



## *Science Translational Medicine Podcast*

Transcript, 23 February 2011

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### MUSIC

*Host – Orla Smith*

Hello, I'm Orla Smith. Welcome to the *Science Translational Medicine* Podcast for 23 February 2011. In this show, I will be speaking with Dr. Ralph Weissleder of Harvard Medical School about his smart portable micro-NMR machine that is set to speed up cancer diagnosis.

Doctors need quick and accurate ways to detect cancer cells in tissue biopsies, so that they can start their patients on chemotherapy straight away. The gold standard for detecting tumor cells in biopsies is immunohistochemistry, but this labor-intensive technique can take days to complete. Ralph Weissleder and his team have tackled this problem by developing a miniature nuclear magnetic resonance machine that's operated by smart phone technology. This hand-held device can be used at the patient's bedside to detect scarce cancer cells in small amounts of biopsy tissue in under one hour.

*Interviewer – Orla Smith*

Here now is Ralph Weissleder on the line to tell us more. Welcome, Dr. Weissleder, and thanks for joining us.

*Interviewee – Ralph Weissleder*

Thank you very much. It's a pleasure to be on.

*Interviewer – Orla Smith*

So how does your micro-NMR machine detect cancer cells?

*Interviewee – Ralph Weissleder*

Well, maybe I should tell you a little bit about the micro-NMR machine first. Very similar as a clinical MRI machine, it uses the same physics principles, but it interrogates very tiny objects i.e., specific cells. It does that by looking at magnetic nanoparticles that are targeted to specific proteins on cancer cells of interest in measuring magnetic properties in those samples. So, by using differently tagged antibodies we can specifically detect protein signatures on these cells.

*Interviewer – Orla Smith*

How did you test your device?

*Interviewee – Ralph Weissleder*

So, we first validated this new technology for multiplexed analysis of multiple different proteins. We then enrolled 50 patients who were referred from an oncology clinic for primary biopsies. And, in those patients, we took an aliquot of fine needle aspirates – so these are not core biopsies but rather using a very skinny needle to obtain single cells – to then measure these protein biomarkers on those cells. So, for each needle path that we do, we obtain anywhere between 1,000 and 5,000 cells that can then be interrogated in the micro-NMR machine.

*Interviewer – Orla Smith*

How does your machine stack up against more traditional methods for cancer diagnosis?

*Interviewee – Ralph Weissleder*

So, one of the very unexpected findings of this study was that the new technology was actually much better than conventional pathology. All of our patients also went on to have core biopsies taken, as well as traditional cytology. And when we compared the results from the micro-NMR i.e., the molecular measurement of molecular biomarkers against the more traditional H&E stains in either the core biopsy or the traditional cytology, our method was on average 10-20% better than conventional means.

*Interviewer – Orla Smith*

So, what are the main advantages of your machine?

*Interviewee – Ralph Weissleder*

Well, the device is very tiny compared to a real clinical MRI machine. For those of us who have ever been in an MRI scanner there are tons of RF generators and entire rooms of electronics behind the actual NMR machine. Now, our device sits basically in the palm of your hand, and it is being operated by a smart phone. So, all the electronics are incorporated onto little silicon chips integrated in the NMR machine, and everything is driven by the smart phone.

*Interviewer – Orla Smith*

So can I go out and buy one of these fascinating devices?

*Interviewee – Ralph Weissleder*

Well, first of all, the technology is not commercially available yet. It is quite a feat to develop these handheld NMR devices, so it has not been tested outside our own realm. I would hope that as funding comes in we will be able to scale this up and then do multicenter clinical trial and hopefully gather enough support for this to get commercialized one of these days.

*Interviewer – Orla Smith*

So are you planning to make your micro-NMR machine even smaller and smarter?

*Interviewee – Ralph Weissleder*

Smarter definitely, smaller you might lose them. The they are already very compacted, and as one makes them even smaller the microfluidics become so tiny that it may be difficult to process blood samples.

*Interviewer – Orla Smith*

What about other clinical applications for your micro-NMR machine?

*Interviewee – Ralph Weissleder*

So, we're currently pursuing other clinical applications, such as detecting infections in bodily fluids, such as TB or pneumonias in patients on ventilators. We are applying this technology to the profiling of exosomes – these are tiny little circulating microvesicles that are shed by a number of different cells in our body, including tumor cells. And we're testing this to detect, then ultimately profile, circulating cancer cells. And, with respect to that application, one of the unique advantages would be to be able to test whether emerging molecular targets drugs actually have inhibited their intended target in those cells.

*Interviewer – Orla Smith*

Dr. Weissleder, thank you so much for joining us today and congratulations on a fascinating paper.

*Interviewee – Ralph Weissleder*

Thank you very much.

*Host – Orla Smith*

That was Ralph Weissleder of Harvard Medical School in Boston, Massachusetts. Check out his paper on the *Science Translational Medicine* website at [stm.sciencemag.org](http://stm.sciencemag.org).

I'm Orla Smith, thanks for listening!

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