Docket #: S12-486

Predicting and Improving Embryo and Oocyte Viability Through Mechanical Measurements and Biomarkers

Stanford researchers have developed a quantitative, noninvasive, and early predictor of viability at the early embryo and oocyte stage using mechanical biomarkers. Embryo and oocyte viability can be predicted within 1 day after fertilization by applying a mechanical input to the outside of the cell and extracting mechanical parameters by observing the response of the cell. These mechanical parameters may then be used to rank a group of embryos by predicted viability, enabling a single most viable embryo to be transferred back to the patient. This technique will be very important in improving the success rates of in vitro fertilization (IVF) as well as reducing the risks of complications from multiple births.

Figure:

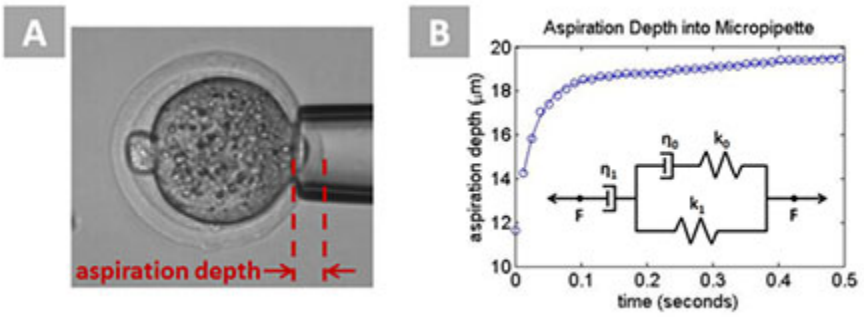

Figure description: (A) This shows how a mechanical input is applied to the outside of an embryo by partially aspirating it into a micropipette. The micropipette is part of an automated system which can apply a pressure through the pipette and record video of the resulting embryo aspiration. (B) The aspiration depth over time is extracted from the video in (A) and fit to a bulk mechanical model with viscous and elastic elements. The parameters extracted from this model are then used to predict an embryo's viability immediately after measurement.

Stage of Research:

- **Prototype completed-** Once the user locates an embryo, the device can automatically apply a mechanical input to the embryo and record a video of its response.
- **Proof-of-principle** at embryo stage has recently been completed. Mechanical parameters at 1-cell stage have been shown to be predictive of blastocyst formation as well as live birth in mouse embryos. They have also been shown to be predictive of blastocyst formation and quality in 1-cell human embryos.
- **Proof-of-principle** is currently underway at oocyte stage.
- Further device development is underway for future clinical use.

Applications

- **In vitro fertilization (IVF)**
  - Increases success rate by providing increased predictive power over morphological assessment of viability
  - Reduce rate of multiple births in IVF by allowing clinicians to transfer a single embryo to patient with high confidence in its viability rather than multiple embryos at once with low confidence in each embryo's viability

Advantages

- **Quantitative and non-invasive**
- **Easy to integrate into current clinical practice** because it uses a micropipette similar to holding pipettes already used in IVF, and device is low-cost
- **Early (day 1) predictor** of viability at the embryo and oocyte stage
- **Can predict viability directly after fertilization** vs. current standard of 3-5 days
- **Improve the pregnancy rate from IVF** because it predicts viability better than morphological assessment alone
- Can be combined with other noninvasive predictors of viability such as cell cycle parameters
- **Reduces rate of non-singleton pregnancies** by accurately predicting which embryo is most likely to survive and allowing clinicians to confidently transfer 1 embryo back to the mother

Publications

- Livia Z. Yanez, Jinnuo Han, Barry B. Behr, Renee A. Reijo Pera & David B. Camarillo, "Human oocyte developmental potential is predicted by mechanical properties within hours after fertilization," Nat. Commun. 7:10809 doi: 10.1038/ncomms10809 (2016).
- Bjorn Carey, "'Squishiness' can indicate embryo viability, Stanford researchers find," Stanford Report (Feb. 24, 2016).
- US Patent Application 20130184518

Patents

- Published Application: 20130184518
- Published Application: WO2013106753
- Published Application: 20160109428
- Issued: 9,179,935 (USA)
- Issued: 10,031,123 (USA)

Innovators

- Livia Zarnescu
- David Camarillo
- Jinnuo Han
- Renee Reijo Pera
- Shawn Chavez
- Barry Behr

Licensing Contact

Seth Rodgers

Licensing Manager, Life Sciences

Email