count + characterize quickly

flow cytometry techniques advance microbubble science

Narrator: These tiny bubbles are on the frontiers of medicine. How small are they?

Tom Matula: They are about one to ten microns in size.

Narrator: These microbubbles are ultrasound contrast agents.

Camilo Perez: One of main uses for contrast agents is medical imaging. They become a way to clarify or make brighter the ultrasound image.

Narrator: The diagnostic and therapeutic possibilities of these tiny bubbles are vast. They act as probes and beacons within the body. They can perform mechanical work on tissues, and will someday carry and deploy chemotherapeutic payloads.

Matula: One of the reasons people want to use these microbubbles is to do site-specific targeting and site-specific therapeutics. So that means they need to attach ligands to the bubbles that have specific antibodies that are specific to certain receptors of a disease protein. So there's a lot of biochemistry that goes on to try to figure out what the right antibodies and antigen combinations are and how to do the attachment biochemistry so that you can actually attach them to the bubble's wall.

Narrator: The challenge for the Center for Industrial and Medical Ultrasound at the Applied Physics Laboratory is how to measure the physical properties of ultrasound contrast agents — a very time-consuming process not that long ago.

Matula: So you would take a PhD student, their whole PhD thesis, to get information about a few bubbles.

Narrator: Now, Tom Matula's team can extract the information in a matter of minutes. It's done by combining an off-the-shelf flow cytometer with an acoustic transducer.

Matula: We're hitting the bubbles with megahertz frequencies so we can get enough information in about five to ten microseconds in order to characterize that bubble.

Narrator: The next step: tagging the microbubbles so that they can be put to work.

Matula: Tagging them is important so you can image these diseases early in the process. The flip side is even more interesting to me and that's the therapeutic side. Imagine having these bubbles filled or attached with a bunch of drug — a chemotherapeutic drug. And now these bubbles attach to the cancer tumor. And now you break the bubble with ultrasound because now you can break them as well as image them. And now you release the drug at the site — at the location of the cancer tumor.

Narrator: Image guided, site-specific chemotherapy at the molecular level. All done with tiny bubbles.

this is apl — the applied physics laboratory at the university of washington in seattle