# Integrating AI-Powered Computational Pathology with 3D Bioprinted Tumor Models for Predictive Drug Response in Precision Oncology

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## ABSTRACT

Researchers at the University of California, Davis have developed an integrated platform that combines AI-driven computational pathology with 3D-bioprinted, patient-derived tumor models to predict therapeutic response and enable functionally guided precision oncology.

## FULL DESCRIPTION

This technology integrates artificial intelligence with ex vivo 3D-bioprinted tumor models that preserve key cellular and microenvironmental features of patient tumors, including tumor, stromal, and immune components. Patient-derived tissues are engineered into standardized 3D constructs suitable for high-throughput functional drug screening across targeted therapies and immunotherapies. The platform generates multimodal datasets by combining quantitative drug response measurements with high-content imaging and histopathologic features. AI-enabled computational pathology is applied to paired functional response and imaging data to identify morphometric and phenotypic features associated with drug sensitivity and resistance. This functionally anchored approach enables prediction of drug sensitivity and resistance beyond genomic profiling alone. By integrating experimentally derived response data with computational modeling, the platform enables rapid, patient-specific evaluation of therapeutic strategies in a biologically relevant system. This approach supports translational research and has the potential to inform personalized treatment selection and accelerate drug development.

## APPLICATIONS

- Functional precision oncology and patient-specific drug response profiling.
- Preclinical evaluation of therapeutic compounds and combinations.
- Biomarker discovery for prognosis, recurrence risk, and therapy response prediction.
- Immunotherapy testing in models incorporating patient-matched immune components.
- Mechanistic studies of tumor biology and metastasis in a biomimetic 3D environment.
- Clinical decision support tools integrated with electronic health records and genomic databases.
- Pharmaceutical research for identifying novel therapeutic targets and optimal drug combinations.
- Pharmaceutical development, including target identification and SAR optimization.
- Academic and clinical research in cancer heterogeneity and tumor microenvironment modeling.

## FEATURES/BENEFITS

## CONTACT

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## INVENTORS

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## OTHER INFORMATION

### KEYWORDS

3D bioprinting, cancer therapy, cellular morphometric biomarkers, ex vivo screening, hydrogels, personalized medicine, predictive biomarkers, precision oncology, tumor microenvironment, unsupervised machine learning

### CATEGORIZED AS

- **Biotechnology**
  - Bioinformatics

- Preserves key tumor microenvironment features, including cellular heterogeneity and immune context in 3D-bioprinted models.
- Accelerates therapy evaluation by running high-throughput functional screens across conventional and immunotherapies.
- Predicts drug sensitivity and resistance by applying AI to multimodal experimental and clinical data.
- Delivers actionable results through a clinical-grade interface that integrates with existing healthcare systems.
- Improves consistency and turnaround time versus in vivo testing by standardizing functional assessments.
- Enables broader use by leveraging assay-agnostic biomarker signatures. Identifies novel therapeutic targets and supports personalized treatment strategies.
- Improves translational relevance compared to conventional 2D and simplified 3D systems.
- Models tumor heterogeneity by preserving complex cellular and molecular interactions.
- Reduces reliance on time- and resource-intensive in vivo animal models.
- Clarifies therapy selection by connecting biomarkers and functional drug responses to predict benefit and avoid ineffective treatments/side effects.
- Tames multimodal oncology data complexity by integrating and interpreting large experimental and clinical datasets.
- Adapts to molecular diversity and disease progression by supporting dynamic tumor modeling.

- **Medical**
  - Disease: Cancer
  - Screening
- **Research Tools**
  - Screening Assays

**RELATED CASES**

2025-538-0

## PATENT STATUS

Patent Pending

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Modulation Of p53 as a Cancer Therapeutic Target

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