Reducing Cutting Artifacts During Cryo-sectioning

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Lab Goal:
The Nicastro lab at Brandeis University is working to produce a life-like image of the 3D structure inside cells and tissues through the process of cryo-sectioning.

Process:
1. Freeze sample
2. Shave sections with the cryo-ultramicrotome
3. Image using Transmission Electron Microscopy (TEM)

The Problem:
The sample must be sectioned below 140K or ice crystals will form. Cutting to imageable thickness with the cryo-ultramicrotome (200 nm) for the TEM leaves artifacts (deformations and crevasses) on the cryo-sections and final image.

SCOPE Project:
Develop a new mechanism to eliminate cutting artifacts when sectioning cellular tissue while preserving the sample.

Challenges:
- Cryogenic conditions
- Localized temperature control
- Nanometer sample thickness
- Usability

Process:
1. Initial research about cryo-sectioning
2. Ideation of possible solutions
3. Build a test rig for initial questions
4. Design and manufacture of two prototypes

Results:
The final prototype will be used by researchers in the Nicastro lab to prepare samples. The device includes a mechanism to manipulate the sample that can be operated by one user. The prototype also includes a high-precision temperature control system to protect the sample.

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