# Double Emulsion Droplets as Osmotic Pressure Sensors in Soft Materials and in Living Biological Cells and Tissues

Tech ID: 33249 / UC Case 2023-868-0

## BACKGROUND

Osmotic pressure significantly impacts cell behavior, tissue homeostasis, and even cancer progression, making it a crucial topic for many life science applications. Skincare, for example, relies strongly on the water content of the tissue, which is directly related to osmolarity. Osmotic pressure is also an important indicator of hemodynamic disorders, kidney disease, and the evolution of tumors. However, quantifying osmotic pressure in living cells and tissues is difficult and impossible inside 3D multicellular systems, such as living embryos, tissues, organs, and organoids, without considerably perturbing the system. Direct *in vivo* and *situ* osmotic pressure measurements would unlock critical data on fundamental cellular and developmental processes and help understand multiple disease processes.

## DESCRIPTION

Researchers at the University of California, Santa Barbara, have developed a technology that non-invasively measures osmotic pressure *in situ* and *in vivo* within 3D living cells and tissues. The key to the invention is double emulsion droplets (generated using microfluidics) composed of an aqueous core with calibrated osmolarity surrounded by an oil layer. The oil layer acts as a semi-permeable membrane that enables the exclusive transport of water molecules. When the osmolarity between the aqueous core and the surrounding environment is different, water molecules exit or enter the core through the oil layer resulting in changes to the droplet volume, which provides a direct readout of osmotic pressure in the living system. The droplets are inserted using fine glass capillaries. The osmotic pressure measurement is precisely localized at the droplet, allowing for direct, absolute measurements of osmotic pressure in living cells and the extracellular spaces of living tissues.

## ADVANTAGES

- Non-invasive measurements of osmotic pressure in situ and in vivo within 3D living cells and tissues
- Direct, spatially-localized and time-dependent measurement of osmotic pressure

## APPLICATIONS

- Biotech
  - o Skincare
  - o Diagnostics
- Pharmaceuticals

## CONTACT

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## OTHER INFORMATION

### KEYWORDS

In situ quantification, Osmotic pressure, Living embryonic tissues, Double emulsion droplet sensors, 3D multicellular systems, Blastomeres

### CATEGORIZED AS

- **Biotechnology**
  - Health
- **Materials & Chemicals**
  - Biological
- **Medical**
  - Diagnostics
  - Disease: Dermatology

### RELATED CASES

2023-868-0

o Drug delivery

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| Patent Cooperation Treaty | Reference for National Filings | WO 2024/107547 | 05/23/2024 | 2023-868 |

Patent Pending

## RELATED MATERIALS

- Proliferation-driven mechanical compression induces signalling centre formation during mammalian organ development - 04/03/2024
- In situ quantification of osmotic pressure within living embryonic tissues - 12/06/2022

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Ferrofluid Droplets to Locally Measure the Mechanics of Soft Materials

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