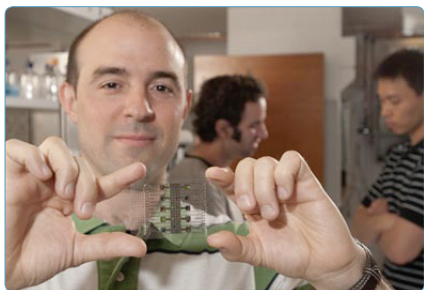


Scientists

Focused Serendipity

Aaron Wheeler

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Aaron Wheeler's development of new microfluidic tools to solve biological problems caught our attention. Curious to know more, *BioTechniques* contacted him to find out about the ambitions, character, and motivations that led to his success.

What do you think has been your greatest scientific contribution so far?

I work with microfluidics technology, particularly digital microfluidics, a method whereby discrete droplets of microfluids are manipulated on the surface of an array of electrodes by electrostatic means. Many people working in microfluidics focus on detection, but what needs to be done to the sample before it can be analyzed or detected is often ignored. Authors tuck away the required sample-processing steps in smaller type in the methods sections at the end of their papers, but in my experience these steps are extremely important parts of the experiment and can be a source of variability. My group has been the first to really explore the application of digital microfluidics to sample preparation problems to make analyses faster, better, and less expensive.

For example, we have been working on a technique to quickly prepare tissue or blood samples for hormone analysis by mass spectrometry. Traditional methods take hours of bench work, but using small samples and digital microfluidics to automate this process, we can complete the sample preparation in about 20 minutes.

How do you approach a question like that?

I am fortunate to work with really creative and fearless young scientists in my lab. Once we understand the problem, we brainstorm how bench processes can be implemented in our miniaturized devices and how to take advantage of the favorable scaling of microfluidics to eliminate some of the steps. My students will often propose something that I think isn't possible, but we are willing to take a step out on the brink and develop a new technique, and often I am proven wrong.

What in particular has really surprised you?

We have seen many surprising results. One interesting example is a project we had a couple of years ago: we built microfluidic mazes for *C. elegans* and followed their progress as they moved through the mazes. I was skeptical about how much we would learn, but when we put the worm in the maze and gave it the scent of food as a reward for moving toward a particular location, much to our surprise, it continued to favor that position when placed into new mazes.

Tissue preparation for measuring hormones by mass spectrometry and *C. elegans* learning are quite different research areas. How do you decide what to study?

That is what I love about my job. By leading a lab that focuses on methods development and technology, we get to dabble in all kinds of different applications. I'm fortunate to work in a scientifically rich community here in Toronto. I was in the elevator one day with Peter Roy, a *C. elegans* expert who works in my building, and we started talking about interesting questions related to worms. The next thing I knew, my postdoctoral fellow was making mazes. The hormone question was presented to me

by one of my former students, Mohamed Abdelgawad and his wife Noha Mousa. Noha had been practicing obstetrics in Egypt and, at the time, was working on a Ph.D. in clinical science with Bob Casper, an endocrinologist at one of the University hospitals. At dinner one night, she described some difficulties she had encountered while trying to measure estrogen in very small samples of breast tissue. Mohamed, on the other hand, described his work focused on using digital microfluidics to extract small amounts of material into droplets. One thing led to another and they approached me to propose the idea. There's a bit of serendipity, but it is focused serendipity because I'm around so many interesting people who are studying interesting problems.

What do you believe is the most important open question in microfluidics now?

A very practical question that my whole field is struggling with now is how to get the ever-growing number of tools out of the labs of inventors and into the hands of eventual end-users. I repeatedly see the development of really exciting new tools—with demonstrable advantages over conventional methods—that get into the literature and die there. I'm an academic and all of my time is taken up by running my research group. Although I'm dabbling a little bit in commercialization, I don't have the time to start a company to commercialize these techniques. There needs to be a better path for moving useful methods out of academic labs and into the hands of folks who can use them on problems where they can really make an impact.

Interviewed by Kristie Nybo, Ph.D. Image courtesy of Henry Feather. 

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