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McKAY ORTHOPAEDIC RESEARCH LABORATORY
PROBLEM STATEMENT

Michele: Hi David. I see you are still struggling with the indenter probe. Those mouse tendons are a real pain.

David: They sure are! But mice are the ideal model for our research, since they're genetically similar to humans. So we can learn a lot from how mouse tendons respond to different treatments and then try to use that information to help human tendons heal faster. But unless we can measure the thickness of the tendons, we won't be able to determine some mechanical properties, like their ultimate strength or elastic modulus, which are important indicators of how healthy a tendon is.

Nelly: Yeah, but they're so soft and so tiny ... when the probe touches the tendon it deforms, so it's hard to get an accurate reading. And besides that, we only get a single thickness measurement each time we place the probe on the specimen. We've been measuring the width from digital photos of the specimens. And then we make the assumption that the cross-sectional area is a rectangle, so we can multiply the thickness measurement by the width. This is OK, but assuming a rectangle is a really rough approximation. It sure would be nice if we could somehow capture how the thickness of the tendon varies along its entire width instead.

David: That'd be a huge improvement to our method. And if we could do it some way where we wouldn't have to apply any pressure to the tendon, it'd be even better. There must be a way ...

Michele: Well let's think about it for a minute. These tendons are small – about 3 mm long, 1 mm wide and less than 1 millimeter thick. The actual shape varies depending on the sample and there are small surface irregularities. No two are ever the same. In fact, even for a single tendon the cross-sectional area might vary slightly along its length, so we should really account for that with our new method too.

The measurements also have to be done quickly – in two minutes or less, really. Otherwise the tendons will start to dry out and the dimensions will change.

Nelly: It has to be accurate and repeatable. The results of these measurements are really important for the lab's tendon injury research. What kind of resolution are we talking about here?

Michele: I'd say 10 um or better.

David: Whatever we come up with, let's try to make it as simple as possible. Remember, I'm the guy who has to troubleshoot this stuff when it doesn't work, and we don't have an unlimited budget either.

Michele: Yeah, and I want to graduate sometime this century so let's come up with something that works well and gets the results we need.