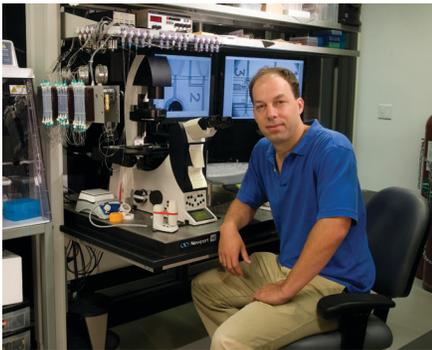


PREMATURE BIRTH AND GESTATIONAL AGE: DETECTION THROUGH A SIMPLE BLOOD TEST

Very soon, doctors may be able to use a simple blood test to detect biomarkers that indicate premature birth. This is outcome of research now underway recently completed and led by Stephen Quake, Ph.D., Professor of Bioengineering and of Applied Physics at Stanford, and sponsored in part by the March of Dimes Prematurity Research Center at Stanford University. Professor Quake and his team used a technique previously developed in his lab to identify specific RNA, or ribonucleic acid, molecules in the blood of the mother and baby. While DNA is like a blueprint of biological guidelines that a



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living organism must follow to exist and remain functional, RNA is what carry out this blueprint's guidelines. The study was recently published in the prestigious journal, *Science*.

It's been known for decades that blood contains miniscule amounts of free-floating DNA and RNA

released by dying or damaged cells throughout the body. Often this cell death represents natural cellular turnover; sometimes it's the result of disease processes. But, until recently, analyzing this genetic material has been difficult due to its scarcity.

New sequencing techniques, capable of handling very tiny amounts of genetic material, have transformed this dynamic. Based on this, Quake's team pioneered an approach a few years ago that identified which circulating RNA molecules in a pregnant woman were likely to have come from her fetus, and which were from her own organs. What this new study shows is that with a blood test clinicians can determine whether a fetus

is likely to be born premature. In addition, the same test has been shown to predict the gestational age of the fetus as accurately as an ultrasound, but at far less cost. More study is needed, but it's very likely that in the very near future, pregnant women may be able to use Quake's noninvasive prenatal blood test to learn with reasonable certainty the timing of their baby's birth.

"This work is the result of a fantastic collaboration between researchers around the world, said Quake, who is also the Lee Otterson Professor in the Stanford's School of Engineering. "We have worked closely with the team at the March of Dimes Prematurity Research Center at Stanford, and the Center at the University of Pennsylvania, as well as scientists in Denmark and Alabama. It's really team science at its finest."

YEARS OF DEVELOPMENT

The tests Professor Quake and his team devised is the result of years of work from many different quarters of the scientific community and represents some of the first real scientific breakthrough in the study of premature birth. By assessing maternal blood levels of cell-free RNA, the messenger molecules that carry

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David K. Stevenson, M.D. The Harold K. Farber Professor of Pediatrics, Senior Associate Dean, Maternal and Child Health and Professor, by Courtesy, of Obstetrics and Gynecology

the body's genetic instruction to its protein making factories, and measuring the activity of maternal, placental and fetal genes in the samples, the team was able to identify which genes gave reliable signals about gestational age and prematurity risk. The next step is to validate these results in much larger studies.

David K. Stevenson, M.D., principal investigator of the March of Dimes Prematurity Research Center at Stanford University, likened the noninvasive blood test approach to "eavesdropping on a conversation" between the mother, the fetus and the placenta, without disturbing the pregnancy. "With further study," he added, "we might be able to identify specific genes and gene pathways

The goal of this theme is to develop a blood test that could indicate potential risk for preterm birth.

Moms and babies in the U.S. are facing an urgent health crisis:

- In this country 1 in 10 babies is born prematurely each year.
- Worldwide 15 million babies are born prematurely each year.
- Premature birth and its complications are the largest contributors to infant death in the United States and globally.
- More than 380,000 babies are born prematurely in the U.S. each year.
- In addition to the human toll, the societal cost of premature birth is more than \$26 billion in the U.S. per year.
- Women of color are up to 50 percent more likely to give birth prematurely and their children can face a 130 percent higher infant death rate.
- In this country black women have maternal death rates over three times higher than women of other ethnicities.
- More than 20 percent of premature babies are born to black women—that's 1 in 5 babies.
- Employers pay 12 times as much in health care costs for premature/ low birthweight babies compared to babies born without these complications.

Because premature birth has many possible causes, each PRC is charged with exploring a different transdisciplinary research target that is likely to be crucial to the prevention of premature birth. Stanford University research themes have unique strengths in the study of the microbiome, the transcriptome, and the immunome. In addition, they also house the Data Repository for all the Prematurity Research Centers enhancing collaboration and data coordination.

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Being able to observe the changes in RNA in this way has the potential to be a powerful diagnostic tool for identifying the biomarkers of that may signal disruptions in a pregnancy, as well as more accurately pinpointing the baby's all-important first birthday. This cutting edge research is why March of Dimes is investing in new ways to improve the health of moms and babies, especially to address the crisis of premature birth in this country and around the world.

THEME 2 LEADER



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