THE AUTHOR FILE

Dmitriy Chudakov

He switched from designing fluorescent proteins to investigating immunology.

Nearly a decade into his work with fluorescent proteins, molecular biologist Dmitriy Chudakov switched to immunology. Most recently, he and his team developed an algorithmic strategy to eliminate errors when profiling the immune system's repertoire of B cells and T cells.

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Dmitriy Chudakov

High throughput–sequencing errors and mistakes that occur during the polymerase chain reaction can lead to erroneous readouts, which his computational method, called molecular identifier groups–based error correction (MIGEC), can correct.

The balance and efficiency with which the adaptive immune system reacts to and defends against infectious diseases and cancer depends on the functional variety of the immune system's B cells and T cells, says Chudakov. The immune repertoire of the many unique receptors on T cells and the diversity of antibodies produced by B cells can be seen as potentially readable information about an individual's immune system, he says. Among other possibilities, this readout can help monitor the extent to which immune receptor diversity is restored after chemotherapy.

The challenge with error correction for immune profiling, he says, is that it is like trying to fix errors created when ten fast typists each reproduce a 300,000-page book on old typewriters in a language they do not know. MIGEC allows a user to compare words and mistakes across the ten book copies in order to discern between a true 'variant' and an error. MIGEC "hunts for the reproducible errors," says Chudakov, which must be filtered out to detect rare sequence variants.

An important part of MIGEC is its use of unique molecular identifiers during the synthesis of cDNA libraries. And, he says, the method can be applied beyond immunology, such as to data from exome sequencing experiments.

Chudakov runs two labs: one at the Shemiakin-Ovchinnikov Institute of Bioorganic Chemistry in Moscow, where he did his PhD work studying molecular biology, and one at Masaryk University in Brno, Czech Republic, where he worked as a postdoctoral fellow.

Konstantin Lukyanov, also at the Shemiakin-Ovchinnikov Institute, calls Chudakov his best former PhD student: highly motivated and creative in his work on photoactivatable fluorescent proteins. Engineering new proteins, says Chudakov, is exciting because nucleotide changes lead directly to a new color, which feels like "touching and changing a protein with your hands." He also says it is beautiful to peer down a microscope to see a living cell's proteins glowing colorfully.

Inspired by the work and ideas of Sergey Lukyanov (Konstantin's older brother), who directs the lab where they all work, Chudakov switched from fluorescent proteins to molecular immunology. It was a hard decision to start over, but Chudakov was keen on trying something completely new and positioning his work closer to medicine.

"Initially it was, and still is, not that simple," he says, given that immunology is a large and complex field. "I always loved playing with DNA," says Chudakov, which is one reason why he likes the combination of high-throughput sequencing and immunology. Immunology is also "beautiful and mathematical."

Chudakov has been successful with fluorescent proteins and in immunology, says Lukyanov. "Amazingly, just in a few years, he again reached the top world level." He observes Chudakov avidly discussing experiments with an energized lab, including at lunch or birthday parties. "I am quite confident that we will see many new exciting methods and discoveries from Chudakov's lab in the near future."

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With two labs and two small children, Chudakov does not have much spare time. When he travels, he enjoys cities such as London and Melbourne, bikeable towns such as Freiburg and Brno, and hikeable areas in the mountains of the Australian island of Tasmania and in the Russian Altai, a mountain range that runs through Russia, China, Mongolia and Kazakhstan.

In Russia, science funding has been unstable, but he hopes that the situation will change with the newly launched Russian Science Foundation, a government agency that also plans to attract private funds.

Chudakov says his lab is staffed with people fond of developing technologies that can potentially help many scientists. "Limited resources stimulate you to invent, often simpler and more reliable techniques," he says. The constraints also "protect you from being depressed by the burden of too many available solutions," which have to be tried before one is selected.

Vivien Marx

Shugay, M. *et al.* Towards error-free profiling of immune repertoires. *Nat. Methods* **11**, 653–655 (2014).