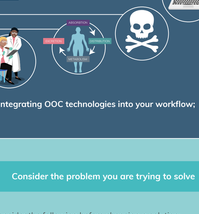
BioTechniques In Focus

CN-BIO

Top tips for integrating organ-on-a-chip technology into your workflow

Organ-on-a-chip (OOC) is a key emergent technology to add to your preclinical toolbox. It can be used at various stages of drug discovery and development to more confidently predict human responses to drugs.

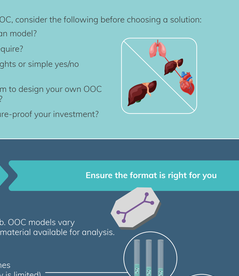


OOC models use physiologically relevant combinations of human cells to recreate human tissue and organ models *in vitro*.

They overcome bottlenecks, providing a way to recreate the human immune system and a path for testing molecules with human-specific modes of action.

These models can be used throughout preclinical research for a range of purposes:

- Target ID/validation
- Drug efficacy screening
- Safety assessment
- ADME profiling
- To understand unexpected clinical effects



There are many factors to consider when integrating OOC technologies into your workflow; here are some tips for getting started.

Tip 1

Consider the problem you are trying to solve

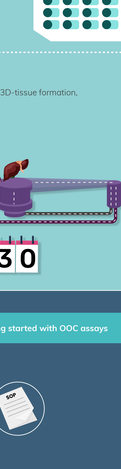
Based upon your reason for utilizing OOC, consider the following before choosing a solution:

- Do you need a single- or multi-organ model?
- What level of throughput do you require?
- Do you need deep mechanistic insights or simple yes/no answers?
- Are you looking for an open platform to design your own OOC models or an off-the-shelf solution?
- Can you adapt OOC models to future-proof your investment?

Tip 2

Ensure the format is right for you

Decide which format is best for your lab. OOC models vary in size, throughput and the quantity of material available for analysis.



- **Microscale designs**
  - Operate at extremely low volumes (advantageous when cell supply is limited)
  - Require steady, experienced hands
  - Enable the experiment to be imaged while live
  - Low amounts of recoverable material to analyze
  - Provide lower throughput
- **Plate-based designs**
  - Familiar multi-well formats are compatible with single- and multi-channel pipettes
  - Provide easy access (induce disease, drug dosing, media sampling)
  - High amounts of recoverable material - multiplexed endpoint analysis
  - Provide higher throughput

Tip 3

Ensure the OOC microenvironment appropriately models a human

Everything a cell interacts with influences its behavior; therefore, the material used to culture OOC models is crucial.

Cell culture plastic

Consider your consumable material. Many solutions use polydimethylsiloxane (PDMS), which:

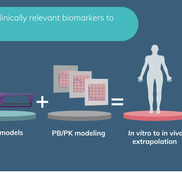
- ✓ is good for prototyping or imaging
- ✗ has high protein-binding and lipophilic drug-absorption properties

Look for consumables made from low-binding materials such as cyclic olefin copolymer (COC), where accuracy and sensitivity are paramount.

Can your solution meet the needs of different organ models?

Creating a physiologically relevant microenvironment that supports 3D-tissue formation, function and long-term culture benefits from:

- Fluidic flow to mimic blood; deliver nutrients, oxygen and biomechanical cues
- Control over flow rates and types (pulsatile or continuous) to match human exposure
- Perfused 3D scaffolds
- Inserts for biological barrier formation
- Addition of extracellular matrix



It's also important to consider whether the OOC technology will meet your current and future research goals. Does your chosen solution provide the flexibility to add or adapt models?

Tip 4

Getting started with OOC assays

If you are new to OOC, getting started is simple. Look for vendors that help you become an OOC pro by supplying:

- Complete kits
- Standard operating procedures
- Guidance on which primary cells work best with OOC cultures

Tip 5

Consider how donor variation may affect your results

All people are different; the same can be said for primary cells collected from different donors!

This can make answering a specific research question complex because not all primary cells:

- Form the same tissue structures
- Differentiate into human-representative tissue
- React in the same way to stimuli or drugs

However, being able to anticipate and model cellular variation is a powerful use of OOC technology.

Variability can:

- Be useful for understanding population differences (sex, ethnicity, age, genetics, disease profiles)

Remember, OOC providers have a wealth of experience, so leverage their knowledge to get a head start.

Tip 6

Interpreting OOC data

Always consider your results. It's important to understand how to compare, interpret and scale your results into clinical predictions.

For comparative drug screens, consider the practicalities of normalizing data to controls.

Check that your chosen OOC technology delivers clinically relevant biomarkers to help translate results into human outcomes.

To get the most accurate predictions, use OOC models with physiologically based pharmacokinetic (PB/PK) modeling to:

- Validate *in silico* predictions
- Extrapolate your data to more accurately predict human responses

This Infographic has been made as part of a *BioTechniques* feature sponsored by CN Bio.

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