A Microfluidic Prostate-on-a-Chip Platform

For Dose-Dependent Cytotoxicity and Molecular Response Studies

Ghazaleh Madani, Omid Nejati, Zhina Mazhari
CanChip GmbH

The Challenge in Prostate Cancer Drug Development

Prostate cancer is a leading malignancy in **men**. Although AR-targeting therapies like **enzalutamide** work initially, most patients develop resistance. Traditional models fall short:

- **2D cultures** lack tumor–stroma and vascular interactions
- **Animal models** don't mimic human AR signaling
- **Static assays** miss dynamic drug distribution and shear stress

Pharma needs predictive, human-relevant models to evaluate AR-targeting drugs in realistic conditions.

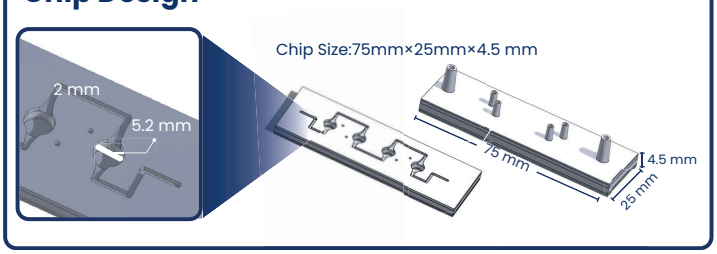
Our Solution: CRC-on-a-Chip

CanChip developed a **3D microfluidic co-culture system** integrating **LNCaP cells** with **HUVECs** under continuous perfusion. It:

- Maintains AR-regulated behavior
- Recreates tumor–endothelial crosstalk
- Enables quantitative readouts (viability, PSA, gene expression)
- Uses **ISO 9001**–aligned workflows for reproducibility

This dynamic model bridges the gap between static assays and **in vivo conditions** for anti-androgen drug testing.

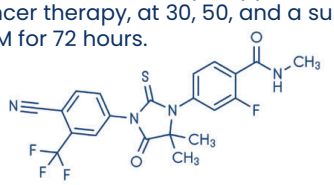
Chip Design



Case Study: Enzalutamide

We evaluated enzalutamide, a clinically approved AR antagonist for prostate cancer therapy, at 30, 50, and a supra-physiological dose of 100 µM for 72 hours.

enzalutamide



Results

Morphology:

- 30 µM: minor LNCaP density loss
- 50 µM: partial detachment and reduced cell–cell junctions
- 100 µM: extensive apoptosis and endothelial disruption

Viability (MTT):

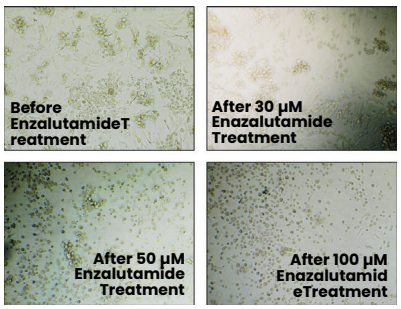
- LNCaP IC_{50} ≈ 22.95 µM
- HUVEC IC_{50} ≈ 80.77 µM
- Co-culture IC_{50} ≈ 36.24 µM

PSA (KLK3) Secretion (ELISA):

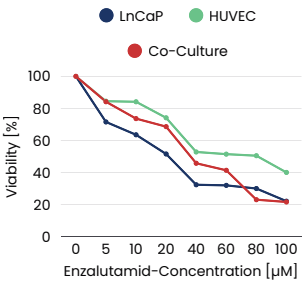
- Control: 546 pg/10^5 cells
- 30 µM: 307 pg/10^5 cells (-44%)
- 50 µM: 187 pg/10^5 cells (-66%)

Gene Expression (qPCR):

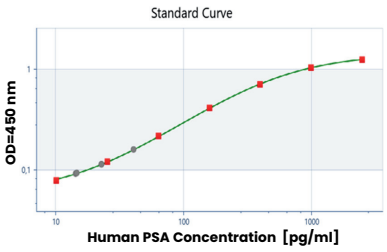
- **PSA:** Dose-dependent suppression (1.01× → 0.77× → 0.33×)
- **PSMA:** upregulation (1.71× → 2.25× → 0.30×), reflecting AR pathway inhibition and cytotoxic effects at high doses.



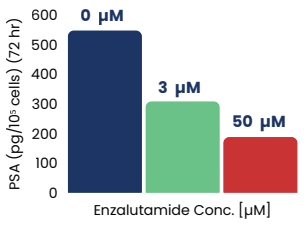
Microscopic images from the CRC chips before and after treatment.



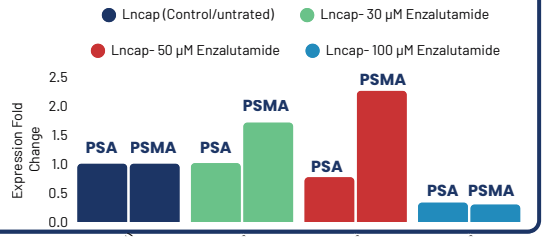
Enzalutamide sensitivity of LNCaP prostate cancer-on-chip cultures



PSA secretion in the LNCaP-on-Chip model.



Effect of Enzalutamide on PSA secretion in LNCaP cells.



PSA & PSMA Expression Fold Change Normalized to Control Group (Untreated)

Partner with CanChip

The **Prostate-on-a-Chip model** offers a robust, human-relevant platform for evaluating AR-targeted therapies. Partnering with **CanChip helps pharma companies:**

- Reduce attrition in oncology pipelines
- Strengthen preclinical decisions
- Accelerate the development of next-generation anti-androgen drugs

CanChip GmbH
Am Mühlenberg 10,
14476 Potsdam, Germany
+49 331 20018980
www.CanChip.org