



# Prioritized Technology: Instruments to Identify Microscopic Organisms in Ocean Worlds

## Technical Goal

- Identify and characterize morphological, textural, or other indicators of life.
- Identify cells and other microstructures that are 0.2  $\mu\text{m}$  or larger in their longest dimension\*.
- Detect putative cells Limit of Detection (LOD): 100 cells per cc of ice\*.
- Detect key molecular signatures that represent dormant stage of cells (DPA) and energy supplier of cells (ATP)
- Detect native auto fluorescence

*\*Ref: Hand et al. (2017) Report of the Europa Lander Science Definition Team*

## Mission Applications

- Identification of structures with dimensions similar to terrestrial microorganisms with observed mobility would be a very strong indicator of life.
- Identification of terrestrial organisms in the sample would be strong indicator of terrestrial contamination.

## Technical Status/SOA

### Optical Microscopes:

**Visible Bright/Dark Field;** Phoenix and Rosetta however resolution insufficient;

**Holographic Microscopy & Bright Field Microscopy**

**High resolution bright/dark field;**

**Deep-UV (DUV) Microscopy** detection of native fluorescence (e.g., aromatic amino acids);

**Epifluorescence Microscopy** with fluorescent stains that target biomolecules, allows identification of cells  $<0.2 \mu\text{m}$  in size;

**Atomic Force Microscopes:** Rosetta, Phoenix AFM

**Electron & Atomic Force Microscopes:**

COLDTech/ICEE-2/PICASSO/MATISSE