A 'fat forward' research tool: Microscope-based cell scanner speeds research into fat-busting drugs

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Anglers rely on fish finders to help them locate the big catch. Now Tel Aviv University researchers in tissue engineering have developed a "fat finder" that can help scientists accelerate their research into new fat-melting drugs.

The new software-based tool, reported in a recent issue of the journal *Tissue Engineering*, fits onto a microscope like a pair of goggles and allows a scientist to measure a broad number of physical parameters in the Petri dish while investigating fat cells. They might explore how fat cells change when given insulin, or how they react when treated with new experimental drug compounds. Normally these kinds of questions need to be investigated with intensive pre-clinical and clinical trials -- an expensive and time-consuming process.

With the tool he invented, Prof. Amit Gefen of Tel Aviv University's Faculty of Engineering is able to address these questions at the cellular level -- by looking at individual fat cells to see what happens to them under experimental conditions. The tool allows scientists to see and assess quickly what is happening to each cell, and how individual cells change over time. Until now, fat tissues were studied as a whole, with little knowledge as to how cells react one by one. But a look at individual cells gives clues about the toxicity or effectiveness of a treatment almost immediately.

Cell squats and push-ups

Prof. Gefen's new research looks at lab-engineered fat cells. "Good for studying fat, the 'fat finder' is also a general purpose tool. It can save researchers time and money and help them answer questions in basic research and drug design," he says.

Prof. Gefen's tool gives scientists the ability to accurately measure what happens in live cell cultures over time. Equipped with algorithms to measure baseline cellular activity and compare it to how cells being experimented on behave, his device helps understand how fat tissue develops, so that "optimal" tissue-engineered fat can be produced as a biological substitute for treating wounds and in plastic surgery procedures.

Prof. Gefen is now adding other components to the microscope, such as a laser-based scan that can see cell slices in three dimensions. From these slices, he can make a computer model of the actual cell. Once the cell is "inside" the computer, it can be stretched and compressed mechanically via software controls under very specific parameters.

This tells Prof. Gefen how fat cells in different parts of the body react to pressure due to immobility, for example. "Our starting point is the chronic wounds field, but if you're a brain researcher, you can use it to see how neurons respond to pressure," he says.

Tissue made to order

Dr. Gefen's interrelated tools open up many possibilities for basic biological research and drug development. Researchers will be able to "see" details of cellular events that can't be described by other methods. And the tools can help investigators planning drug studies and clinical

trials to implement well-controlled and efficient tissue engineering protocols and experiments.

Until now Prof. Gefen's engineered fat cell cultures and software tool have been tested using animal cells, but Prof. Gefen plans to do similar studies based on human fat cells. In addition to helping drug developers come up with more effective anti-obesity drugs, Prof. Gefen's research seeks to know more about paraplegics and how their weight gain affects other cells and body processes. With this information in hand, he hopes to be able to devise better injury prevention and treatment regimens.

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