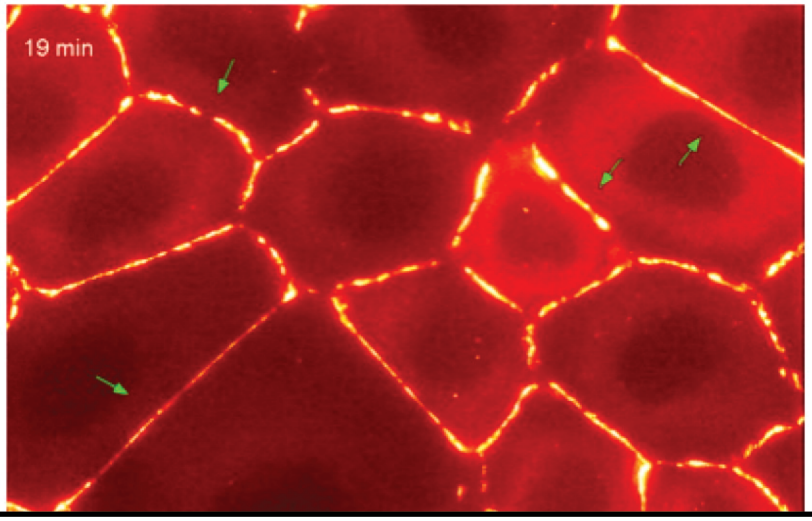
Formation of the tissue barrier: One of the proteins required to make the tight junction was labeled with a fluorescent dye. Using fluorescence microscopy, the labeled proteins were observed live. Copyright: Beutel et al.

Our organs are specialized compartments, each with its own milieu and function. To seal our organs, the cells in the tissue must form a barrier which is tight even down to the level of molecules. This barrier is formed by a protein complex that "sticks" all the cells together without any gaps. The loss of this barrier can lead to many diseases, including the infiltration of pathogens into our internal system. Since maintaining the tissue barrier is central to our organ functions, it is important to understand how this barrier is created between cells. Researchers at the ▸ Max Planck Institute for Molecular Cell Biology and Genetics (MPI-CBG) in Dresden discovered that cells use a process similar to condensation of water droplets on a cold window to form cell junctions. Specific proteins condense as droplets on the cell membrane when neighboring cells touch. These droplets enrich all the components required to create a stable barrier between cells. The results are published in the journal Cell.

The surface of our organs is lined with a layer of epithelial cells. These cells play an important role in protecting our organs, adapting them to a changing environment, and transporting molecules in and out of tissues. What seals epithelial tissue are tight junctions that act as the molecular barrier between cells. A key question for scientists was how this molecular complex robustly assembles between cells. The team around MPI-CBG research group leader **▸ Alf Honigmann** set out to piece together the building blocks that could explain how tight junctions are built.

One key building block of tight junctions is the family of ZO proteins which are located on the inside of cells. Using a combination of tissue imaging, gene editing, and biochemistry, the researchers found that the proteins inherently contain regions that allow them to stick to one another and form droplets on the membrane of epithelial cells. This ability allows the ZO proteins to become more concentrated and to selectively sequester adhesion proteins, needed for tight junction assembly. Oliver Beutel, the first author of the study, explains: "This process is somewhat similar to the phenomenon of water condensing on a cold glass window, spontaneously forming liquid droplets and streams. In the case of tight junctions, the ZO proteins condense on the inside of epithelial cell membranes to form a hub where all the necessary components can be encapsulated to assemble into a tight junction." These findings suggest that the properties of ZO proteins can serve as a template to reconstruct the architecture and function of tight junctions.

Alf Honigmann, the supervisor of the study, concludes: "This study reveals an important mechanism, which epithelial cells use to establish tight junctions. Our work on this protein machinery exemplifies the principles how cells leverage simple physical phenomena like condensation to assemble complex molecular structures." He adds: "Our findings imply exciting possibilities how junctions can quickly remodel during tissue growth and repair."



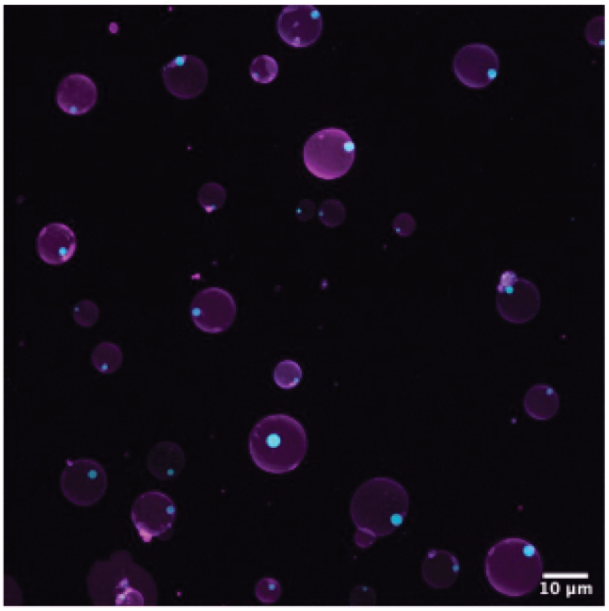
Original Publication

Oliver Beutel, Riccardo Maraspini, Karina Pombo-García, Cécile Martin-Lemaitre, Alf Honigmann: **▸ "Phase Separation of Zonula Occludens Proteins Drives Formation of Tight Junctions"** Cell, 31. October, 2019, **▸ doi: https://doi.org/10.1016/j.cell.2019.10.011**

22/01/2020

Let's build a cell

Dresden researchers engineer a minimal synthetic cellular system to study basic cell function



Synthetic cells with compartments. Magenta shows the lipid membrane, cyan shows the fluorescently tagged membrane-free sub-compartments. Copyright: Love et al. / MPI-CBG

Cells are the basic unit of life. They provide an environment for the fundamental molecules of life to interact, for reactions to take place and sustain life. However, the biological cell is very complicated, making it difficult to understand what takes place inside it. One way to tackle this biological problem is to design a synthetic minimal cell as a simpler system compared to biological cells. Researchers at the Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG) in Dresden and the ▸Max-Planck-Institute of Colloids and Interfaces (MPICI) in Potsdam accomplished such an engineering challenge by building a synthetic cell that can encapsulate fundamental biochemical reactions. They also show that such a minimal system can respond to changes in environment. The results are published in the journal Angewandte Chemie International Edition, the journal of the German Chemical Society.

Cells make up the basic building blocks of life. They provide a distinct and dynamic environment for the organization of molecules and reactions that are needed to sustain life. Inside the cell there are countless molecules including DNA, proteins, sugars, and fats (lipids) that need to come together in different ways. To understand, how cells organize all these components to function in a complex environment, scientists have been building synthetic cells with fewer components to engineer simple systems that mimic certain cellular processes. This research field of synthetic biology combines engineering and biology and focuses on taking parts of the natural biological system and simplifying it.

Despite much progresses in the synthetic biology field, building dynamic systems is still very difficult. The research team, funded through the MaxSynBio network, made up of MPI-CBG research group leader Dora Tang in collaboration with MPICI research group leaders Rumiana Dimova and Tom Robinson have now accomplished this engineering challenge and built a synthetic cell that can react to changes in the environment. The researchers constructed a compartment with a membrane that contains a membrane-free sub-compartment inside it. This sub-compartment can assemble and disassemble depending on changes to the environment. The key challenge during this process was to create a sub-compartment from molecules that were floating within the synthetic cell. These cells were visualized by fluorescence microscopy. Celina Love, the first author of the study, explains: "Just like our taste buds can let us experience tastes that are salty or sour, components inside a cell can also respond to the acidity (pH) of an environment. We found that by changing the pH of the environment, we can affect the behavior of molecules coming together and their ability to form sub-compartments. It was especially exciting to see how chemical reactions could be switched on and off by changing the acidity within the synthetic cell."

Dora Tang, the supervisor of the study, gives an outlook: "Our work is a major step forward in the design of more complex synthetic cells that can mimic biological behaviors." She adds: "This tunable synthetic system presents exciting possibilities in addressing fundamental questions in biology, such as how cells integrate a multitude and variety of signals from the environment to perform and tune basic cellular functions such as metabolism."

Original Publication

Celina Love, Jan Steinkühler, David T. Gonzales, Naresh Yandrapalli, Tom Robinson, Rumiana Dimova, T.-Y. Dora Tang: "Reversible pH-responsive coacervate formation in lipid vesicles activates dormant enzymatic reactions" Angewandte Chemie, International Edition, 14. Januar, 2020. ▸ **doi.org/10.1002/anie.201914893**

The Opening of the Lise-Meitner-Gesellschaft Dresden Chapter

-Edlyn Wu -

Dresden is home to many research institutes, in disciplines that span across science, technology, engineering and mathematics (STEM). Lingering in the shadows of the success in many workplaces and still in today's society, are ongoing struggles and discrimination against women, non-binary people, and minority groups. There is still an obvious gender imbalance in STEM, and an under-representation of women in leading roles and positions.

Established in 2016, the Lise-Meitner-Gesellschaft (LMG) is a non-profit organization in Germany that gathers young researchers committed to improving equal opportunities for women and minority groups in STEM. It also aims to provide a network and promote careers within and outside academia. The society has four regional groups: Berlin, Hamburg, and as new 2018 additions Dresden and Leipzig.

The Regular's Table

Over this summer, Celina Love, a PhD student in the Tang lab, and Lucia Rotheray, a PhD student at TU Dresden at the Department of Mathematics, initiated the LMG Dresden group. On September 19th, 2018, the two opened the LMG Dresden chapter with a gathering at a cafe in Altstadt. What got the two students involved in this initiative? "I learnt about the LMG at the I, Scientist conference (see below). I saw there was an opportunity to start a group here in Dresden", says Celina. Through the LMG network, she connected with Lucia to kickstart the Dresden LMG group. She continues: "We want to raise awareness of these social unconscious biases in our society that are affecting young talented scientists from being recognized for their performance and efforts, preventing them from reaching their goals."

For each meeting, the duo has a theme for discussion, which thus far have included: everyday sexism, and how to combat sexism in society and in the workplace. "I liked how the diversity of the people in attendance, in terms of career and different stages of life. The LMG really provides a platform for people to exchange experiences about different situations one may or has encountered in daily life, or at work" says Ksenia Kuznetsova, a PhD student in the Vastenhouw lab.

photo: private

Lucia Rotheray and Celina Love

On December 18th, LMG-Dresden will wrap up the year with a social gathering in time with the holiday spirit. What can the group and future members expect in 2019? "We plan to kick off 2019 with a bigger meeting, where we will propose some action plans to support the initiative. In addition to our regular meetings, we'd like to start some workshops, invite speakers, and also do some charity work more connected with the community," says Celina.

I, Scientist: a moving platform for scientists

In addition to these regional 'Stammtisches', the LMG has been organizing I, Scientist, a yearly conference since 2017, which brings together researchers across different fields of research in both academia and industry. The conference focuses on three themes: gender, career paths, and networking. From MPI-CBG, both Celina and Florian Oltsch, a predoc in the Zechner lab, attended this year's conference held in Berlin. Celina reports: "I, Scientist felt more than just a conference. There were some very personal and moving talks. It was very cool to be sitting in a room with almost entirely women. This doesn't very often happen. You take a lot of energy from it." And for Florian: "The practical tips given at the meeting were very useful. Gender equality is not a one-sided issue but affects men as well. It's important to have mutual understanding of ongoing issues regardless of your gender or your origin."

Frauenzimmer

At the MPI-CBG, the Frauenzimmer Stammtisch also shares similar aims. It was initiated in 2012 by Elisabeth Knust and former MPI-CBG group leader Karla Neugebauer and is currently organized by Gloria Slattum, a postdoc in the Knust lab. Group members meet invited female speakers after their Thursday's seminars. The group meet for lunch in an informal setting where postdocs and students hear and ask questions about science, career options and career progression. Speakers are typically very generous in sharing their personal experiences from their career journeys. Interestingly, in 2018, for the first time in the history of Frauenzimmer, men were also invited to participate in the conversation. The group value working together in issues that concern both genders. The new format has brought exciting new insides and an opportunity to hear both sides united in one room.

Next gathering:

Meet Eugenia Padini from the University of Bristol UK on January 17th, 2019.
Lunch from noon – 13:00 MPI-CBG.
Please contact Gloria Slattum for details at *slattum@mpi-cbg.de*

Save the date:

The next I, Scientist conference will take place on September 20-21, 2019 in TU Berlin.

I, SCIENTIST
Conference | Gender, career paths & networking

The LMG group in Dresden welcomes everyone to join their monthly Stammtisch. If you are interested in joining or for more information, please contact Celina (*love@mpi-cbg.de*) or email *dresden@lise-meitner-gesellschaft.de*

LISE MEITNER GESELLSCHAFT E.V.

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From the CBG to the CIG

In 2012, Nadine Vastenhouw left Boston after finishing her postdoc at Harvard University and moved to Dresden to start her group leader position at the MPI-CBG. Eight years later, in the midst of the second wave of the COVID-19 pandemic, Nadine and her group packed up and moved to Lausanne, Switzerland, where she is now an Associate Professor at the University of Lausanne (UNIL). Speaking from her office at the Center of Integrative Genomics (CIG), with views onto Lac Léman and of the Alps, Nadine sat down with her postdoctoral fellow Edlyn Wu to reflect on her MPI-CBG chapter, moving during COVID, and settling in Switzerland.

You and your group packed up the lab and moved to Lausanne just as the CBG entered a second lockdown before the Christmas holidays. How difficult was it to not bid a fond farewell to the city and institute you called home for the past eight years?

Very difficult! We did plan on having a farewell party. We thought of making use of the outdoor tent at the entrance of the CBG and turning it into the VASTENHAUS. And people could visit us to say goodbye. But COVID disrupted those plans, so we were sad not to be able to socialize and say our goodbyes in the way we imagined.

What do you miss most about MPI-CBG? Dresden?

I miss the people at the CBG and how we would interact. The CBG is clearly built for interactions, which I really enjoy and it was also one of the main reasons why I chose the CBG to start my group. I also miss our tight-knit RGL group. And of course, I also miss Sabrina Pralow (now in the Rodenfels lab), who was with me from the very beginning of my Dresden chapter.

For Dresden, I loved how it was easy to get around. I miss the views of the Elbe River and walking and biking in the Elbwiesen. Dresden is bigger than Lausanne, and it feels more open, spread out, and spacious – you can look far into the distance. I do love the mountains here in Lausanne, they are so close! Yet if you are in the city, everything is on a slope, so it is more cumbersome to get around.

How would you describe your first six months in Lausanne?

It is going quite well! Looking back at our moving transition, we came from a situation in Dresden where we couldn't all go to the lab all the time. When we moved to the CIG, we were able to do so. So, I felt we had a good momentum to kickstart the lab and to get ourselves settled. It was also good for lab bonding to all be here at the same time. Occasionally, I get asked about how it was to move during COVID times. My answer: I have never moved a lab without COVID. So, I have no comparison. I think that had we moved during normal times, I would have been more pre-occupied with connecting to people at the institute. Since COVID limited such interactions, I was more focused on getting our lab here and getting it up and running. Perhaps it was beneficial that we moved under the circumstances, and it felt somewhat staged. Now, with the COVID situation getting better, we have time to interact with people and enjoy beautiful Switzerland. I love living here. However, the biggest struggle is the French language. I am learning, but it is slow.

What are you looking forward to here at CIG? In Lausanne?

Vacation! I am looking forward to exploring more of Switzerland and getting to know Lausanne better. With my little boy, it can be difficult and it takes more time.

At the CIG, now that the lab has settled, I'm looking forward to interacting with more people. We have resumed our lab meetings in person for about three months now. I hope the same goes for internal seminars and some of our meetings with other research groups, to stimulate more dynamic discussions and to meet our colleagues in person rather than through zoom. Also, we haven't celebrated our arrival here yet. So, we still don't know many of our colleagues at the institute. A great way to celebrate would be at the annual institute retreat in September.

How did your first day at the CIG compare to your first day at the CBG?

I remember very vividly my first day at the CBG. I was arriving on May 1st, 2012 and Caren Norden had notified me beforehand that it was a holiday and shops would be closed. She asked me for my shopping list. When I arrived to the CBG, I saw my grocery basket sitting on my desk. Since then, Caren and I hang out together every 1st of May to celebrate our first encounter.

As for my start at the CIG, it felt more diffused. I arrived during the Christmas holidays and had to come into the institute to take care of the fish room. The image I have of my real first day at the CIG is the moving truck arriving from Dresden with all of our boxes from the lab. It arrived on January 5th early in the evening. We transported those boxes to the lab, unpacked them, and had a sushi dinner together in the conference room to celebrate our move.

How do you feel about being the first zebrafish lab at the CIG? You have quite a big task in setting up the fish facility.

It is definitely a change. Both at the CBG and at Harvard, I felt well-cushioned and our fish were well-taken care. So, I had to learn how to build the facility. It forced me to think about all the things needed for a fish facility. At the moment, we have built a small fish room for our lab. And we have plans and financing to build the big fish facility for the institute. What is interesting is that there clearly is a strong push for the use of zebrafish in Switzerland. I see zebrafish becoming a more important model organism over time. So, it's nice to be at the leading edge of that. And it has already brought on some new interactions and potential collaborations. Some groups are attracted to the model and want to use zebrafish for their work.

I want to also acknowledge the Fish Facility of the École Polytechnique Fédérale de Lausanne (EPFL) next door. So, we are not completely alone here. Without them, it would have been difficult to settle in, since they hosted our fish that we brought over from Dresden.

When you settled in Dresden, you came alone and moved all the way from Boston. To Lausanne, it was a move with the whole family. How exciting was it for you and the family?

Both experiences were different. When I moved to Dresden, I was excited to explore the city that would be my home for the next eight years. I do enjoy the process of moving and the energized feeling to discover new things alone and even more when Joeri, my then-partner, moved. It is also easier to move with a family because you get to do all the above together. But the little one has inhibited our schedule a bit, so I haven't been able to give myself some time to explore Lausanne yet, just playgrounds.

I would also like to give a shout out to the CBG International Office. Not just for settling into Dresden, but throughout the time I was in Dresden. They've done so much for us.

There are quite a few CBG Alumni in Switzerland. Are you excited to be reunited with them?

With Andy Oates (*group leader from 2003-2013, now at EPFL*), I have been in touch with him, as well as with his former postdoc, Guillaume Valentin (*now managing the EPFL Fish facility*) for bringing our fish over from Dresden and also to learn more about building and maintaining a fish facility.

I just wrote a grant with a bunch of CBG alumni: Martin Weigert (*postdoctoral fellow in Gene Myers group, now at EPFL*); Lucas Pelkmans (*postdoctoral fellow in Marino Zerial group, now at the University of Zurich*); Markus Gonzales Gaitan (*group leader from 2000-2006, now at the University of Geneva*).

It was a lot of fun and it was a scientifically-enriching experience to discuss science from so many angles.

Looking back on your move and reflecting on your time in Dresden, any parting advice or words of wisdom for people moving with the lab or to newcomers to MPI-CBG?

Don't be afraid to reach out. We've asked friends and colleagues who have moved to share their experience and tips. Before we moved, we also reached out to our future colleagues at the CIG and bombarded them with questions related to moving to Switzerland and life at the CIG. It was nice to already connect with them before we moved. Another tip: I would advise to pack your paraphernalia and any little things that may have sentimental and/or practical value. You'll start to feel at home much quicker. And last advice: hire a local technician, they know everyone at the institute and are resourceful.

Personally, the moving preparations and the moving itself went overall smoothly. If you have animals to move, it does bring on some stress. The biggest hassle for us was customs, as we were moving to Switzerland. So, if you are moving across international borders, familiarize yourself with the customs regulations or have people who can help you with this, that way it'll help in minimizing downtime and disruptions.

To newcomers to the CBG: take advantage of the interactive nature of the institute and appreciate all the services CBG has to offer. Be inspired by the various approaches and the diversity of science that will expand your horizons. Wherever you go, spread and continue the CBG mentality of interacting with people.

Edlyn Wu

edlynwu · Jun 4

Zebrafish Meets World

Updated: Jun 5

On June 3 and 4, 2023, the University of Lausanne (UNIL) opened its door to the public for **Les Mystères de l'UNIL**. Across the university campus, people of all ages participated in various activities (tours, workshops, animations) organized by the university, students, research labs, and facilities to discover the mysteries of science.

This year marks the first time the Vastenhouw Lab took part in this event. Families and children got a tour of our Fish Unit, where they had the opportunity to follow **Gilles** and **Noémie** and learn about zebrafish, its use in research, and animal welfare. Visitors also had the chance to look at the early development of zebrafish under the microscope.

Thank you all for visiting us and we look forward to seeing you again next year!

edlynwu · Jul 19

Fish and Kids

On July 19, 2023, we welcomed a young audience. Fifteen four-year olds went on an outing to the CIG to learn about the zebrafish.

Alicia, Dora, and Edlyn led several activities in the conference room, giving the children their first "pipetting" experience, colouring in zebrafish pulling on chromatin, and doing arts & crafts to make their own happy colourful fish.

Nadine shuttled the kids in small groups to meet the zebrafish. Pedro, technician of the Fish Unit, gave the kids a tour of the fish room, where they had the opportunity to see the zebrafish up close and under the microscope.

Looking forward to introducing zebrafish to more people!

Check out some photos from our fish & kids afternoon:

Dora, Alicia, and Edlyn setting up the conference room.

And here they come!

Interested in doing similar activities? Here are some ideas:
Fish arts & crafts: https://www.instagram.com/p/CuJcsXOOi-D/?img_index=1
Drawing/colouring template:

Zebrafish_chromatin_colouring.pdf
Download PDF • 332KB

edlynwu · Jun 14, 2022

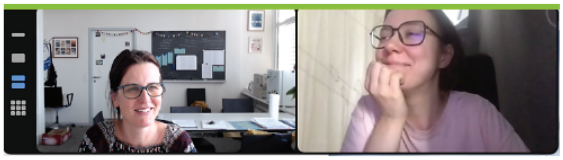
Check out Ksenia's PhD work on bioRxiv!

It has been a busy first-half of 2022 for Ksenia. From thesis writing to thesis submission, followed by manuscript compilation and submission for review, Ksenia's PhD work is now on bioRxiv!

In her very first first-author manuscript, Ksenia addresses the question of how the transcriptional machinery comes together to form transcription bodies in the nucleus. Taking advantage of two prominent transcription bodies that form in the early zebrafish embryo, Ksenia set out to characterize the dynamics of how these transcription bodies form. Using a combination of genetics and imaging, Ksenia found that these bodies are enriched for initiating and elongating RNA polymerase II. The transcription factors, Nanog and Sox19b, also are enriched in these transcription bodies and cluster in a sequential manner: Nanog clusters first, and this is required for the clustering of Sox19b and the initiation of transcription. Through a series of Nanog mutant analysis, Ksenia discovered that both the DNA-binding domain, as well as one of the two intrinsically disordered regions of Nanog are required to organize the two bodies of transcriptional activity.

For in-depth reading and to grasp how clustering of transcription factors dictates the formation of transcription bodies, check out the manuscript:
https://www.biorxiv.org/content/10.1101/2022.06.13.495463v1

Other Vastenhouwies, Martino and Edlyn, also make an appearance in the manuscript. This work was a collaboration with Yuko Sato, Haruka Oda, and Hiroshi Kimura (the Kimura lab at the Tokyo Institue for Technology, Tokyo, Japan thank you for the Fab-ulous Fragmented Antibodies, Fabs) and Manan Lalit and Florian Jug (the Jug lab at the Human Technology, Milan, Italy for imaging analysis support).



Happy faces and moment of relief following paper submission

publications

edlynwu · Oct 20, 2022

A Night at the Museum

PostNatural History n.
1. the study of the origins, habitats, and evolution of organisms that have been *intentionally* and *heritably* altered by humans.
2. The record of the influence of human culture on evolution.
[Center for PostNatural History, accessed 18 October 2022, <https://www.postnatural.org/]

On Friday, October 14th, 2022, Nadine and Edlyn were invited to attend the vernissage of the exhibition "Artificial", at le Pénitencier, in Sion. The former penitentiary-turned museum since 2000, showcased over twenty stories of organisms that have been *intentionally* and *heritably* altered by humans over time. Some familiar stories we know of include the domestication of animals; others can be more surprising, such as the breeding of goats that are genetically engineered to produce spider silk in their milk. Each story has its own cell with preserved specimens and other objects on display. A small description (who, when, where, how, why) is written on the wall, while the full story can be heard with an audiopen. Outside each cell, a one-worded banner hung on the door to denote the human purpose behind such alterations, such as for productivity, experimentation, aesthetics, and selection to name a few.

The "Artificial" exhibition is a collaboration between the **Valais Museum of Nature** and the **Center for PostNatural History** in Pittsburgh, US, the latter started the curation of postnatural organisms. At the start of the exhibition, visitors encounter a "cabinet of curiosities", where visitors are put to the test, to find out which organism among the displayed specimens has not been intentionally altered by humans. "The cabinet is a preview for what's to come before visitors continue their journey up the stairs," says Gil Oliveira, the scientific curator for the exhibition. "Our purpose is to tell a collection of stories about the complex interplay between human and nature, without taking any sides. We want to create a place where visitors can explore postnatural history through story-telling of the many postnatural beings that lived and continue to live amongst us."

Gil Oliveira is creating a Museum of PostNatural History in Switzerland. Any person interested in the topic is welcome to contact him (contact@mhpn.ch).

The "Artificial" exhibition runs until 14.05.2023.

For more info and upcoming events related to the exhibition:
https://www.musees-valais.ch/musee-de-la-nature/expositions/item/1784-artificiel.html

edlynwu · Feb 6, 2021

Microenvironments, come together!

Updated: Mar 4, 2021

edlynwu · Jul 20, 2018

VW Foundation Grant for Nadine & Jan

Updated: Dec 3, 2020

Congratulations to Nadine and Jan Brugués!

Nadine and Jan received a 1.5 million Euro grant from the Volkswagen Foundation (VolkswagenStiftung), as part of the funding initiative "Life? - A Fresh Scientific Approach to the Basic Principles of Life".

The two groups will collaborate on the project "The spark of life: initiation of transcription in embryos, and recapitulating such in synthetic nuclei".

The Germans have a perfect word (and attitude) for how one should end their work day: *Feierabend* (literally translates to "party evening"). Together with the Brugués lab, we hung up our pipettes, turned off those microscopes, bade farewell to our pet fish and frogs for the day, and partied together to celebrate Nadine and Jan's achievement.

Contact us if you're interesting in joining our team to investigate the physical principles that govern transcription initiation during early embryo development.

edlynwu · Oct 12, 2022

Vastenhouwlab Retreat 2022

After COVID and its many restrictions, lab move to Lausanne, and new lab members joining one after another, the Vastenhouw Lab was finally able to gather under one roof for a lab retreat in Auvergne-Rhône-Alpes, southeastern region of France, by Lake Annecy.

The retreat featured many team building activities, requiring Vastenhouwies to use their knowledge, experience, creativity, and testing their communication skills. As many of us learnt, cooking for 12 people is a difficult and long task! We also visited the cute and beautiful city of Annecy, with Lake Annecy and the mountainous backdrop almost as amazing as our Lake Léman.

Happy 10th anniversary Vastenhouw Lab!

We also took this opportunity to throw Nadine a surprise celebration for the lab's 10th anniversary. The traditional cake-cutting (a delicious tiramisu made by Maciej) and champagne bottle opening were on the agenda. A movie montage featuring many lab alumni, old colleagues and friends of Nadine from across the years, and current CIG peers, shared their wishes.

Cheers to many more #funwithvastenhouwies moments and scientific discoveries!

Teaching

Lecturer and Teaching Assistant

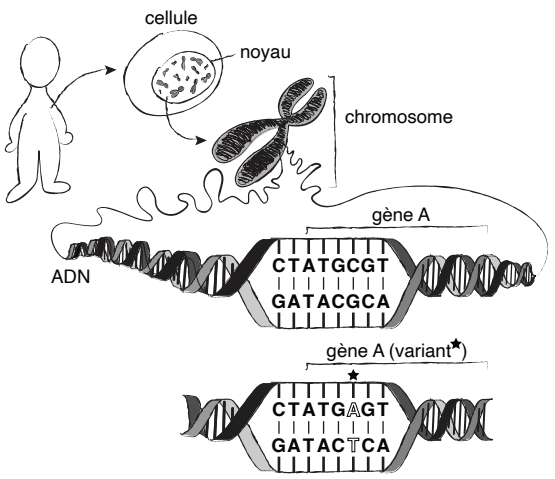
Practical Work in Cellular and Molecular Biology
First-year Bachelor students, teaching in French
University of Lausanne (UNIL), Lausanne, Switzerland

Lecture on "Transcription" in Lecture Series: Stem Cells, Development and Regeneration
Master students, teaching in English
Center for Regenerative Therapies Dresden (CRTD), Dresden, Germany

EDLYN WU • *Portfolio*

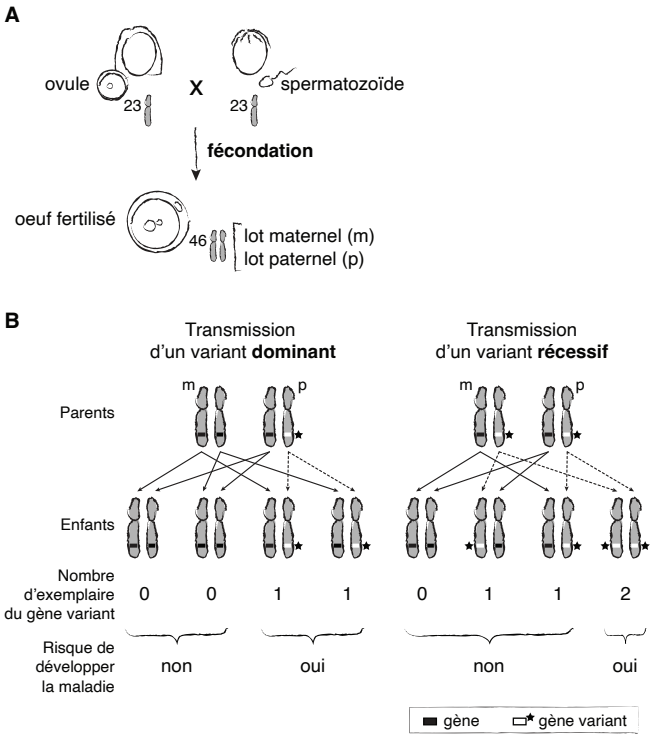
Artwork

Illustrations for Desvergne, Béatrice. La médecine personnalisée. PU Polytechniqu. October 19, 2023.
with accompanying legends written by Béatrice Desvergne.



Chaque être humain est constitué de milliards de cellules. Chaque cellule contient un noyau dans lequel se trouve 23 paires de chromosome, soit 46 chromosomes. Pour chaque paire, un chromosome provient du père et l'autre provient de la mère.
Un chromosome est une longue molécule d'ADN (acide desoxyribonuclique) enroulée en spirale. L'ADN est fait de l'enchaînement de 4 petites molécules appelées A, T, G, C.
Un gène est morceau d'ADN formé par la suite précise de plusieurs de ces lettres. Les gènes donnent les indications à la cellule pour fabriquer les éléments essentiels à la vie cellulaire. Il y au total environ 20'000 gènes.
Un variant génétique est un gène qui dans l'enchaînement des lettres (A, T, G, C) contient une modification portant, par exemple, sur une seule lettre, ce qui peut suffire à changer l'information donnée à la cellule.

(Dessiné par Edlyn Wu)



A) Fécondation et transmission des chromosomes. Les ovules chez la femme et les spermatozoïdes chez l'homme ne contiennent que 23 chromosomes (représentés dans cette figure par un bâtonnet). C'est avec la fécondation que se reconstituera la première cellule (l'œuf fertilisé) avec 23 paires de chromosomes soit 46 chromosomes dont la moitié viennent de la mère et l'autre moitié viennent du père

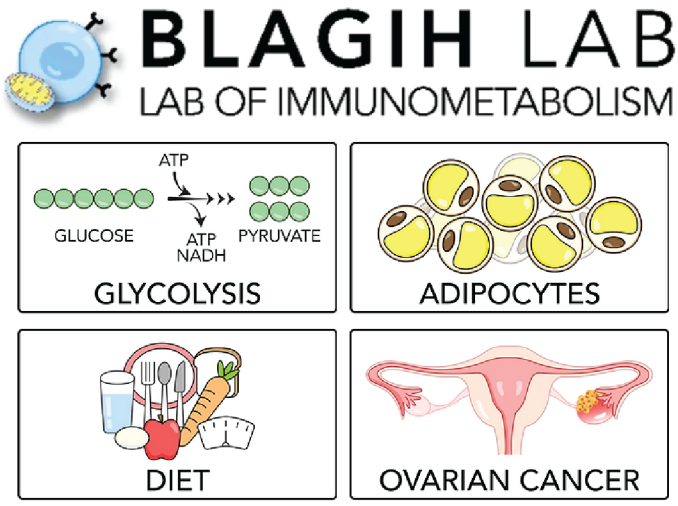
B) Chaque bâtonnet correspond à un chromosome. Les deux bâtonnets m correspondent à une paire de chromosome chez la mère, les deux bâtonnets p à la même paire de chromosome chez le père. Lors de la fécondation, chaque enfant à naître recevra un des chromosomes de la mère et un des chromosomes du père.
L'exemple à gauche montre ce qu'il se passe pour les variants dit dominants. La paire de chromosome chez la mère ne montre pas de variations sur le gène (indiqué par une barre noire). Le père par contre est porteur sur l'un des chromosomes de cette paire d'une variation de ce gène (indiquée par une barre blanche). Si le variant est dominant, et que l'enfant reçoit du père le chromosome qui porte le variant, alors il aura, comme le père, le risque de développer une maladie à cause de ce variant, même si le chromosome reçu de la mère ne porte pas ce variant.
L'exemple à droite montre ce qu'il se passe pour les variants dits récessifs. Dans ce cas, il faut que les deux chromosomes portent le variant pour que le risque de maladie soit là. Il faut donc que la mère comme le père aient le variant sur un de leur chromosomes. Seul l'enfant qui recevra à la fois de la mère et du père le chromosome portant le variant sera atteint.

(Dessiné par Edlyn Wu)

Lab of Immunometabolism

Logo and visuals

I created the lab logo for Dr. Julianna Blagih, new investigator and Assistant Professor of Université de Montréal, Canada at Hôpital Maisonneuve-Rosemont. Her group is investigating how immune responses are regulated through cancer genetics, cellular metabolism, and diet.



17th International Zebrafish Conference

Logo

Artwork selected by the International Zebrafish Society This biennial conference gathers hundreds of zebrafish community researchers. From June 22-26th, 2022, Montreal, Canada hosted the conference, in person and virtually. The logo depicts a zebrafish overlooking the Montreal skyline, with landmarks that include the Jacques Cartier Bridge, the Olympic Stadium, the Clock Tower, and the buildings 1000 de la Gauchetière and La Tour McGill. Behind the zebrafish is the Montreal Biosphere, whose geodesic dome structure is also used here to show the networking opportunities, and both local and global connections that can be made through research at such conferences.

Lausanne Fish User Meeting

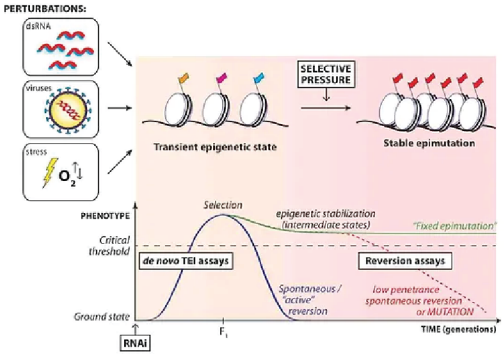
Poster

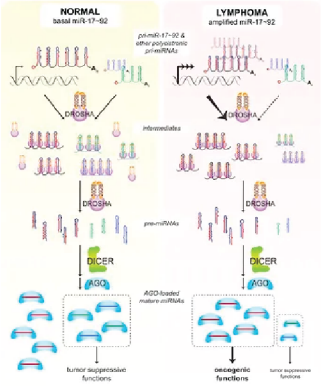
Flier for the very first Lausanne Fish User meeting. The event brought together more than 70 people from 8 research groups on UNIL-Dorigny campus, UNIL-Centre hospitalier universitaire vaudois (CHUV) site, Nestlé Institute of Health Science (NIHS), and École Polytechnique Fédérale de Lausanne (EPFL). The meeting was an opportunity to hear about the latest research using zebrafish and killifish as a model, as well as the techniques and applications used by the different research groups in Lausanne.

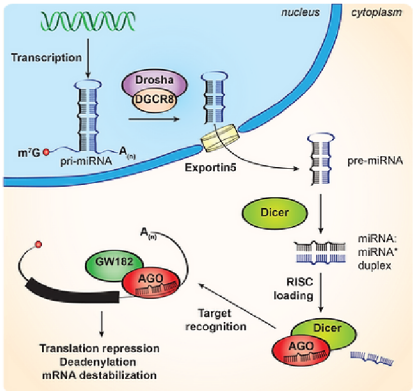
Grants and research articles

Figures

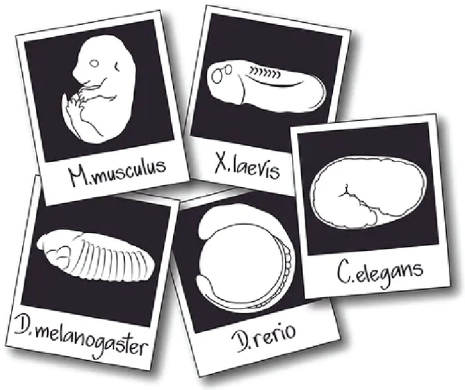
I enjoy scientific illustration and visualization. In addition to making visuals for my research project, I have helped create figures for grants and research articles for colleagues.
Visit the Research section, for more info on the different research projects I've worked on.



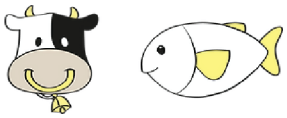


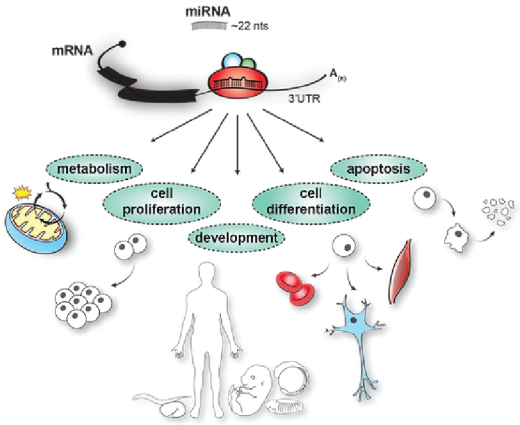


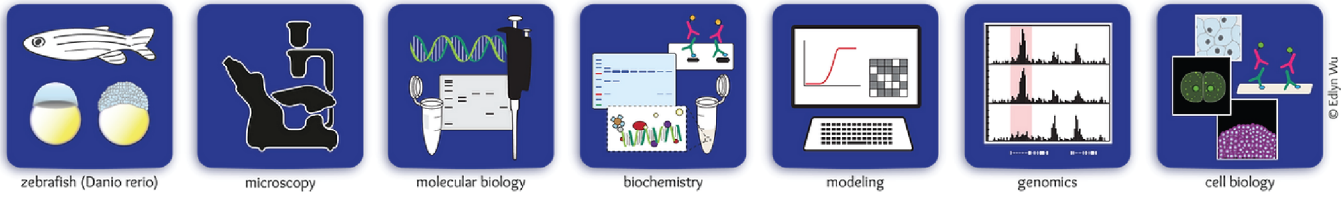
Cover Art



Other Illustrations







Events

Retreats

Co-organizer, Program planner, Logistics

Vastenhouw Lab Retreat
October 3-5, 2022 • Annecy, France

MPI-CBG Postdoc Retreat
June 11-13, 2018 • Lwowek Slaski, Poland

Public Outreach

Facilitator, Photographer, Fish Facility Tour Guide

Daycare visit to the Fish Unit
July 19, 2023 • UNIL-CIG, Lausanne, Switzerland

Fish Room Inauguration
February 9, 2023 • UNIL-CIG, Lausanne, Switzerland

Long Night of Science
June 15, 2018 & June 14, 2019 • MPI-CBG, Dresden, Germany

Let's Talk Science Challenge
May 8, 2015 • McGill University, Montreal, Canada

Guest Speakers Seminars

Postdoc representative, Coordinator, Host

Aydan Bulut-Karslioglu (Max Planck Institute for Molecular Genetics, Berlin, Germany)
April 24, 2023 • UNIL-CIG, Lausanne, Switzerland
Group leader in stem cells and their commitment to cell fate

Julian König (Institute of Molecular Biology, Mainz, Germany)
September 26, 2022 • UNIL-CIG, Lausanne, Switzerland
Group leader in studying the impact of RNA modifications and regulations in diseases

Rene Ketting (Institute of Molecular Biology, Mainz, Germany)
June 20, 2022 • UNIL-CIG, Lausanne, Switzerland
Director of IMB, leader in the uncovering the biology of non-coding RNAs

Kinneret Keren (Technion Israel Institute of Technology, Haifa, Israel)
September 18, 2019 • MPI-CBG, Dresden, Germany
Interdisciplinary group leader at the interface of biology and physics,
studying the self-assembly of molecules inside living cells

Mina Bissell (Lawrence Berkeley National Laboratory, San Francisco, USA)
June 13-14, 2019 • MPI-CBG, Dresden, Germany
Pioneer in breast cancer research and the use of 3D cell culture

Anne Bertolotti (MRC Laboratory of Molecular Biology, Cambridge, UK)
September 18, 2018 • MPI-CBG, Dresden, Germany
Group leader in studying misfolded proteins and its impact on neurodegenerative diseases

Christine Keating (Penn State University, University Park, USA)
March 1, 2018 • MPI-CBG, Dresden, Germany
Interdisciplinary group leader bridging physical chemistry, material science, and biology
to study the compartmentalization of functional structures

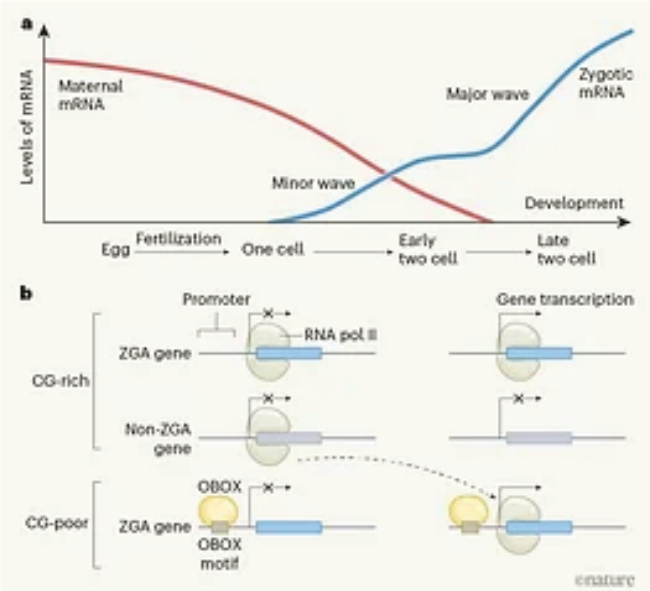
EDLYN WU • *Portfolio*

Research

Sleeping embryonic genomes are awoken by OBOX proteins

Postdoctoral research

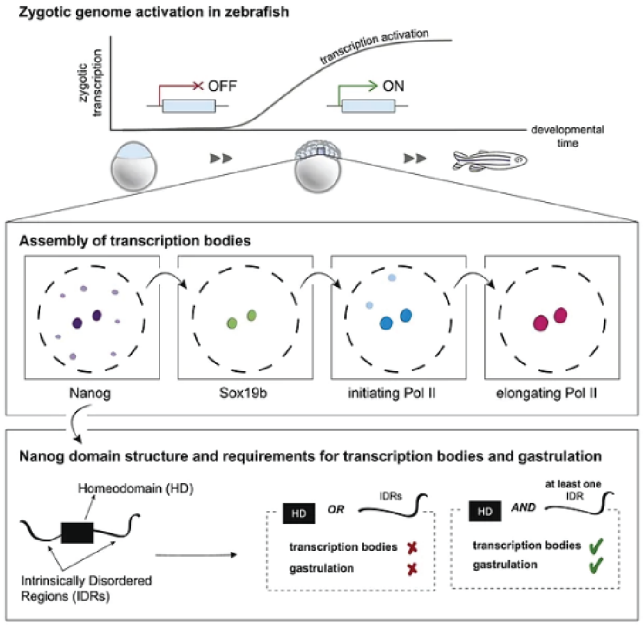
At fertilization, the animal genome is inactive, and the earliest stages of development are driven by pre-existing proteins and RNA transcripts that have been stored in the egg. As the fertilized egg divides into two cells, developmental control is gradually handed over to the embryo. The pre-existing RNA (known as maternally loaded RNA) is degraded, and the embryonic genome (called the zygotic genome) is activated. Commissioned by Nature to write a News & Views article, we highlight the recent publication from **Ji et al.** which describe the identification of a family of transcription factors involved in kick-starting the zygotic transcription program in mice, and provide evidence that these factors have a role in targeting the transcriptional machinery to the correct genes.



Wu & Vastenhouw. *Nature*. 2023

The role of Nanog in transcriptional organization

Postdoc • Design and cloning of Nanog constructs, figure design and data visualization



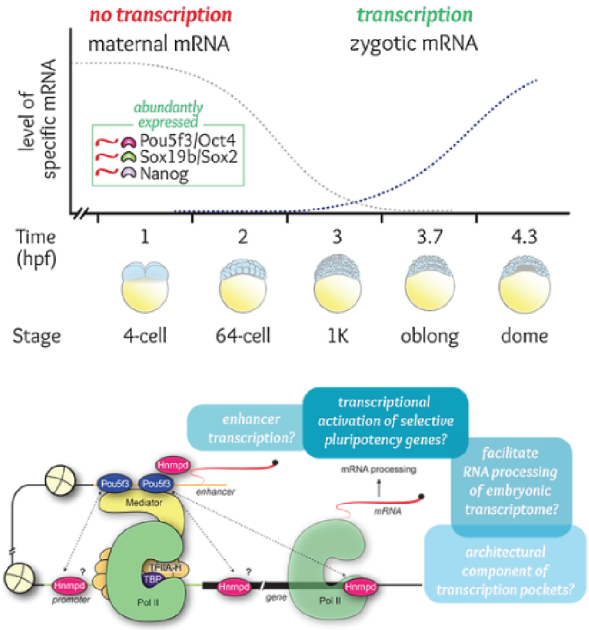
Kuznetsova et al. *Curr Biol.* 2023

Transcriptional activity is compartmentalized in our cells. How the transcriptional machinery come together on DNA to form such compartments is not clear. The zebrafish embryo, being transparent, is a good system to visualize the dynamics of different players assembling inside transcription bodies. What is the behaviour of some of these factors and what is the order of events leading up to gene expression? This project was led by first-author, Ksenia Kuznetsova. I made the constructs to dissect the role of Nanog, which we discovered to be a key component in organizing transcription bodies. I also contributed to the data visualization and figure design.

The interplay between transcription factors and RNA-binding proteins in transcription bodies

Postdoctoral research

In animals, early embryo development relies entirely on maternally supplied mRNAs and proteins. These maternal products are important not only for survival, but also to gear up for zygotic genome activation (ZGA). In the last decade, several key transcription factors have been identified as master regulators of genome activation. However, the molecular mechanism that kickstarts the transcription program in the developing embryo remains unclear. For my postdoc, I joined the lab of **Dr. Nadine Vastenhouw** to understand the molecular landscape in the early embryo, while at the same time, expanding the zebrafish biochemical toolkit. I identified an RNA-binding protein that interacts with one of the master regulators of ZGA. This RNA binding protein is also enriched in transcription bodies. I am currently characterizing this factor to understand its role in ZGA.

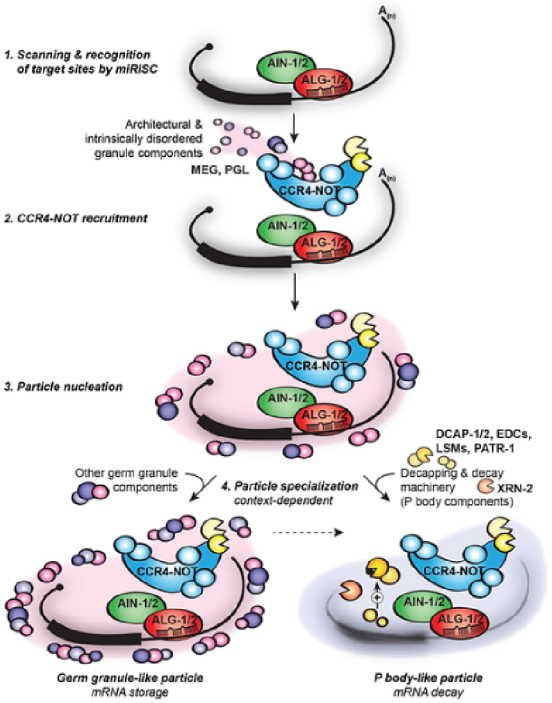


Book chapter: **Wu & Vastenhouw.** ***Curr Topics Dev Biol.*** **2020**

MicroRNAs and gene silencing

PhD research

During my PhD, I integrated biochemistry, proteomics, cell-free assays, and genetics, to provide a greater understanding of the mechanism of gene silencing by microRNAs. I aimed to resolve and delineate the temporal order of events during microRNA-mediated silencing: from target recognition by miRISC, to the recruitment of the effector CCR4-NOT complex assembly on target mRNAs, in nucleating a microenvironment that drive target mRNA silencing. The model on the right illustrates the mRNP assembly and specialization on target mRNAs in embryonic miRNA-mediated silencing. My work improves on our understanding of miRISC interactions, and opens up new possibilities into how developmental contexts modulate silencing mechanisms dictated by microRNAs.

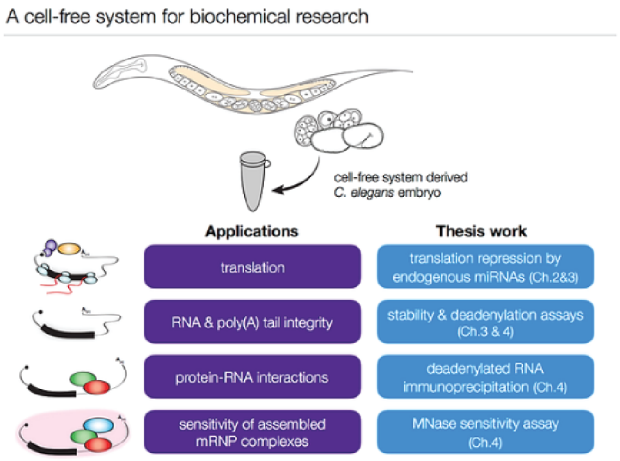


Wu et al. *Nucleic Acids Res.* 2016
Flamand et al. *Nucl Acids Res.* 2015
Wu et al. *Mol Cell.* 2010

C. elegans: from genetics to biochemical toolbox

PhD research • toolbox developer

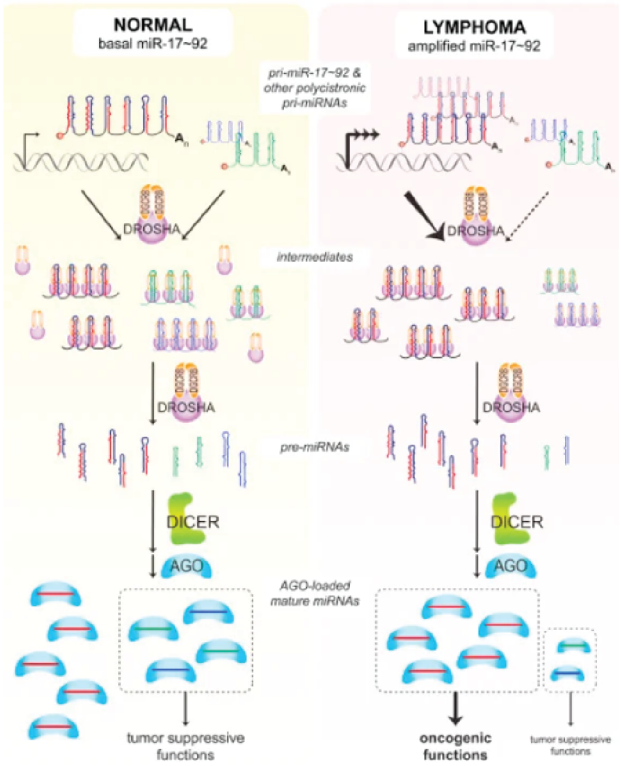
The nematode *C. elegans* has an extensive resume with diverse genetic approaches that has established a framework for the many regulatory pathways that govern animal development. However powerful, genetics also has limitations that were recognized early on by Sydney Brenner (pioneer of the use of *C. elegans*) himself: "only when genetics was coupled with methods of analyzing other properties of the mutants, by assays of enzymes or *in vitro* assembly, did the full power of this approach develop" (Brenner, 1974). To truly understand the mechanism of action for gene silencing by microRNAs, I first embarked on an adventure to develop an extract from *C. elegans* embryos. I succeeded in extending the resume of *C. elegans* and adding 'biochemical toolbox'. This system served as an invaluable tool throughout my thesis work.



Wu & Duchaine. *Methods Mol Biol.* 2011

MicroRNAs in Cancer

Figure design and manuscript revision



Donayo et al. *Mol Cell.* 2019

In addition to using the nematode *C. elegans* to study the fundamental mechanism of microRNA-mediated gene silencing, the lab of **Dr. Thomas Duchaine** is also interested in understanding the processing of miRNAs. In humans and mice, the miR-17~92 polycistron encodes six microRNAs, and has been shown to display oncogenic activity when the microRNAs are overexpressed, such as in diffuse B cell lymphoma. As co-transcriptional processing of primary miRNA transcripts is an important step in miRNA biogenesis, what is the impact of the miRNA machinery on pri-miRNA transcription and maturation? For this project, I helped with the data visualization and figure designs.