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A Dual-Modality Wearable Biosensor Patch for Continuous Female Reproductive Hormone Monitoring, Ovulation Confirmation and Polycystic Ovary Syndrome (PCOS) Diagnostic

Stanford researchers in the Chemical and Systems Biology Department have developed a wearable biosensor patch that enables continuous monitoring of female reproductive hormones.

Polycystic ovary syndrome (PCOS) impacts 10% to 20% of women worldwide, highlighting the urgent need to understand and monitor the complex endocrine dynamics governing fertility and reproductive health. The female reproductive cycle is regulated by a tightly coordinated hypothalamic-pituitary-ovarian axis, wherein an estradiol-induced luteinizing hormone (LH) surge triggers ovulation, followed by luteal progesterone secretion. Tracking this endocrine cascade is essential for assessing general reproductive status, diagnosing PCOS, and evaluating luteal phase deficiency. Nevertheless, current diagnostic modalities for the female reproductive cycle, including serum assays, urinary ovulation predictor kits, and basal body temperature tracking remain clinically limited by their invasive, episodic, or retrospective nature. No existing device provides continuous, quantitative, simultaneous monitoring of multiple reproductive hormones across the full menstrual cycle in a wearable, non-invasive or minimally invasive format.

The present invention addresses these unmet needs by providing a wearable dual-modality biosensor patch that continuously monitors estradiol and progesterone

simultaneously, uses the temporal and quantitative relationship between these signals to infer LH surge timing without directly measuring LH in a biologically challenging medium. Furthermore, it confirms ovulation with high specificity and provides PCOS-specific diagnostic outputs through an integrated machine learning algorithm deployed in a companion mobile application. This novel technology bridges long-standing diagnostic and management gaps in PCOS, ultimately driving improved clinical outcomes.

Stage of Research
Proof of Concept

Applications

- The system is designed to support multiple clinical applications:
  - PCOS diagnosis and monitorings
  - Recurrent pregnancy loss (RPL) investigation
  - Hypothalamic amenorrhea detection
  - Perimenopause and menopausal transition assessment
  - Endometriosis monitoring

Advantages

- Device provides continuous, quantitative, simultaneous monitoring of multiple reproductive hormones across the full menstrual cycle
- Wearable, non-invasive or minimally invasive format
- Includes integration of companion urinary LH measurements into a unified reproductive hormone monitoring platform

Innovators

- Stanford Researchers

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