

# Plant Single-Cell RNA Sequencing, Reimagined

## FX-Cell™ Protoplast Preparation for Challenging Plant Samples

Plant single-cell RNA sequencing has long been limited by difficult cell-wall digestion, restricted sample compatibility, and dissociation-induced transcriptional artifacts.

FX-Cell™ is a patented protoplast preparation workflow designed to support high-quality plant single-cell transcriptomics across field-collected samples, frozen materials, and difficult-to-dissociate tissues.

### ➤ Supports

- Field-collected samples
- Frozen samples
- Difficult plant tissues

### ➤ Method Comparison

|                               | Conventional scRNA-seq                              | snRNA-seq  | FX-Cell™  |
|-------------------------------|---|--|---|
| <b>Data output</b>            | High  | Lower  | High  |
| <b>Typical gene detection</b> | ~1,700 genes/cell                                   | ~600 genes/nucleus                                   | ~1,700 genes/cell                                   |
| <b>Cellular integrity</b>     | Intact cells, with cytoplasmic information retained | Nuclei only, cytoplasmic information is largely lost | Intact cells, with cytoplasmic information retained |
| <b>Sample compatibility</b>   | Fresh, easy-to-digest tissues                       | Frozen and difficult tissues                         | Fresh, frozen, and difficult tissues                |
| <b>Processing artifacts</b>   | Higher risk from long digestion                     | Mild extraction stress                               | Reduced by rapid fixation                           |

### ➤ Published Application

#### Plant materials

Gymnosperm (*Pinus tabulaeformis*), fern (*Nephrolepis auriculata*), lycophytes (*Selaginella martensii* and *Lycopodium japonicum*), and angiosperms including rice and *Arabidopsis*; shoot apices / young apical tissues were used.

**Technology** FX-Cell™-based plant single-cell RNA sequencing

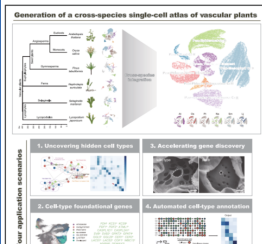
#### Key findings

- First integrated single-cell atlas of vascular plants
- Conserved cell types and core marker genes identified
- Previously uncharacterized cell types revealed
- Automated cell-type annotation tool developed for vascular plants

**Cell** Resource

**A unified cell atlas of vascular plants reveals cell-type foundational genes and accelerates gene discovery**

**Graphical abstract**



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**In brief**  
A cross-species single-cell atlas highlights a core subset of cell-type foundational genes associated with major vascular plant cell types, enabling the identification of hidden cell types and the development of an automated cell-type annotation tool for vascular plants.

## ➤ How FX-Cell™ Works



### Small-Molecule Cell Fixation

Improves resistance to shear stress and high-temperature digestion, while preserving cell morphology and transcript integrity



### High-Efficiency Cell-Wall Digestion

50°C enzymatic digestion improves protoplast release by 10- to 364-fold



### Highly Purified Dissociation Enzymes

RNase is removed through GMP-affinity chromatography, followed by ultracentrifugation-based enzyme purification to support RNA integrity and more reliable data output.

## ➤ FX-Cell™ for Common Plant scRNA-seq Bottlenecks

### Delayed Processing After Field Collection

Samples can be snap-frozen after collection, shipped on dry ice, and dissociated later in the lab.

### Difficult Tissue Dissociation

Optimized fixation and high-temperature digestion improve protoplast release from difficult-to-dissociate tissues.



### Nuclear-only RNA-seq provides an incomplete cellular profile

FX-Cell™ enables whole-cell scRNA-seq, retaining both nuclear and cytoplasmic transcript information for a more complete and representative view of the cellular transcriptome than snRNA-seq.

### Processing-Sensitive Biological Responses


Rapid fixation helps preserve wound-, pathogen-, and stress-related transcriptional states before digestion.


## ➤ Sample Submission Guidelines

Because preparation efficiency may vary by species, tissue type, and sample condition, we recommend submitting enough material for at least three tests per sample.

| Sample Type                    | Amount per Test | Shipping |
|--------------------------------|-----------------|----------|
| Root, stem, leaf, flower, seed | ≥0.1 g          | Dry ice  |
| Fruit                          | ≥0.2 g          | Dry ice  |
| Other plant tissues            | ≥0.2 g          | Dry ice  |

## Contact us

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