

# FACES OF MASS SPECTROMETRY

## Aleksandra Nita-Lazar



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December 2024



### Beyond the Finish Line

**A**leksandra Nita-Lazar grew up in Poland and studied biology at the University of Warsaw, where she first became interested in the world of protein biochemistry. She went on to earn her PhD in biochemistry from the University of Basel, working with the Friedrich Miescher Institute for Biomedical Research. There she studied post-translational modifications using mass spectrometry. During this time, Aleksandra cultivated her skills and interests while using mass spectrometry and protein biochemistry to discover the mechanisms of protein functions. After completing her PhD, Aleksandra moved to the United States and accepted a postdoc position at Stony Brook University, studying the influence of post-translational protein modifications on cell signaling. She received additional postdoctoral training at MIT, studying signaling networks in cells using systems biology approaches.

These experiences led Aleksandra to her current position as Senior Investigator and Chief of the Functional Cellular Networks Section at the National Institutes of Health (NIH).

The major areas of focus for her research group include protein modifications involved in cell signaling and absolute quantification of molecular representation and interaction.

Aleksandra's primary disease of focus is sepsis, which she notes is still one of the leading causes of worldwide mortality. Her research in this area strives to understand and harness the inflammatory cascades which lead to sepsis. Some of the other diseases that her research focuses on include COVID, flu, and certain parasitic diseases.

One of Aleksandra's priorities is supporting women in science. Whenever possible, Aleksandra takes the opportunity to reach out to women at all career levels to encourage them to pursue a career in science. She enjoys participating in groups such as FeMS and Moms in Proteomics, which provides opportunities to mentor, learn from, and network with other women in the field. Notably, Aleksandra's lab group is part of the Intramural Research Program at NIH whose focus is on collaboration, which is another priority for her. Her group recently had the opportunity to collaborate on a project involving potential therapeutic agents for eosinophilic esophagitis, a food-driven inflammation of the esophagus. Aleksandra also considers transparency and positive feedback to be essential principles for maintaining a positive work environment.

### Did your interest in mass spec begin while growing up in Poland, or at the University of Basel in Switzerland?

I studied biology at the University of Warsaw and as an undergrad did a course on spectroscopic methods, which included mass spectrometry. It was interesting, but my master's thesis was on molecular genetics. In 1998, I applied for international PhD programs, many of which were emerging in Europe at that time. I wanted to do more protein, biochemistry-related work. I had a good background of two years of advanced biochemistry courses. At the FMI, the group Jan Hofsteenge was working on post-translational modifications and discovered C-mannosylation using mass spectrometry. It was a great match for me. My graduate years were formative for developing my skills, for discovering the mechanisms of protein functions, and for deepening my interest in mass spectrometry and protein biochemistry.

### What attracted you to the postdoc programs at Stony Brook University and MIT?

I met my Stony Brook advisor, Bob Haltiwanger, at a Glycobiology Annual Conference in Boston in November 2002. I knew his work very well, because it was related to my graduate work. At that conference, I presented at an abstract talk where afterwards, Bob and I spoke. He offered me a postdoc position in this lab to work on the roles of O-fucose and O-glucose in Notch signaling. This was extremely interesting and allowed me to delve more into the world of protein signaling. After nearly three years there, I wanted to explore the signaling networks in the cell using more global,



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Figure 1. Aleksandra at the NIH relay event, for the lab team “Protein Masterminds,” on September 12, 2024. (Photo courtesy of Sung Hwan Yoon.)

systems biology approaches. I found that Forest White at MIT had just started his lab and was looking for postdocs to work on the phosphoproteome changes in various signaling cascades related to disease. I joined the Biological Engineering department at MIT, chaired by Doug Lauffenburger. These were exciting times.

**How did you first become interested specifically in cell proteome changes?**

This took place when I was a graduate student. It was a process rather than a one-time decision.

**What brought you to your current position with the Functional Cellular Networks Section at the NIH?**

When I started looking for independent PI positions during the economic crisis in 2008, Forest brought to my attention that Ron Germain at NIAID was establishing a Program in Immunology and Infectious Disease Modeling (PSIIM) and was looking for a PI with expertise in proteomics. I didn’t know that NIH had an Intramural Research Program, but with Forest’s encouragement, I applied and interviewed. I was offered a position and moved to Bethesda in April 2009. I established my lab first as the Cellular Networks

Proteomics Unit, which I renamed Functional Cellular Networks Section after I received tenure in 2018.

**Are there any specific diseases that you hope your work will one day help contribute to curing or treating?**

My current disease focus is sepsis, which can be triggered by many pathogens. I’d like to think my work gets us closer to being able to harness the inflammatory cascades leading to sepsis, which is still one of the leading causes of worldwide mortality, as the drug candidates so far have failed. There are many other diseases under the umbrella of my work, such as COVID, flu, and even certain parasitic diseases. Although sepsis is the main one, because it’s such a huge problem right now, with so many deaths occurring every day.

**Is there an emerging application for mass spec technology that you are particularly excited about?**

There are two recent advances that are causing great excitement for me and my group. Data independent acquisition (DIA), which offers unprecedented analytical depth, and single-cell



“It’s all about finding success in your own way, even if it’s not necessarily the standard path.”

Figure 2. Aleksandra at the 2024 Memorial Day race with the Montgomery County Road Runners Club. (Photo courtesy of Aleksandra Nita-Lazar.)

proteomics. The DIA piece allows us to increase depth to basically cover the whole proteome in any given condition, which I find fascinating. For single-cell technology, it’s exciting to explore the heterogeneity within any kind of given cell population.

**Can you tell us about a time when an opportunity to collaborate outside of your area of focus had a positive impact on your research?**

We have collaborations with clinical investigators, and working with patient samples is very interesting and challenging. Recently, we collaborated with Mark Rochman in Cincinnati Children’s Hospital, working on eosinophilic esophagitis (EoE); a food-driven inflammation of the esophagus. Through a proteomic screen, we identified the involvement of the minichromosome maintenance complex in EoE and proposed MCM inhibitors as potential therapeutic agents for the disease.

**As a principal investigator, what are some practices you consider important for maintaining a productive and supportive work environment?**

Important work environment principles for me are transparency, positive feedback, and mentoring that fosters collaborative effort. I work in an intramural NIH research program, which is a

bit different from academic programs, in the sense that we have a lot less competition for money. This gives us more freedom to work openly and collaboratively with all kinds of colleagues across departments and across the whole of NIH. In my lab, collaborative spirit is very important, because many different perspectives are needed for success. This is especially true when it comes to systems biology projects, where we need expertise from many different people. I think it’s also important to support my colleagues, and those whom I mentor, on whatever road they might choose. For example, I recently had a postdoc who became a science teacher in the public school system. In our program, he found he was very good at explaining things to our summer trainees and could condense the knowledge and present it in a way that students could understand. It’s all about finding success in your own way, even if it’s not necessarily the standard path.

**We understand that one of your major interests is working toward equity of women from all backgrounds in medical sciences. Could you tell us about some of your efforts in accomplishing this goal?**

Supporting women and girls has come naturally, in part because so many females have applied to my lab. I belong to FeMS and Moms in Proteomics, taking opportunities to network, mentor, and be mentored by other women in the field. Through this



Figure 3. Aleksandra and her son, Michael, hiking in 2023 at Blackwater Falls. (Photo courtesy of Soren Ulrik Sonder.)

group, I strive to model how to maintain a good balance between private life and professional success. It's quite a big effort, with workshops at national meetings, such as the ASMS meeting. In a more general sense, I support female trainees and reach out to the women at all career levels to encourage them to pursue a career in science. My female trainees come from many different backgrounds, including low-income groups and underrepresented minorities. One thing I miss is finding competent girls at the high school level. We used to have a lot of high school students and trainees, but it has recently become much more difficult due to safety concerns in the lab. I try to support these young girls by visiting the ones at the International Chemistry Olympiad.

**Outside of the lab, do any of your interests involve the outdoors?**

I really like running (Figures 1 and 2), and I train with a local runners' club, Montgomery County Road Runners. I have been in this club for about 13 years or so. My favorite races to run are between 10K and the half marathon. My husband is an avid runner, and he has run a lot of full marathons, so he's very supportive of me. Training for full marathons is a huge commitment, but half marathons are within my reach! I also enjoy hiking with my teenage son. He and I hike in the Appalachian Mountains, and we like going to the cabins in Blackwater Falls, which is in West Virginia. He absolutely loves it!

