

THE AUTHOR FILE

Bart Deplancke

An engineered approach to study gene regulation, and why home is where the heart is.

The genome is “our unifying subject,” says Bart Deplancke, a biological systems engineer at the



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École Polytechnique Fédérale de Lausanne (EPFL). Many labs, including his, explore genomic function and evolution. His lab’s overarching technology angle feeds into his projects on genomic and phenotypic variation and the regulatory aspects of metabolism and aging.

Deplancke’s latest project helps to quantitatively probe the binding of transcription factors (TFs) to DNA. SMiLE-seq, selective microfluidics-based ligand enrichment followed by sequencing, is a microfluidic device and a semiautomated workflow that the team validated with human, mouse and fruit-fly TF–DNA interactions.

TFs are a large, influential family of cellular proteins. What surprises Deplancke is that despite many years of effort, many TFs remain uncharacterized; even their basic functions are unclear, such as how they bind DNA. TFs act alone and in pairs, and pairing can change the way they bind to DNA. Analyzing TF binding is hard: there are many heterodimers, TFs often are not well expressed or don’t bind *in vitro* the way they do *in vivo*.

Technology development is how Deplancke adds one piece to the puzzle that is genome regulation. One advantage of microfluidic devices is their low reagent needs. His device, approximately the size of a microscope slide, captures TF–DNA complexes in tiny alcoves. After capture comes sequencing. Then, a computational pipeline his EPFL colleague Philipp Bucher developed helps to find TF motifs, the sites where TFs bind DNA. The 1,500 most abundant sequencing reads—the ones for which the TF likely has the highest affinity—are used to find an initial motif. To find a motif more representative of the entire DNA-binding landscape, the scientists trained the software with tens of thousands of other reads.

Modeling TF–DNA interaction is a hotly debated subject, says Deplancke. But discussion, accessible technology and methods will help the community work out how best to describe a TF’s DNA-binding

behavior. “The more people join the field, the better,” he says.

Building a microfluidics platform is no longer the feat it was a decade ago, and both academic and commercial fabrication facilities have emerged to help, says Deplancke. He kept his device design simple, avoiding components that might lead to microchannel clogging. “Once built, the platform does not require much maintenance, since the micro chips used for experiments are disposable,” he says. “You just take a ‘fresh’ chip, plug it in and SMiLE.”

Deplancke completed his master’s degree in bioengineering at Ghent University and did his PhD work in immunobiology at the University of Illinois at Urbana–Champaign. He was a postdoctoral fellow at the Dana–Farber Cancer Institute and the University of Massachusetts Medical School. He joined the EPFL faculty in 2007 and has been an associate professor in the lab of systems biology and genetics since 2014. He cofounded the scientific network Junior European *Drosophila* Investigators (JEDI).

Ideas come to him in hot showers and on long runs through a nearby forest. “It’s amazing how alive a forest is throughout the four seasons, and running in it is each time like running in a gorgeous landscape painting,” he says. He relaxes with audiobooks, usually

nonfiction, from Thomas Piketty’s *Capital in the Twenty-First Century* to Walter Isaacson’s biography of Steve Jobs and Bill Bryson’s travel stories. As a music aficionado he is happily carried away by Rachmaninov, Debussy, Ravel and Max Richter. “I love to withdraw in my music studio and tinker away on my piano and computer software to make music,” he says. These tunes are not intended for wider consumption, but he wonders what it might feel like when people sing or dance to one’s own music.

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Deplancke is from Belgium; he spent a decade in the United States and has been in Switzerland almost as long. “Home is where my family is,” he says, referring to his wife and two sons. “Where they are, that is where my home will always be.”

“The great thing about Bart is that he always pushes technology, he thinks like an engineer and can get things to work, which is still quite rare in biology,” says Ben Lehner, a team leader at the Centre for Genomic Regulation in Barcelona. He and Deplancke have stayed in touch since they began meeting at conferences as postdoctoral fellows on different continents and then after they started labs. “And he’s a great dad, a keen cyclist and runner, and a reasonable DJ.”

Vivien Marx

Isakova, A. *et al.* SMiLE-seq identifies binding motifs of single and dimeric transcription factors. *Nat. Methods* **14**, 316–322 (2017).