HOW BIOPRINTING TECHNOLOGY IS PAVING THE WAY FOR THERAPY DEVELOPMENT AND RAPID VIRUS TESTING

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Tecan's D300e Digital Dispenser (HP's D300e BioPrinter) offers new possibilities in personalized medicine, therapy development and virus testing — a critical attribute as researchers around the world seek fast and effective solutions to the novel coronavirus pandemic. Annette Friskopp, Global Head and General Manager of Specialty Printing Systems at HP, spoke with Dr. Lun about his perspective on the current and future potential of this type of innovative bioprinting technology.

Annette: How does the D300e Digital Dispenser work?

Dr. Lun: It's actually quite simple. It's an instrument that rapidly and accurately dispenses liquids in an automated way. A decade or so ago in biopharmaceutical research labs, you'd see hundreds of technicians manually pipetting samples from one test tube to another. This was the process for developing genetic test kits or for immunoassays, a procedure for detecting or measuring specific proteins or other substances through their properties as antigens or antibodies. This process had several limitations. It was prone to human error, as volumes varied, and test tubes are sometimes mixed up when they're exchanged. It was also slow because it was manual.

Reproducibility and reliability are important, for example, in the discovery of pharmaceutical applications. It's not as simple as taking a foreign compound and adding it to a reaction with a cell to see what happens. Researchers need to create millions of reactions. That means creating different reactions with different concentrations, and in different combinations with other molecules. If you map out how many iterations that would be, it starts to get overwhelming. Manually, it could take a team of 20 people two entire years to accomplish this.

That's where automation, like the D300e, enters.

For example, scientists often have to go through processes we call "serial dilution." It's a time-consuming process where you slowly dilute a compound by pipetting it from one test tube to the next—combining it with other liquids—until you reach many different dilution levels. The D300e, meanwhile, is able to add an extremely small and precise amount of a compound to another liquid, creating the exact concentration that you're looking for.

Annette: What is the dispensing resolution of the D300e?

Dr. Lun: We can go all the way down to the nanoliter (one-billionth of a liter) and picoliter (one-trillionth of a liter). That precision adds a lot of flexibility and opens up a world of new access we didn't have before.

Annette: What are the implications for bringing research and products to the market using this technology?

Dr. Lun: I'll give two examples. The Department of Surgical Oncology at the University of California San Francisco is using the D300e to assess the impact of cancer drugs in curing the disease. Normally, if you suspect a patient might have cancer, you take a biopsy. Biopsies tend to be painful, and nobody really wants to go through that process. So, doctors and researchers need to be really careful how they use the cells gathered from a biopsy. Because otherwise,

you need to keep calling the patient to come in for another one. In this context, if you're able to miniaturize your reactions, you can use the cells in a much broader environment, rather than getting one, two or maybe five reactions at most. Specifically, for oncology, it means that researchers can test several compounds simultaneously and see how they affect cancer growth. Then, they can personalize drug composition and dosing specific to the patient.

A second example is antibiotics' susceptibility to microbes. Imagine this situation: you are in intensive care and have an infection that cannot be cured with a single antibiotic. This isn't hypothetical; it's something that happens on a daily basis in hospitals. So, the hospital needs to use a combination of different antibiotics that have synergistic effects and kill the respective bacteria causing the infection. This combinatorial approach is where the D300e has proven it can cut down on the time spent on getting to the right answer. It makes it possible to test numerous new combinations that otherwise you wouldn't be able to test.

Annette: How could this technology be used in epidemiology, for example, to combat the ongoing COVID-19 crisis?

Dr. Lun: I think the D300e technology is incredibly relevant given the COVID-19 crisis. The types of tests that are happening today in the clinical setting are analyzing whether or not a patient has contracted the new coronavirus. On the research side, using this technology to miniaturize the overall reaction volume and increase throughput, will enable a broader analysis of different strains of viruses to identify potential treatments.

More broadly, what does it mean for other pandemics? I think the possibility lies in these combinatorial studies. It allows researchers to accelerate the discovery of single compounds that can affect the viability of a pathogen—be it a virus or a bacterium. This is a key advantage this technology brings to virology and epidemiological research.

Annette: Looking ahead, what future advancement are on the horizon for digital dispensing and bioprinting technology in the next few years?

Dr. Lun: Digital dispensing technology will continue to drive personalized medicine. Starting with oncological therapy, doctors will be able to deliver treatment that is very specific to each patient. Then, I'd predict this technology could be used for cell therapies and cell dispensing, where researchers could create experimental set-ups and put 10 or 20 or even 50,000 cells into separate reaction tests. It's also possible to use more routinely for smaller organoid applications, which are tiny three-dimensional tissues derived from stem cells that can be used to replicate the complexity of real organs. This will improve the drug development process, as these experiments can more accurately mimic what happens in patients than with 2D tissue culture alone.

Annette: Finally, what are some of the benefits customers are seeing from the D300e technology?

Dr. Lun: They're able to get much more granular with their measurements and automate manual processes. That saves them time and brings reproducibility. Highly trained people with master's degrees and PhDs are driving these experiments. By giving them the possibility, in a very easy way, to set up and run their experiments faster, they can spend more of their time thinking creatively and devising innovative solutions to the problems they face. The D300e is a truly intuitive instrument that makes tons of difference in the world of personalized medicine and pharmaceutical research.