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PEOPLE & IDEAS

Beata Mierzwa: Bridging the divide between science and art

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Mierzwa studies mechanisms of cell division in different cell types and tissue contexts.

Beata Edyta Mierzwa was born in a small rural village in Poland into a family of farmers and metal workers, but spent most of her childhood living in Austria with her mother, an artist. As an inquisitive undergraduate, she discovered research as an outlet for her curiosity, working in multiple laboratories on diverse projects. In her PhD program, she became hooked on studying cell division with microscopy, a passion she has carried over to her postdoctoral research at the Ludwig Institute for Cancer Research and the University of California, San Diego. Mierzwa uses these cross-disciplinary experiences in science to elegantly combine ideas from seemingly disparate fields. In parallel to her work in the laboratory, Mierzwa creates scientific artwork to illustrate complex biological concepts in beautiful and accessible ways. From journal covers to her own line of whimsical science-themed clothing, Mierzwa interprets scientific messages using mesmerizing designs with vibrant colors and dreamlike patterns.

We reached out to Mierzwa to learn more about how her artistic pursuits shape her science.

When did your interest in science begin?

Despite being raised in an environment that valued a simple life, my natural curiosity growing up had me asking such an overwhelming number of questions that I still hear anecdotes about it today. Though I wasn't exposed to science as a child, my curiosity about the wonders of life drew me to a career in science, and I started studying molecular biology before I even knew what the inside of a laboratory looked like.

Where and with whom have you studied?

I completed my studies at the University of Vienna in Austria. My favorite aspect of the program was the freedom to join as many laboratories as I wanted for extra internships, so I made a conscious effort to become familiar with very diverse research fields. I investigated stress responses in budding yeast using quantitative mass spectrometry, contributed to the discovery of a transfer RNA ligation pathway with biochemical assays (1), and used crystallography to investigate the structure of an arginine phosphatase (2). I completed my master's thesis at ETH Zürich in Daniel Gerlich's laboratory, where I used high-throughput microscopy to study how microRNAs regulate mitosis (3). It was during this time that I discovered my passion for cell division and microscopy. Daniel's laboratory was an incredibly supportive environment, and I decided to move with the laboratory to the Institute of Molecular Biotechnology (IMBA) at the Vienna BioCenter to start a new research project for my PhD.

For my postdoctoral research, I recently joined the laboratories of Karen Oegema and Arshad Desai at the Ludwig Institute for Cancer Research and the University of California, San Diego. I'm thrilled to be part of their big scientific family that has made outstanding contributions to the fields of cell division and development.

What interested you about your current area of study?

I am passionate about cell division, a fascinating process that is as complex as it is beautiful. When I started my PhD, I was particularly excited by a recent discovery about the final step in cell division—that spiral filaments constrict the membrane that connects the cells until they separate (4). I was intrigued that such a prominent structure, involved in a process that had been studied for centuries, could remain undiscovered for so long. The opportunity to uncover such mysteries is the reason I initially chose to focus on cytokinetic abscission (5).

Beata Edyta Mierzwa. Photo courtesy of Beata Edyta Mierzwa.

During my PhD I studied the dynamics of the endosomal sorting complex required for transport (ESCRT) III, which constricts the membrane during abscission and is a highly versatile membrane fission machinery involved in many other fundamental cellular processes. At that time, prevailing models assumed that ESCRT-III forms persistent filaments that change their curvature to constrict membranes, but the possibility that these polymers might be dynamic structures had never been considered. To my surprise, photobleaching experiments showed that ESCRT-III polymers rapidly exchange their subunits. I further uncovered an unexpected role for the ATPase VPS4, which was previously thought to primarily disassemble ESCRT-III. On the contrary, I found that VPS4 stimulates ESCRT-III polymer growth by releasing inhibitory subunits through subunit turnover. This dynamic reorganization places ESCRT-III into the same category

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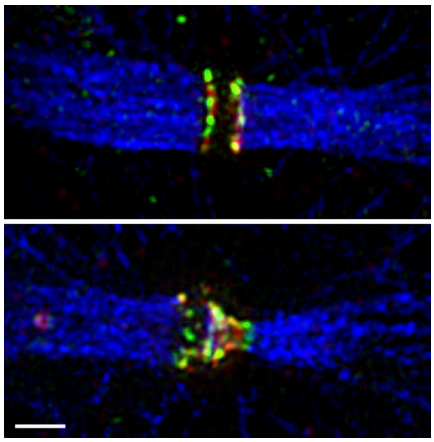


Structured illumination microscopy of HeLa cell midbodies at early and late abscission stages, stained with antibodies against α-tubulin (blue) and ESC RT-III subunits CHMP4B (green) and CHMP2B (red). Bar, 1 µM. Image courtesy of Beata Edyta Mierzwa.

as other force-generating filament systems that require dynamic turnover for function, like microtubules or actin networks, with broad implications for many cellular processes (6).

What are you currently working on?

I am currently investigating whether and how the cell division machinery adapts to different cell types and tissue context. While the majority of cell division research has focused on conserved and universal mechanisms, the diversity of mitotic mechanisms remains largely unexplored. Mechanistic requirements vary between cell types with different morphologies and lineages, and they likely require specialized mitotic machineries. I am exploring these cell type–specific mechanisms using CRISPR-based screening. Uncovering cell type–specific division mechanisms has the potential to identify cellular vulnerabilities for cancer therapy, and it might open exciting cell biological avenues to explore in the future.

How and when did you realize that you could marry your love of science and art?

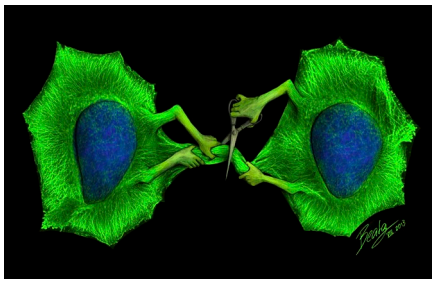
I made my first science art drawing to depict the theme of my PhD research, two cells using scissors to cut their connection in the final step in cell division. I quickly realized that showing this drawing as part of my scientific presentations was an excellent way to introduce my research question and it tended to stay in people's memories. I never really made a conscious decision to start making science art, but the positive feedback I received encouraged me to start creating illustrations for other people's research as well, and I started spending my evenings drawing for journal covers, conferences, and research groups in addition to my daily experiments in the laboratory.

Spending a lot of time behind the microscope also allowed me to appreciate the beauty of cellular structures. One day, as my PhD paper was going through peer review, I decided to browse through my laboratory's large collection of antibodies for some immunostainings; this time not for a particular experiment, but simply to capture the visual beauty of microscopy. Having made a lot of clothes for myself in the past, I had the idea to print these images on scarves, and gradually created my own collection of science fashion.

I was very fortunate to have the support of both my group leader, Daniel Gerlich, as well as the IMBA and the Vienna BioCenter, as I explored these passions. Their continuous encouragement throughout my PhD provided an invaluable environment not only for my science but also for my artistic adventures (you can follow them at http://beatascienceart.com).

Does your passion for creating artwork influence your approach to science?

My science art allows me to practice a skill I consider extremely important in science: breaking down the essence of complex scientific findings to focus on the most important aspects. This is essential for translating abstract concepts into intuitive visuals for my illustrations and greatly impacts the way I present my own research. In addition, through illustrating other people's research I learn about scientific fields outside of my own. Often, my only guidance for an illustration is the manuscript itself, and through researching the background I discover new literature and methods that my own research can benefit from.



In the final step of cell division, the intercellular bridge is cut to give rise to two separate daughter cells. A hand-drawn illustration overlaid with real microscopy images that literally fuses science and art. Image courtesy of Beata Science Art.

Has your work at the intersection of art and science led to any unexpected opportunities?

It has actually led to some very exciting opportunities! I got to design a logo for a space mission, be in a fashion show at a science ball, have my drawings on conference posters all over the world, and design t-shirts for the ASCB|EMBO meeting. I still can't believe that my hobby allows me to do all this.

Somewhat unexpectedly, my illustrations developed into a mission to communicate science. Scientists enjoy seeing research presented in a refreshing way, while non-scientists can discover the beauty in fundamental biological principles. It's not only effective but also fun to mix abstract biological concepts with elements that anyone can relate to, like scissors being used for abscission. Additionally, wearing my science clothes outside the laboratory often initiates conversations, and it's always a pleasure to explain the designs are not random patterns, but real microscopy. This has the wonderful potential to spark fascination and curiosity in a future generation of scientists.

What advice would you give to scientists who have diverse interests?

Don't be intimidated to share your passion with others and reach out to people who inspire you. No matter what your special interest is, you are not alone! I'm repeatedly humbled by how many hidden talents I see among scientists. A perfect example is a scientific conference where I organized an art show. We left an open wall for attendees to display their own art in an informal setting, and I couldn't believe the amazing artwork that had filled the wall by the second day. All it took was an open space, and people were sharing their creativity, being noticed for their talents, and realizing how many of their peers shared their interests. Treat your passions like a grand experiment with potential to create beautiful and unexpected opportunities—something we scientists do in the lab every day.

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