NUANCE
Northwestern University Atomic and Nanoscale Characterization Experimental Center

NUANCE
Tech Talks
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"Automated Electron Microscopy Sample Preparation with the ASP-1000"

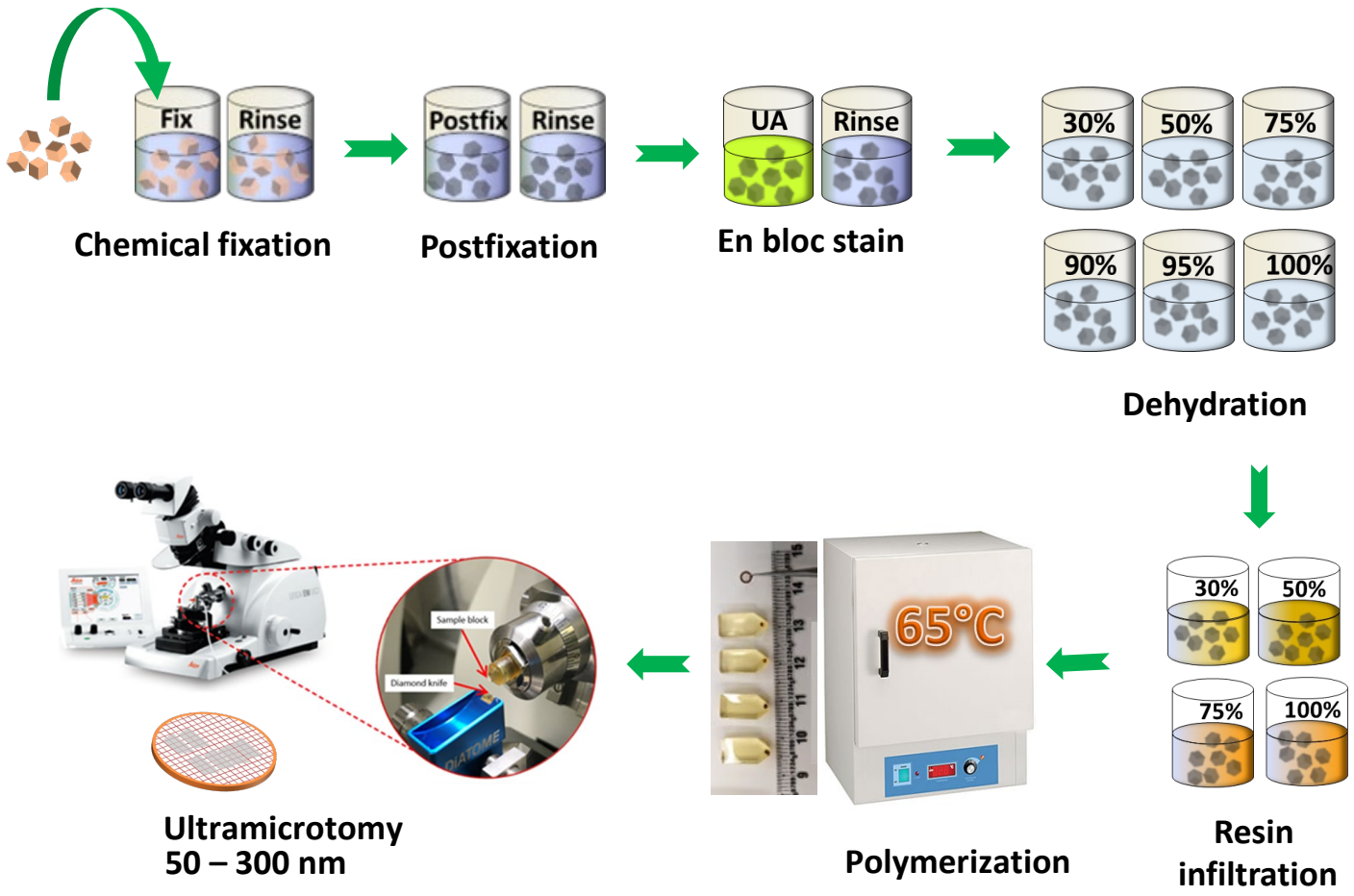
July 18, 2024
11:00 AM CST

Dr. Reiner Bleher
BioCryo Facility Manager
& Research Associate
Professor

Northwestern
Exploring Inner Space

23 years of Excellence...

Resin embedment protocol steps



Fixation:

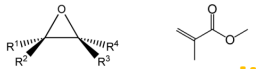
- crosslinking of proteins with glutaraldehyde and/or formaldehyde in buffer
- preservation of ultrastructure/antigenicity for immunolabeling

Postfixation/staining

- OsO_4 to stabilize and stain lipids (membranes)
- staining of charged sites (DNA, proteins) with UA

Dehydration

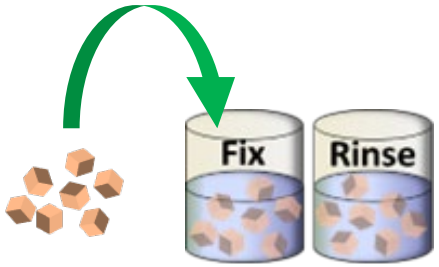
- replacement of water with an ascending series of ethanol, acetone, or acetonitrile



Resin (epoxy or acrylic):

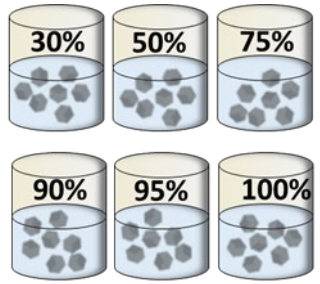
- stainability (LM and EM)
- minimal shrinkage
- hardness/softness for ultramicrotomy
- preservation of antigenicity for immunolabeling
- stability in the vacuum
- stable when exposed to the electron beam

Sample preparation for SEM



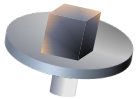
Chemical Fixation

Postfixation



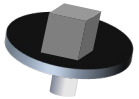
Dehydration

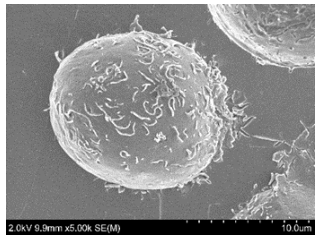
Critical Point Drying



Mounting

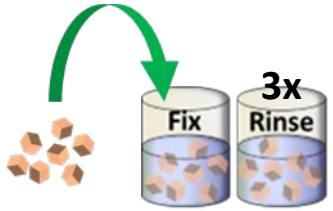
Coating





SEM

Processing protocol steps and time requirements for a standard protocol

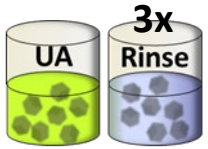


Fixation

≥ 1.5 hours

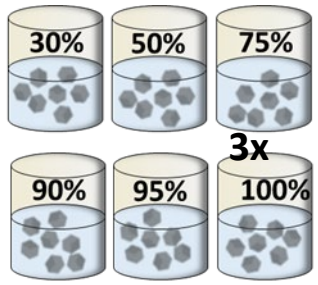
Postfixation

≥ 1.5 hours



En bloc stain

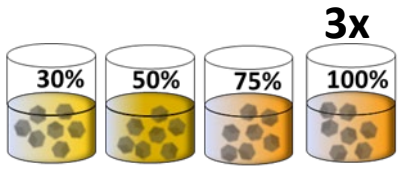
≥ 1.5 hours



Dehydration

≥ 1.5 hours

1 Day on the bench



Resin infiltration

≥24 hours

Mounting & orientating specimens in mold

1/2 day on the bench

Polymerization

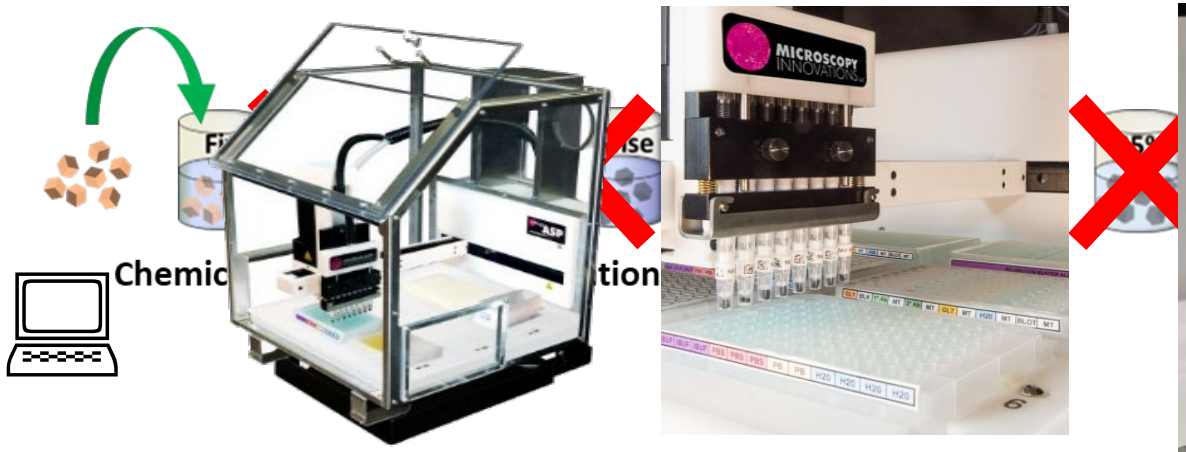
24- 48 hours

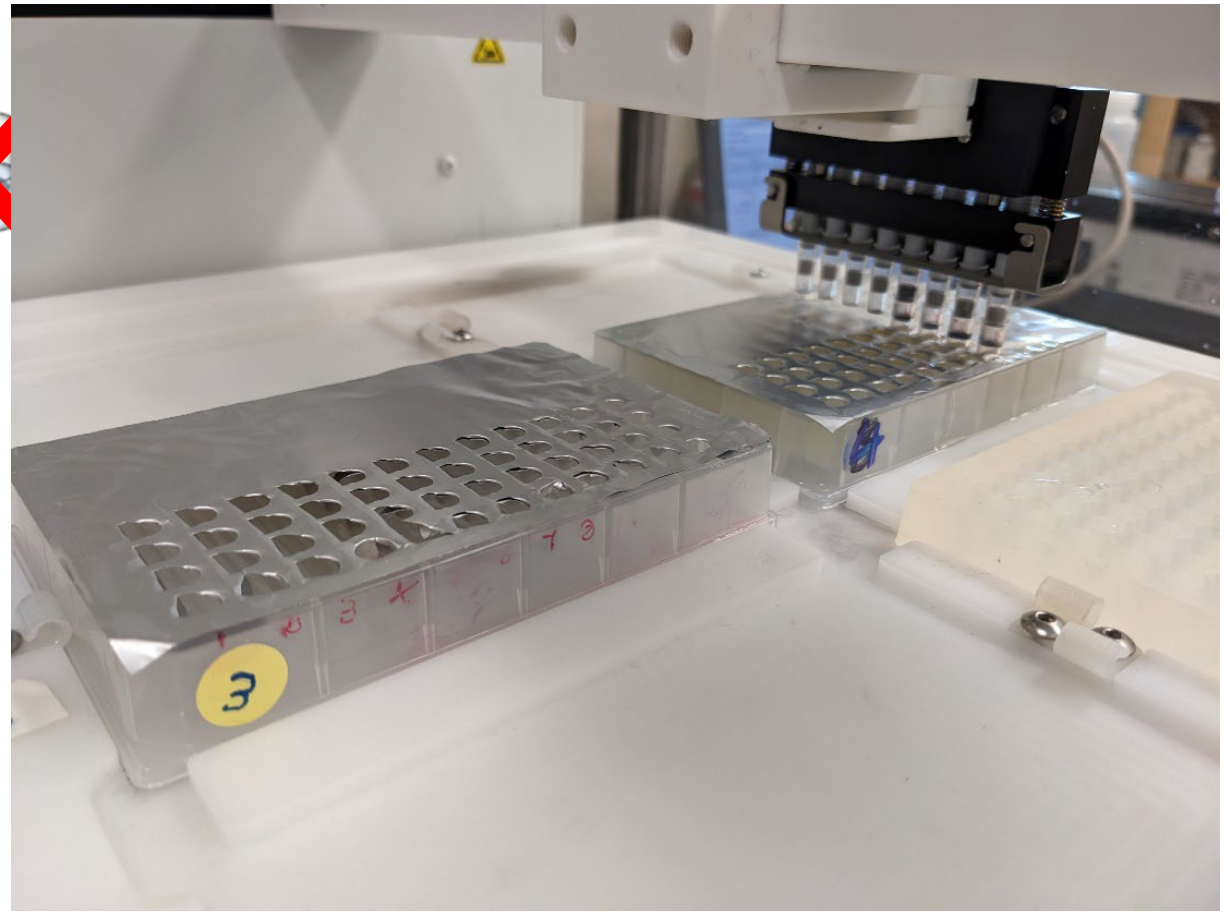
ASP-1000

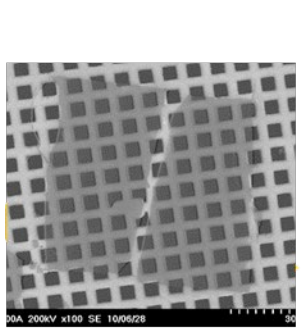
(Automated Sample Processor)

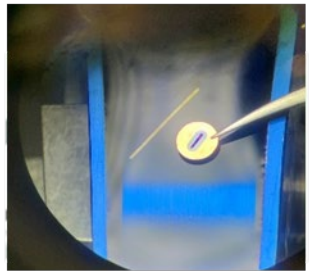
Speed, adaptability, and versatility for automated preparation of biological and soft matter samples

ASP-1000:
automated chemical fixation – dehydration – infiltration



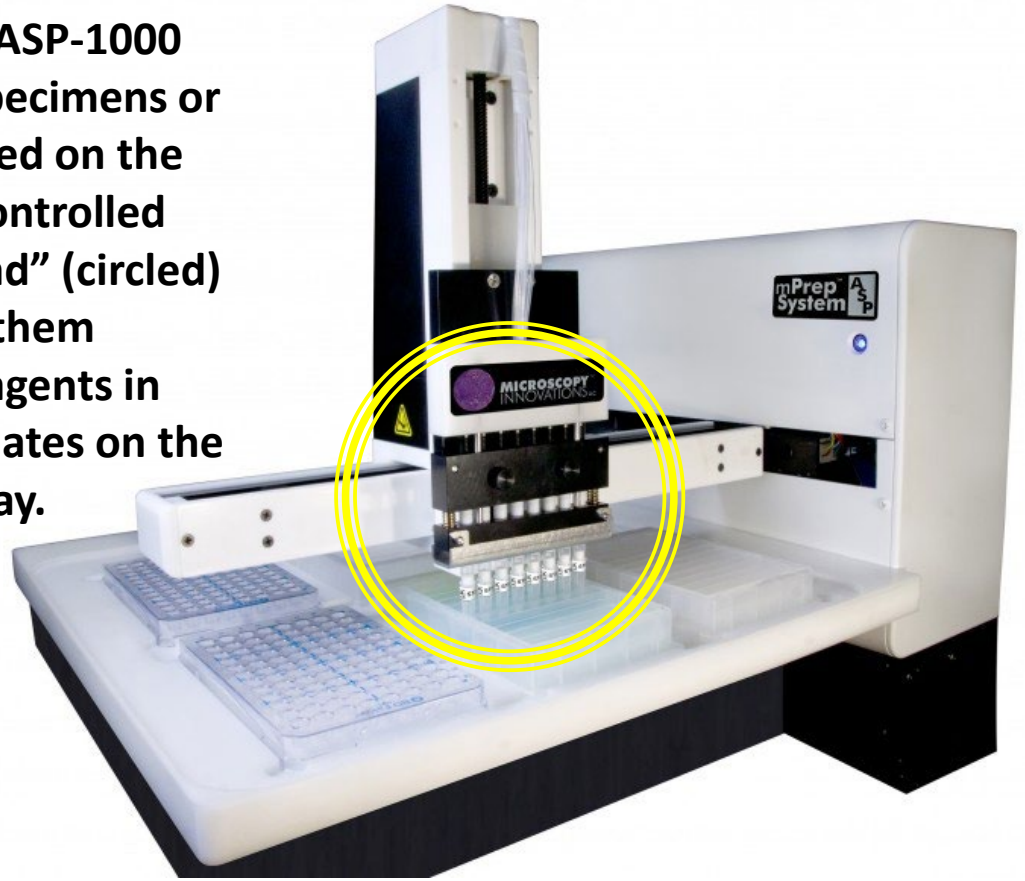






ASP-1000: automated sample preparation for TEM

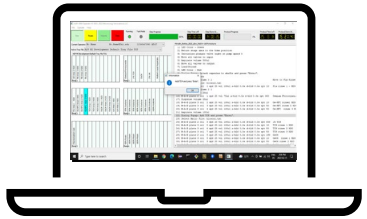
The mPrep ASP-1000 processes specimens or grids mounted on the computer-controlled pipette “head” (circled) that moves them between reagents in microtiter plates on the processor tray.



Processor pipette head with 8 specimens entrapped in 8 labeled mPrep/s capsules (arrow points to one specimen).

Head with 8 mPrep/g capsules containing 16 grids (arrow points to one grid).

Automated sample prep workflow

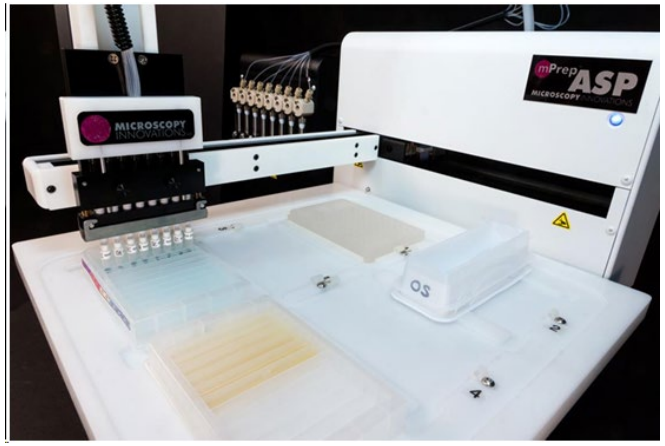


1. Set up the protocol

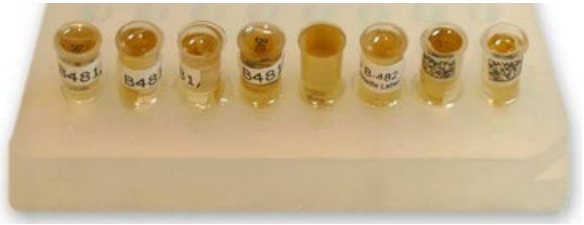
2. Prepare the plates

3. Mount the samples

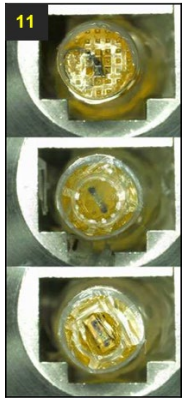
4. Attach the capsules



5. Run the protocol

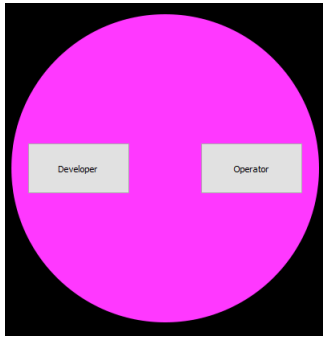


6. Polymerization



7. Retrieve the cured blocks

ASP-1000 Dashboard Control



Operator

ASP-1000 Operator © 2021, 2022 Microscopy Innovations LLC

File Operate Help

Run | Pause | Resume | Stop | Running | Test Mode | Step Progress 100% | Step Time Left 00:00:00 | Step Done At... 14:08:26 | Protocol Progress 1% | Protocol Time Left 25:13:14 | Protocol Done At... 15:21:41

Current Operator: No Name No.Name@Uni.edu 1234567890 AT&T

Active Tray File: ASP MI Development Default Tray File TCU

ASP MI Development Default Tray File TCU

Plate 1: UA rinse 3 H2O | Pb rinse 1 H2O | Pb rinse 2 H2O | Pb rinse 3 H2O

Plate 2: Osmium Ferrocyanide | 1% TCH | OsO4 | 2% UA | Walton's Lead Aspartate

Plate 3: Fix rinse 1 - H20 | Os-KFC rinse1 H2O | Os-KFC rinse 2 H2O | Os-KFC rinse 3 H2O | TCH rinse 1 H2O | TCH rinse 2 H2O | TCH rinse 3 H2O | OsO4 rinse 1 H2O | OsO4 rinse 2 H2O | OsO4 rinse 3 H2O | UA rinse 1 H2O | UA rinse 2 H2O

Plate 4: 35% Acetone | 50% Acetone | 70% Acetone | 80% Acetone | 90% Acetone | 95% Acetone | 100% Acetone | 100% Acetone

Plate 5: Polymerization rack

Plate 6: 50% Resin | 100% Resin | 100% Resin | 100% Resin

Information

Add TCH and press "Enter".

OK

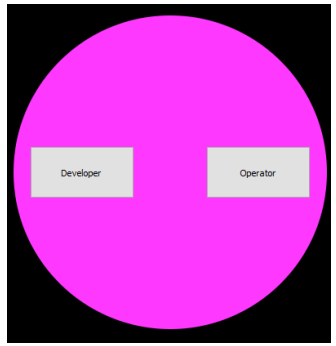
Mrinalini_Retina_2020_slow_Hold-in-100%-Acetone

```
 1) LED Color - Green
 2) Return stage axes to the home position
 3) Initialize plunger valve right at pump speed 0
 4) Move all valves to input
 5) Aspirate volume 500ul
 6) Move all valves to output
 7) Load/Unload
 8) LED Color - Red
 9) Dialog Popup: Attach capsules to shafts and press "Enter".
10) Wait for Green
11) Select Macro File: column 3 1                                  Move to Fix Rinse
12) Select Macro File: blowout.txt
13) M-A-D plate 1 col  1 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   Fix rinse 1 - H20
14) Select Macro File: column 2 1
15) Dispense volume 25ul
16) M-A-D plate 2 col  1 spd 25 vol 75ul a-hld 0.0s d-hld 0.0s rpt 360   Osmium Ferrocyani
17) Dispense volume 25ul
18) M-A-D plate 3 col  2 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   Os-KFC rinse1 H2O
19) M-A-D plate 3 col  3 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Os-KFC rinse 2 H2
20) M-A-D plate 3 col  4 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Os-KFC  rinse 3 H
21) Aspirate volume 100ul
22) Dialog Popup: Add TCH and press "Enter".
23) Select Macro File: blowout.txt
24) M-A-D plate 2 col  3 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 600  1% TCH
25) M-A-D plate 3 col  5 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   TCH rinse 1 H2O
26) M-A-D plate 3 col  6 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   TCH rinse 2 H2O
27) M-A-D plate 3 col  7 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   TCH rinse 3 H2O
28) M-A-D plate 2 col  5 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 180  OsO4
29) M-A-D plate 3 col  8 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   OsO4  rinse 1 H2O
30) M-A-D plate 3 col  9 spd 25 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   OsO4 rinse 2 H2O
```

Type here to search

32°F ENG US 2:08 PM 2022-02-21

ASP-1000 Dashboard Control



Developer

ASP-1000 Developer © 2021, 2022 Microscopy Innovations LLC

File Edit Operate Help

Run | Pause | Resume | Stop | Running | Test Mode | Step Progress | Step Time Left 00:03:09 | Step Done At... 12:12:37 | Protocol Progress | Protocol Time Left 03:16:48 | Protocol Done At... 15:26:16

Current Developer: No Name No.Name@Uni.edu 1234567890 AT&T

Protocol Step Designer

Command: Move-Asp-Disp | Comment: Fix rinse 2

Plate: Plate 3 | Column: Column 2 | Pause (s): 0 | LED

X (mm): 12.7 | Y (mm): 268 | Z (mm): 100 | Setpoint (C): 20.0

Speed: 18 | Vol. (ul): 100 | Asp. Hold (s): 0 | Disp. Hold (s): 0 | Repeat: 50

Operator | SM | Macro File Name: | Dialog/SMS Text:

mPrep/s capsules:
Usual volume = 100 to 150 ul.
Maximum volume = 150 ul.

mPrep/g capsules:
Usual volume: 35 ul.
Maximum volume = 40 ul.

Active Tray File: ASP MI Develop ... le TCU

Plate 1: OsO4 | Os rinse 1 H2O | Os rinse 2 H2O | Os rinse 3 H2O | 2% UA | UA rinse 1 H2O | UA rinse 2 H2O | UA rinse 3 H2O

Plate 2: 50% EtOH | 70% EtOH | 90% EtOH | 95% EtOH | 100% EtOH | 100% EtOH | Acetone 1 | Acetone 2

Plate 3: Fix rinse 1 | Fix rinse 2 | Fix rinse 3

Plate 4: 25% Resin | 50% Resin | 75% Resin | 100% Resin | 100% Resin | 100% Resin

Plate 5

Plate 6: Silicone bench

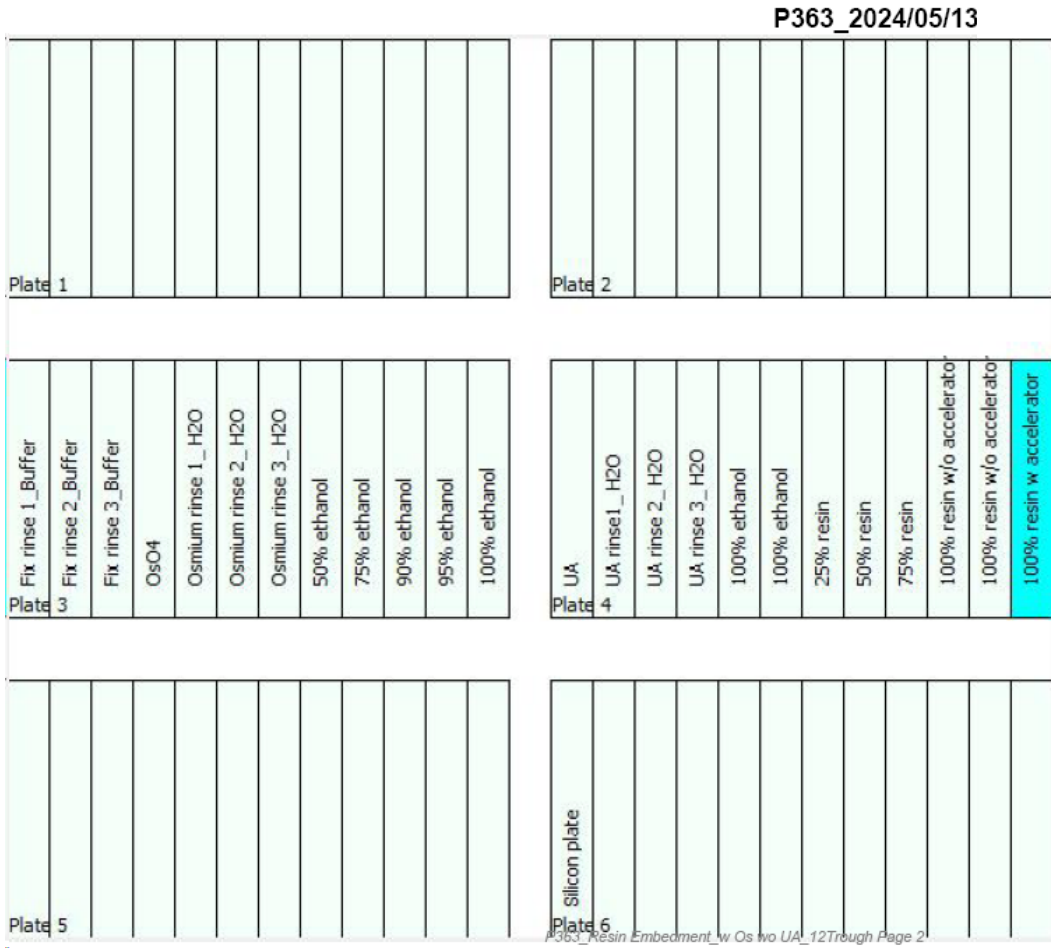
mPrep/s capsules: usually 100 to 150 ul. mPrep/g capsules: usually 35 ul.

Dye_Nerve TEM Tissue All 12-well - SLGv2*

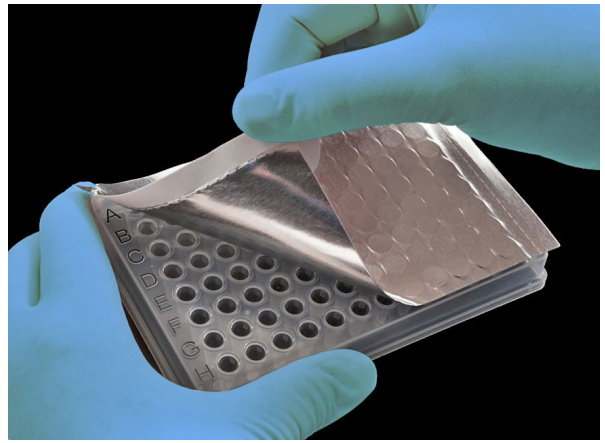
```
 1) Dialog Popup: TEM protocol nerve tissue with Os, UA, EtOH, Acetone,  confirm protocol
 2) LED Color - Green
 3) Return stage axes to the home position
 4) Initialize plunger valve right at pump speed 0
 5) Move all valves to input
 6) Aspirate volume 500ul
 7) Move all valves to output
 8) Load/Unload
 9) LED Color - Red
10) Dialog Popup: Attach capsules to shafts and press "Enter".
11) Send SMS: No Name, 1234567890, AT&T, Begin Nerve Prep processing     send message
12) LED Color - Green
13) Select Macro File: blowout.txt
14) M-A-D plate 3 col  1 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Fix rinse 1
15) M-A-D plate 3 col  2 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Fix rinse 2
16) M-A-D plate 3 col  3 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Fix rinse 3
17) M-A-D plate 1 col  1 spd 18 vol 50ul a-hld 0.0s d-hld 0.0s rpt 300   OsO4
18) Select Macro File: blowout.txt                                       Osmium
19) M-A-D plate 1 col  2 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   Os rinse 1 H2O
20) M-A-D plate 1 col  3 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   Os rinse 2 H2O
21) M-A-D plate 1 col  4 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 100  Os rinse 3 H2O
22) M-A-D plate 1 col  6 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 300  2% UA
23) Send SMS: Steven Goodman, 6082360627, AT&T, Nearing time to add Acet send message neari
24) M-A-D plate 1 col  7 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 10   UA rinse 1 H2O
25) M-A-D plate 1 col  8 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 50   UA rinse 2 H2O
26) M-A-D plate 1 col  9 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 100  UA rinse 3 H2O
27) LED Color - Red
28) Dialog Popup: Time to add Acetone, Resin (and EtOH), then press Ente Time to add reagen
29) LED Color - Green
30) M-A-D plate 2 col  1 spd 18 vol 100ul a-hld 0.0s d-hld 0.0s rpt 100  50% EtOH
```

ASP-1000 protocol

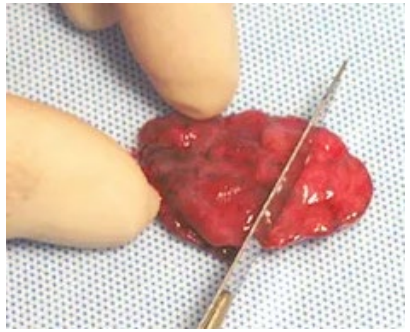
```
 1) LED Color - Red
 2) LED Color - Green
 3) Initialize plunger valve right at pump speed 12
 4) Return stage axes to the home position
 5) Aspirate volume 500ul
 6) Move all valves to output
 7) Load/Unload
 8) LED Color - Red
 9) Dialog Popup: Attach mPrep capsules to pipettor shaft and press "Ent
10) LED Color - Green
11) M-A-D plate 3 col  1 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Fix rinse 1_Buffer
12) M-A-D plate 3 col  2 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Fix rinse 2_Buffer
13) M-A-D plate 3 col  3 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Fix rinse 3_Buffer
14) M-A-D plate 3 col  4 spd 20 vol 100ul a-hld 0.0s d-hld 0.0s rpt 120  OsO4
15) M-A-D plate 3 col  5 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Osmium rinse 1_ H2O
16) M-A-D plate 3 col  6 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Osmium rinse 2_ H2O
17) M-A-D plate 3 col  7 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   Osmium rinse 3_ H2O
18) M-A-D plate 4 col  1 spd 20 vol 100ul a-hld 0.0s d-hld 0.0s rpt 120  UA
19) M-A-D plate 4 col  2 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   UA rinse1_ H2O
20) M-A-D plate 4 col  3 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   UA rinse 2_ H2O
21) M-A-D plate 4 col  4 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   UA rinse 3_ H2O
22) M-A-D plate 3 col  8 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   50% ethanol
23) M-A-D plate 3 col  9 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   75% ethanol
24) M-A-D plate 3 col 10 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   90% ethanol
25) M-A-D plate 3 col 11 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 60   95% ethanol
26) M-A-D plate 3 col 12 spd 15 vol 100ul a-hld 0.0s d-hld 0.0s rpt 120  100% ethanol
27) M-A-D plate 4 col  5 spd 20 vol 100ul a-hld 0.0s d-hld 0.0s rpt 120  100% ethanol
28) M-A-D plate 4 col  6 spd 20 vol 100ul a-hld 0.0s d-hld 0.0s rpt 120  100% ethanol
29) M-A-D plate 4 col  7 spd 25 vol 100ul a-hld 0.5s d-hld 0.0s rpt 120  25% resin
30) M-A-D plate 4 col  8 spd 25 vol 100ul a-hld 1.0s d-hld 1.0s rpt 140  50% resin
31) M-A-D plate 4 col  9 spd 30 vol 100ul a-hld 1.0s d-hld 1.0s rpt 140  75% resin
32) M-A-D plate 4 col 10 spd 35 vol 100ul a-hld 2.0s d-hld 2.0s rpt 160  100% resin w/o accel
33) M-A-D plate 4 col 11 spd 35 vol 100ul a-hld 2.0s d-hld 2.0s rpt 180  100% resin w/o accel
34) M-A-D plate 4 col 12 spd 35 vol 100ul a-hld 2.0s d-hld 2.0s rpt 180  100% resin w acceler
35) Aspirate volume 120ul
36) No-Operation: stage-pause 30 s                                       Comment goes here
37) LED Color - Red
38) Select Plate/Column 6 1                                              Silicon plate
39) Dialog Popup: Remove capsules and press "Enter".                     Remove capsules
40) LED Color - Green
```

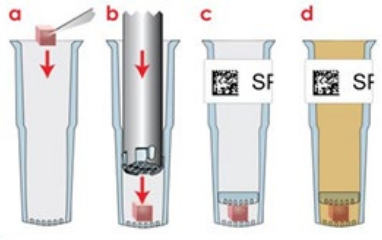


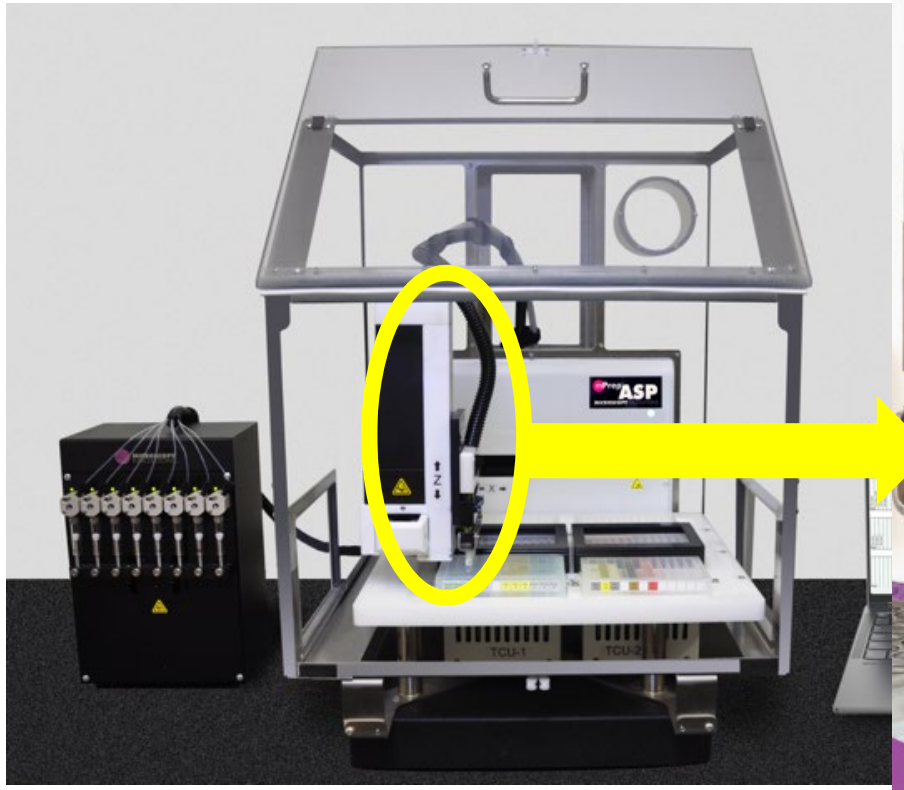
Multi-well plate formats



ASP-1000: automated sample preparation for TEM





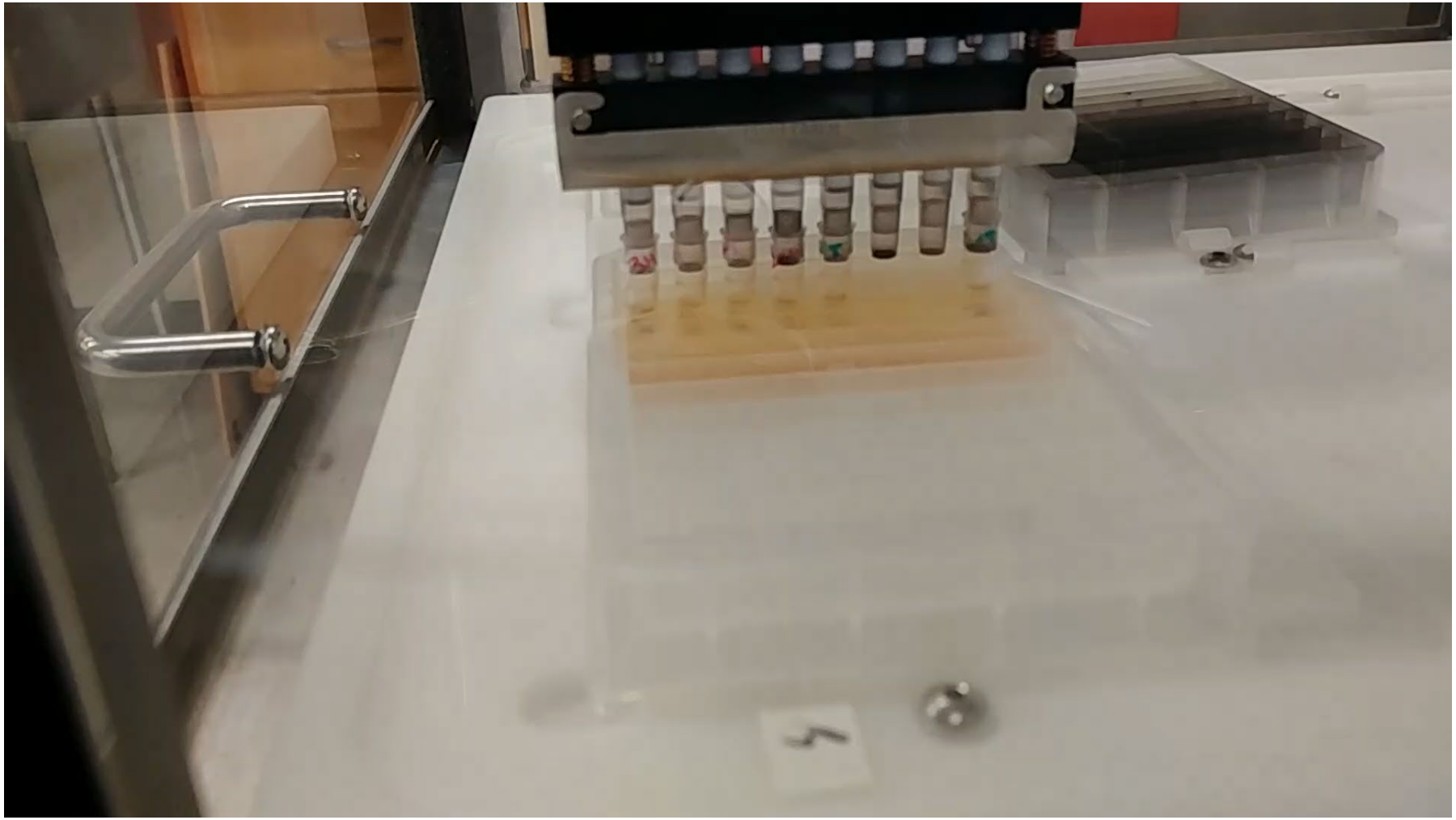


Sample mounting for ASP-1000

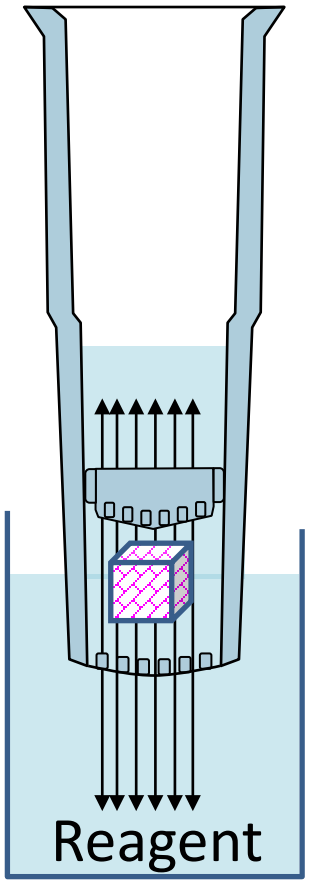
Accurate orientation. Specimens may be oriented using several methods
Efficient workflow. Streamlines specimen processing from dissection to reagent processing
Reduce handling. Once loaded in capsules, specimens are not touched again for TEM embedding or SEM mounting
Easy dissection. Single focal plane keep specimens in focus during dissection and when loading specimens in capsules
Wet samples. Dissect and load specimens wetted by buffers or fixatives
Efficient reagent processing. Directly load capsules onto pipettor from Workstation

https://www.youtube.com/watch?v=ZG1d1Me70y0

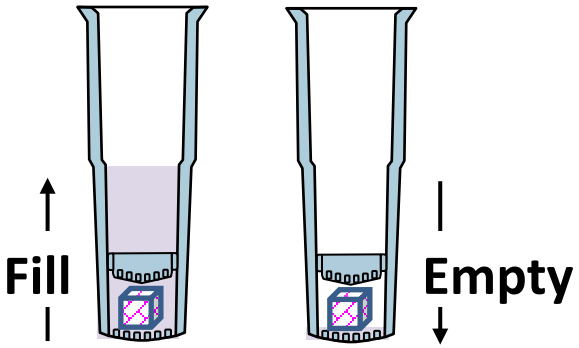
Automated sample preparation for TEM



ASP reagent agitation & mixing



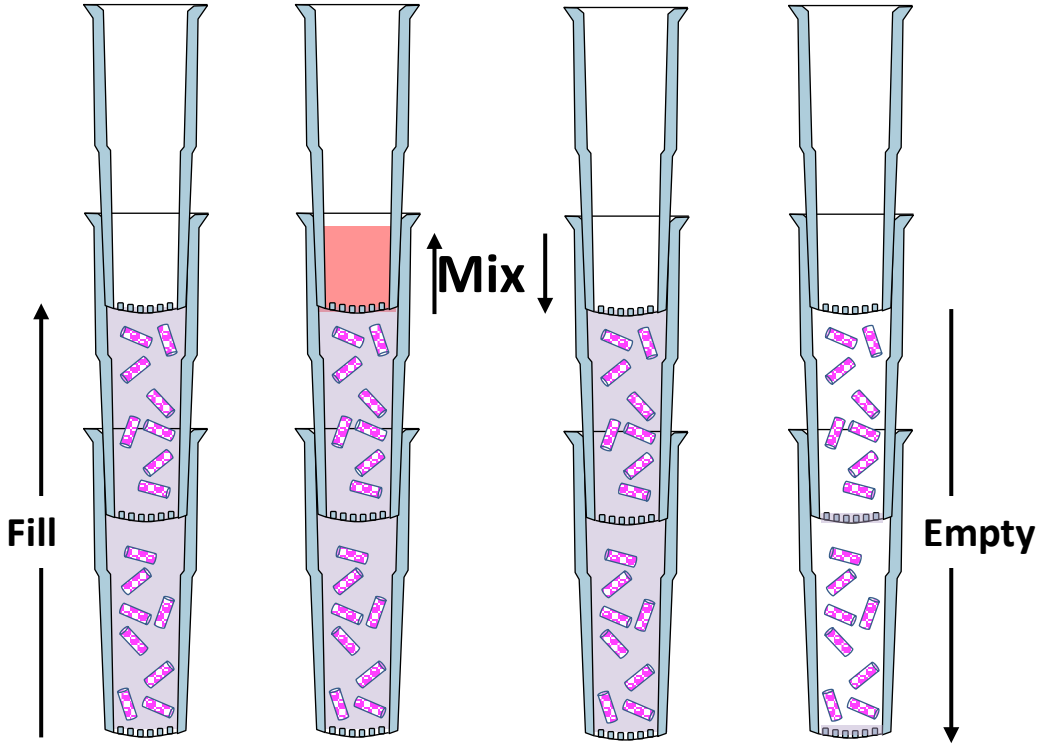
[Aspirate - Dispense] n



Control settings

- Repeats (n)
- Viscosity (speed)
- Volume
- Holds

Aspirate - [Mix] n - Dispense

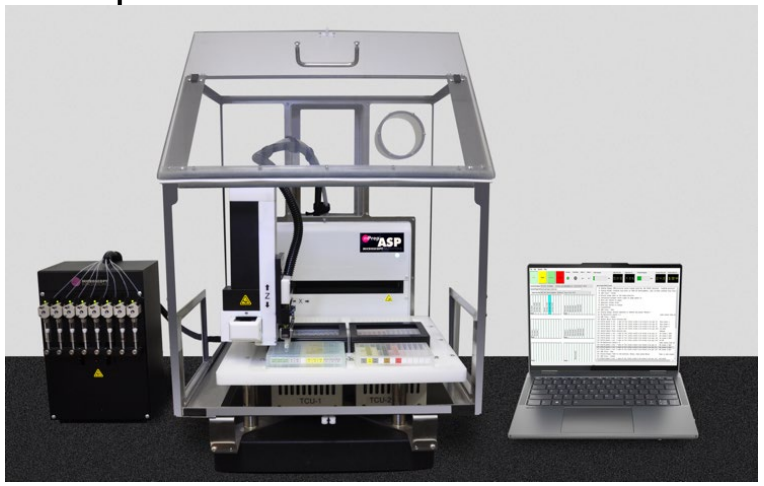


mPrep system components

mPrep/s capsules

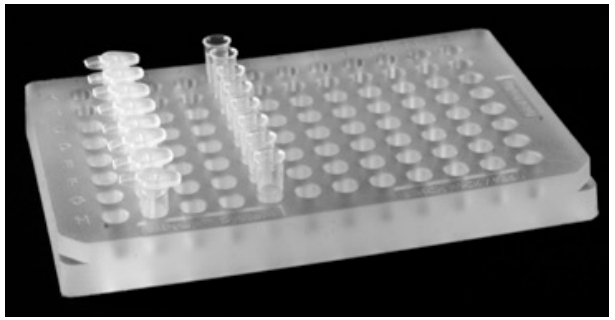
mPrep/g capsules

mPrep ASP Auto Processor



Device Compatibility

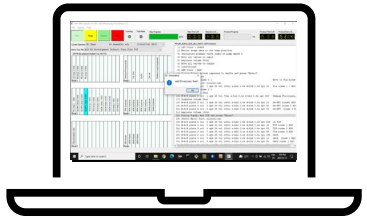
mPrep/bench – seals capsule bottom



Orientation Workstation

Specimen & Grid Holder for CPD and Cryo

ASP-1000 workflow

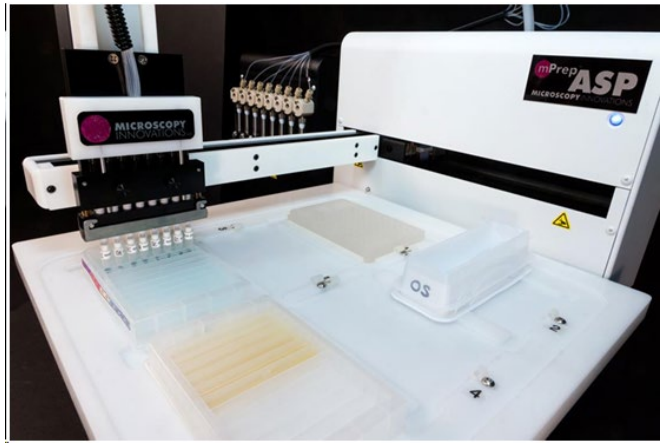


1. Set up the protocol

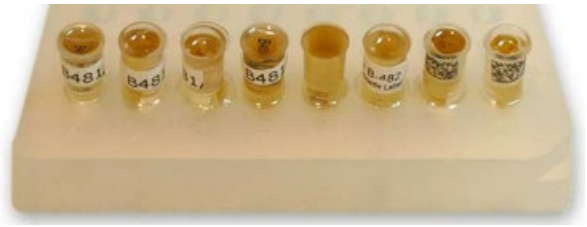
2. Prepare the plates

3. Mount the samples

4. Attach the capsules



5. Run the protocol

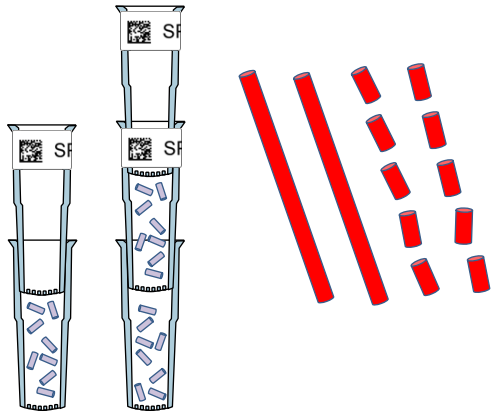


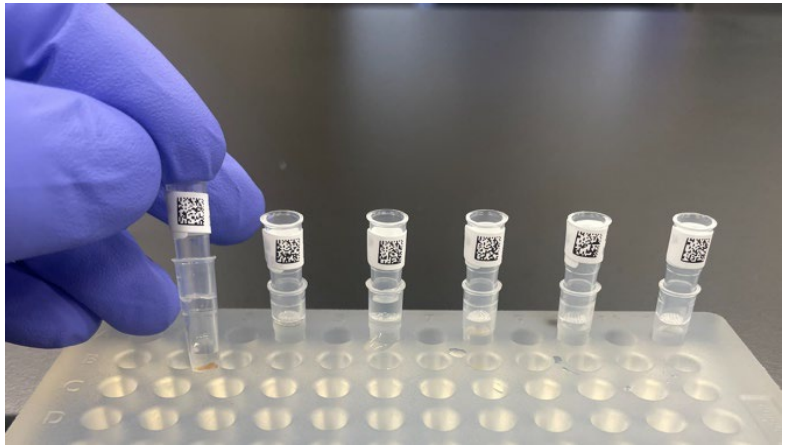
6. Polymerization

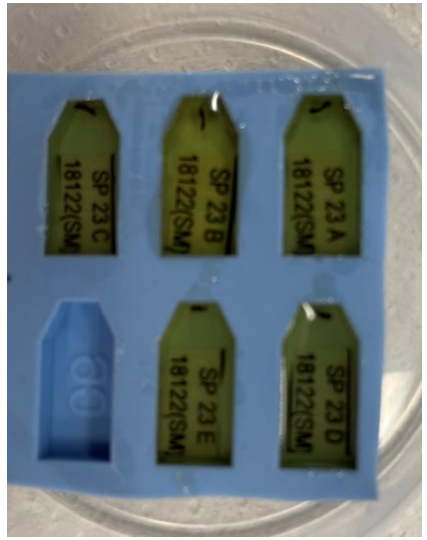
7. Retrieve the cured blocks

Automated TEM specimen preparation for clinical pathology

8 biopsy segments in each stacked capsule



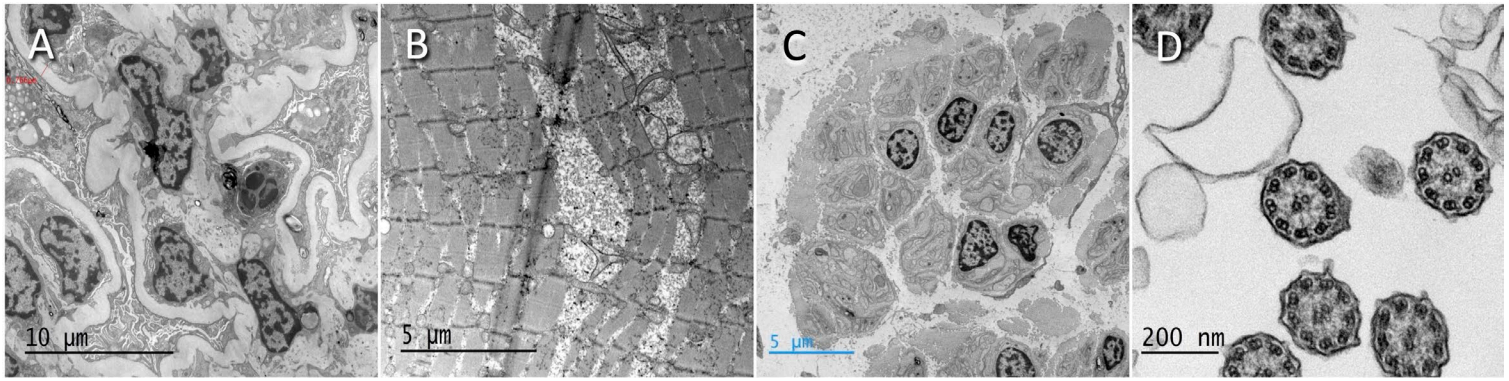




ARUP Labs: CAP, ISO-15189 & CLIA-certified National Reference Lab

- **Up to 128 renal/muscle specimens – 8 pieces/capsule**
- **Renal, Skeletal and Cardiac Muscle, Nerve, Cilia**

2 hours: glut rinse–>Os–>Ur->100% resin



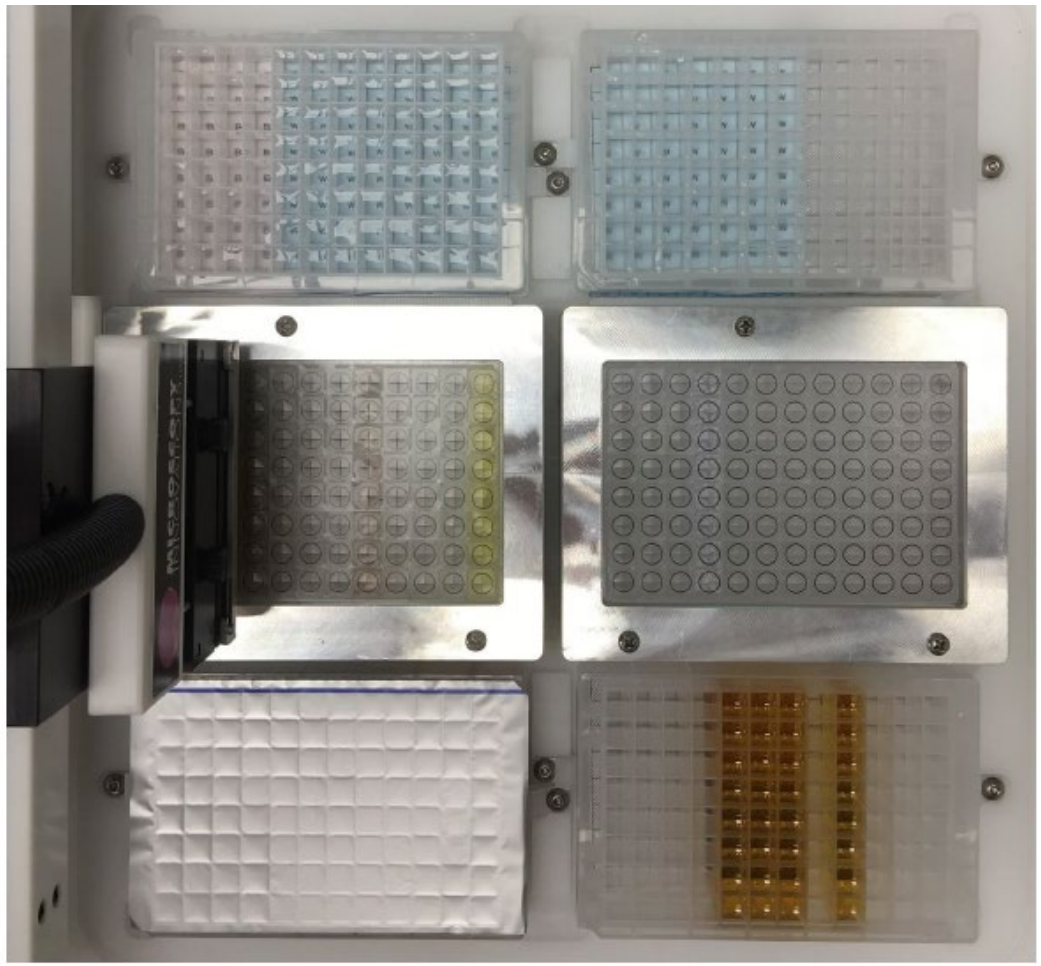
An Efficient Clinical TEM Workflow Using Automated Specimen Processing
Flint et al., M&M 2024 in press.

Creating Efficient Workflows for EM Labs with Automated Specimen Preparation
Goodman et al., Microscopy Today, Jan 2024

Automated heavy metal tissue staining for serial block face imaging with the ASP-1000

The protocol without resin polymerization takes 40 hours

ASP-1000 Robot Protocol	
Steps	Time each step
4X Buffer	15 minutes
2% Buffered reduced Osmium	4 hours
4X Water	15 minutes
1% aqueous TCH	45 minutes
4X Water	15 minutes
2% Aqueous OsO4	2 hours
4X Water	15 minutes
1% Aqueous UA	4 hours
1% Aqueous UA	2 hours
4X Water	15 minutes
Walton's Lead Aspartate	2 hours
4X Water	15 minutes
25%, 50%, 75%, 90% Acetone	15 minutes
3X 100% Acetone	15 minutes
25%, 50%, 75% Hard Plus in Acetone	30 minutes
3X 100% Hard Plus	2 hours
1X 100% Hard Plus	Overnight
Resin Embedding in Hard Plus	48 hours



McClain, Melainia, Morgan Harwood, and Steph Nowotarski. "Automated heavy metal tissue staining for serial block face imaging with the ASP-1000." In Microscopy and Microanalysis Conference. 2019.

Automated heavy metal tissue staining for serial block face imaging with the ASP-1000

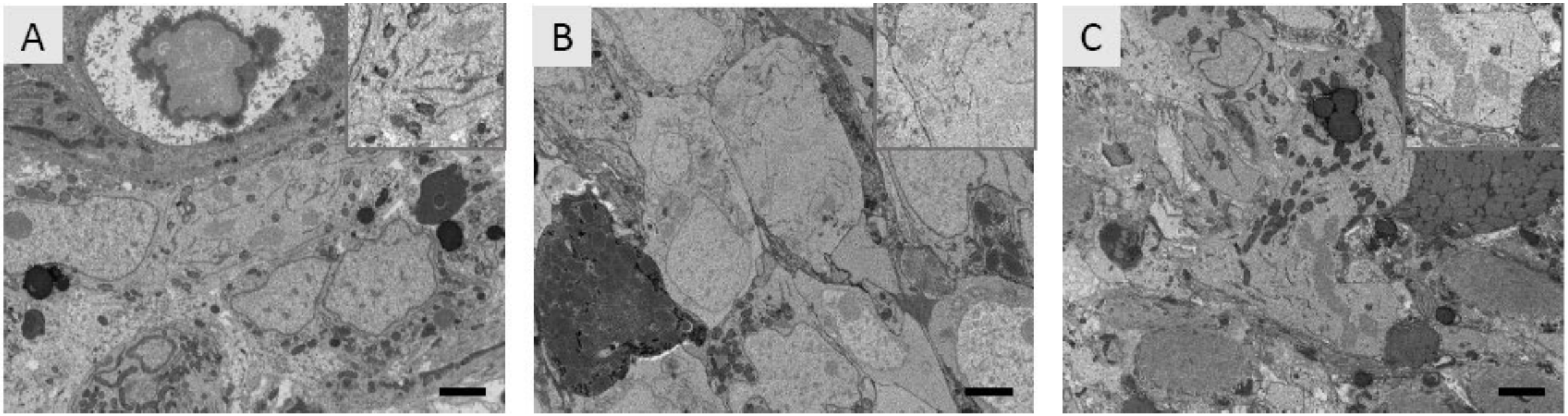
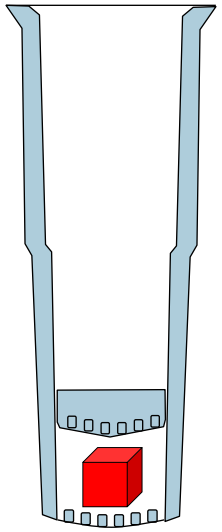


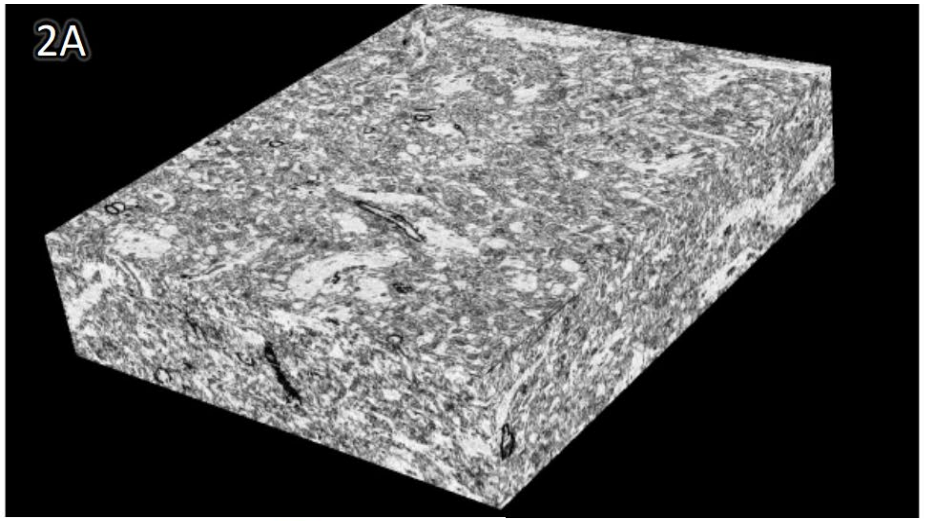
Figure 3. Images (A) and (B) from serial block face volumes processed on the bench using protocol [2] for (A) and [3] with extended staining times for (B). Image (C) from ASP-1000 robot protocol shows equivalent staining and ultrastructure preservation. Inserts show close-ups of the staining in each image. Scale bar is 2 um.

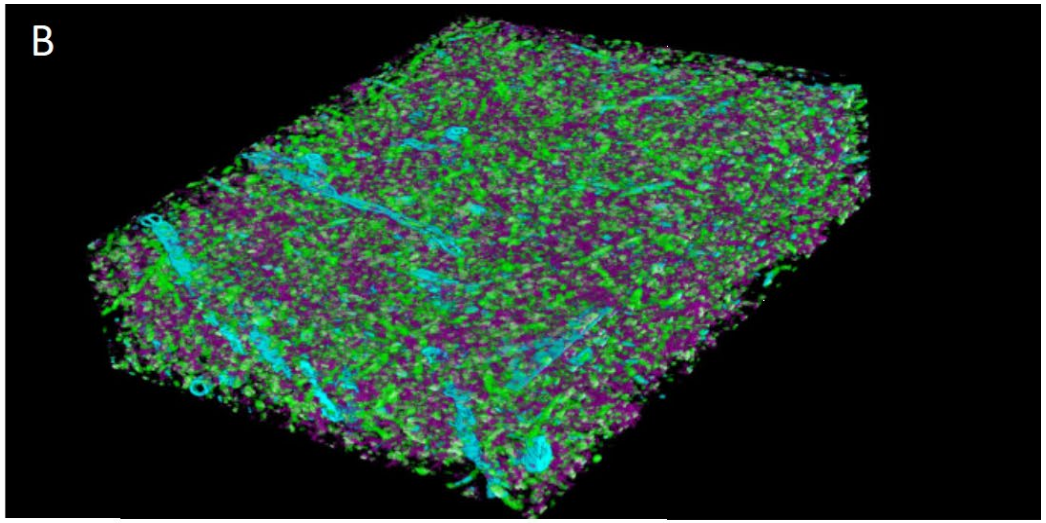
McClain, Melainia, Morgan Harwood, and Steph Nowotarski. "Automated heavy metal tissue staining for serial block face imaging with the ASP-1000." In Microscopy and Microanalysis Conference. 2019.

vEM – Rat brain cortex

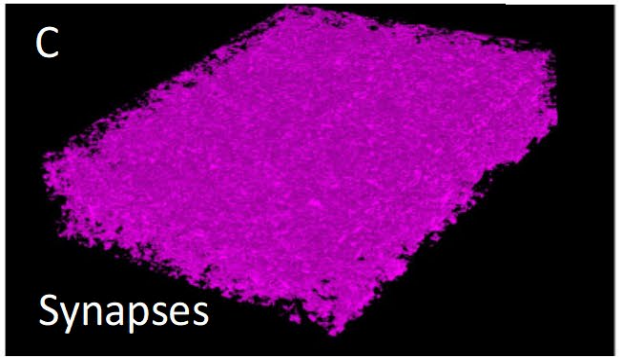
"Artificial Intelligence (AI) segmentation enabled with consistent ASP preparation"

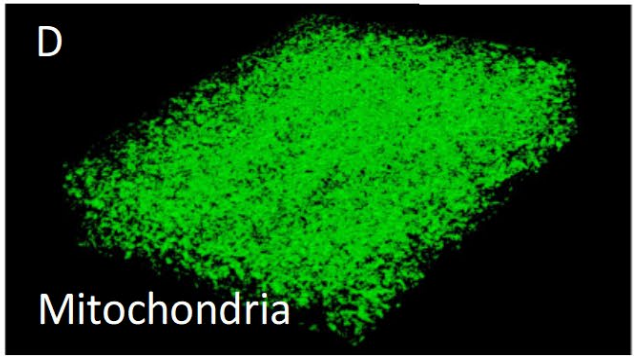


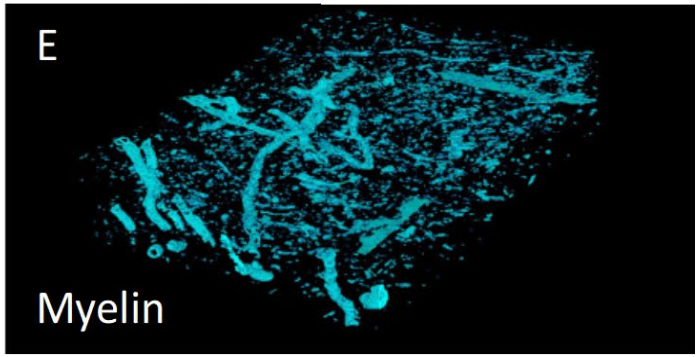




ASP-1000 prep:
- **7.5 hrs to resin curing**
- **1 hr hands-on effort**







Creating Efficient Workflows for EM Labs with Automated Specimen Preparation. **Goodman et al., Microscopy Today, Jan 2024**

Automated vs. manual preparation of brain tissue for vSEM

	Manual		Automated	
Reagent	**Exchanges**	**Time (min)**	**Exchanges**	**Time (min)**
Karnovsky fix	perfuse	Store 5C	perfuse	Store 5C
Buffer	6	30	30/30/30*	3
Tannic acid (some)	1	15	450	15
OsO4 - KFeCN	1	180	1800	60
Water	5	25	90/90/90/90/90	15
1% TCH	1	60	1800	60
Water	5	25	90	3
2% OsO4	1	180	900	30
Water	5	25	90/90/90/90/90	15
2% Uranyl Acetate	1	1,200	1800	60
Water	5	25	90/90/90	9
Lead Aspartate	1	40	900	30
Water	5	25	45/45/45	9
Graded ethanols	15	105	630	53
Acetone	2	30	270/270	9
Epoxy-acetones	2	600	900	30
100% epoxy	1	90	120/120/120	30
Transfer tissue to molds	1	45	NA	0
Resin cure 60C	Into oven	2 days	Into oven	Overnight
Time : Effort	**4 elapsed days : 2 days work**		**1 elapsed day : 1 hour work**	

Table 1: Protocol, reagent exchanges and incubation times for reagent exchanges. *30/30/30 indicates 30 exchanges in 3 different reagent wells.

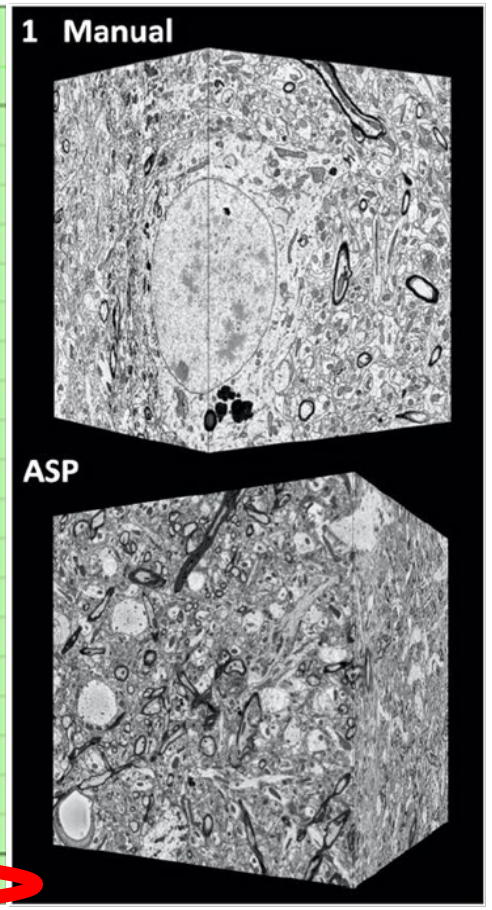
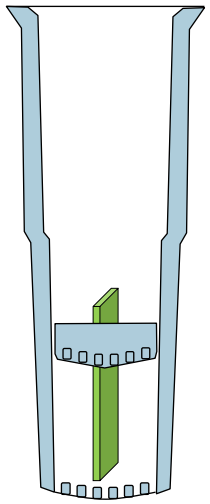
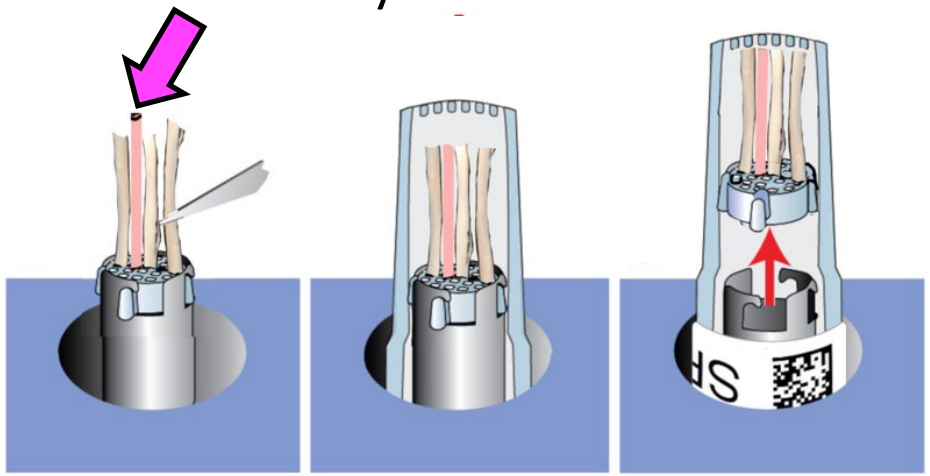


Figure 1. Table 1: Reagent protocol, times, and hands-on labor effort for manual and ASP preparation.
Figure 1: Perspective projections of cortex prepared manually (top) and with ASP (bottom). ~60 x 60 x 20 µm deep, from 350 70 nm thick slices. Images acquired in 25 hr each.

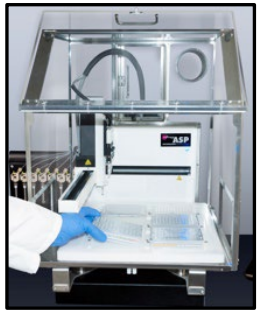
Benson, Emily, Grahame Kidd, Jay Campbell, and Steven Goodman. "Serial block-face SEM of brain tissue using rapid automated preparation." Microscopy and Microanalysis 26, no. S2 (2020): 1372-1373.

vEM–Peripheral Nerve Fibers



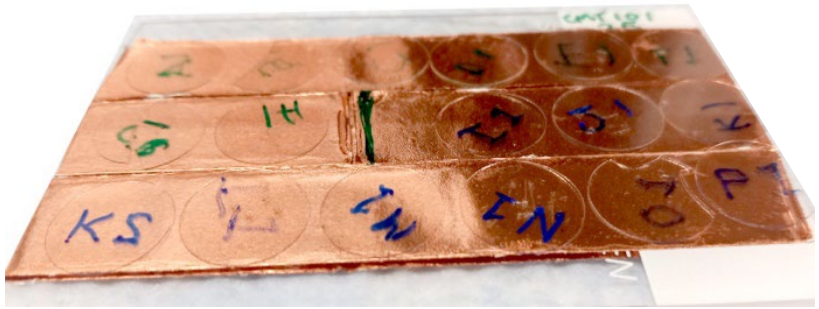


ASP-1000

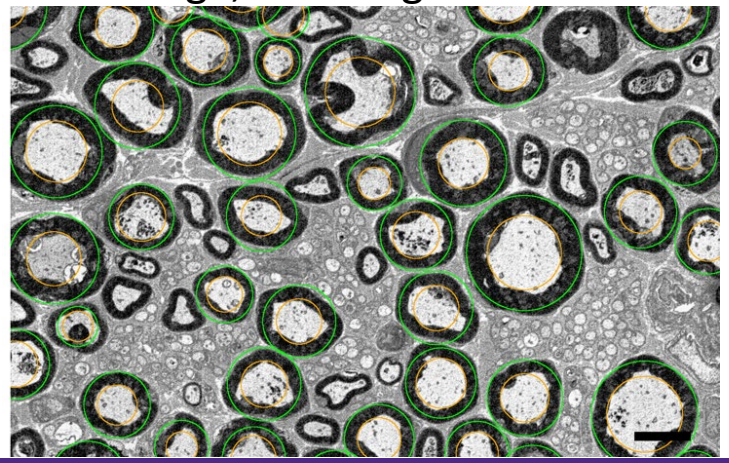


Embed in mPrep/s capsule

1 µm sections on coverslips,
UA-Pb stained, on copper tape



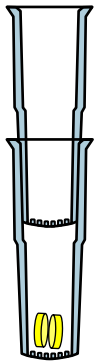
SEM image, auto-segment axons



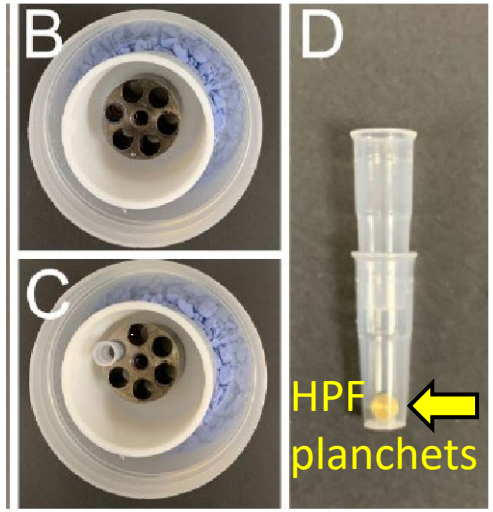
Kidd JK & Benson EK
Volume and Large Field of View EM… Preclinical Therapeutic Testing
Microscopy Microanalysis 29(1):1083 (2023)

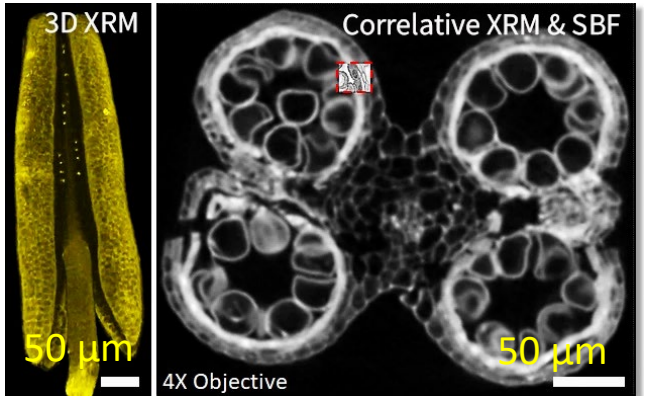
Creating Efficient Workflows for EM Labs with Automated Specimen Preparation
Microscopy Today, Jan 2024

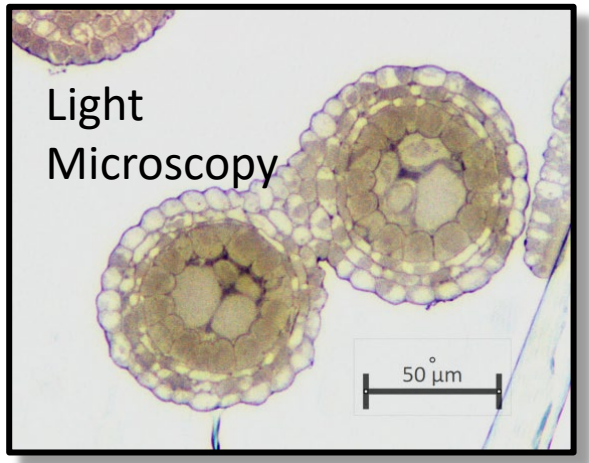
HPF-Freeze Sub: LM-XRM-SBF

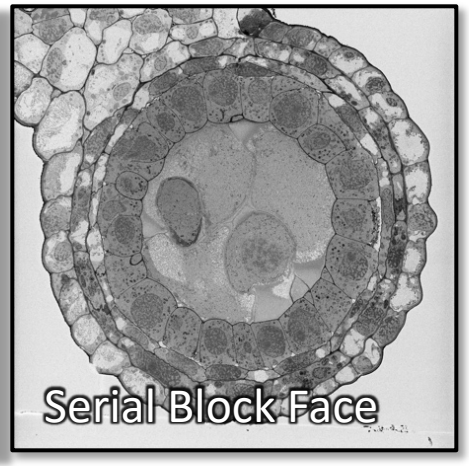


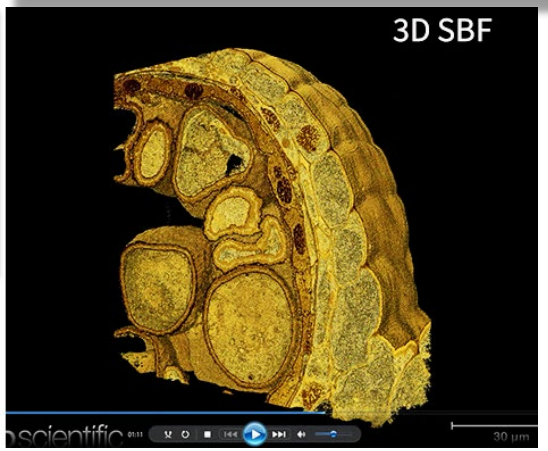
mPrep/s capsules….
"…loss-less handling of small plant samples
… buoyant plant specimens remained immersed throughout preparation"











Barley Anther

A versatile enhanced freeze-substitution protocol for volume electron microscopy. Belanger S, Berensmann H, Baena V, Duncan K, Meyers BC, Narayan K, Czymmek KJ, Frontiers Cell & Develop Biology, 10 (2022)

Specimen prep time, effort & methods

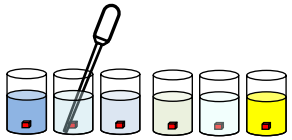
Cumulative hands-on effort

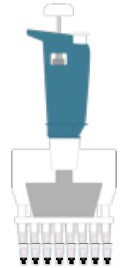
Typical duration

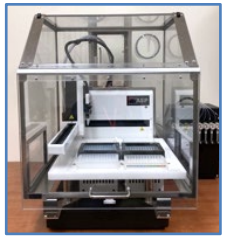
Method options

TEM

- Manual – vials and pipettes
- Manual – mPrep pipettor
- Autoprocessor
- mPrep ASP





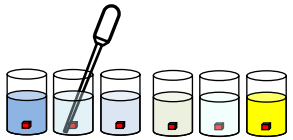


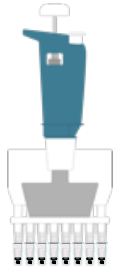
TEM-IGL

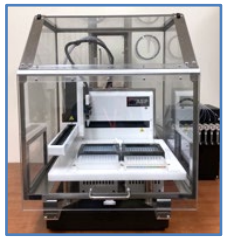
- mPrep ASP – pre-embed IGL (immuno gold labeling)
- mPrep ASP – post embed IGL

vEM

- Manual
- mPrep ASP







SEM

- Manual – vials and pipettes
- Manual – mPrep pipettor
- mPrep ASP

24 hours | 2 days | 3 days | 4 days

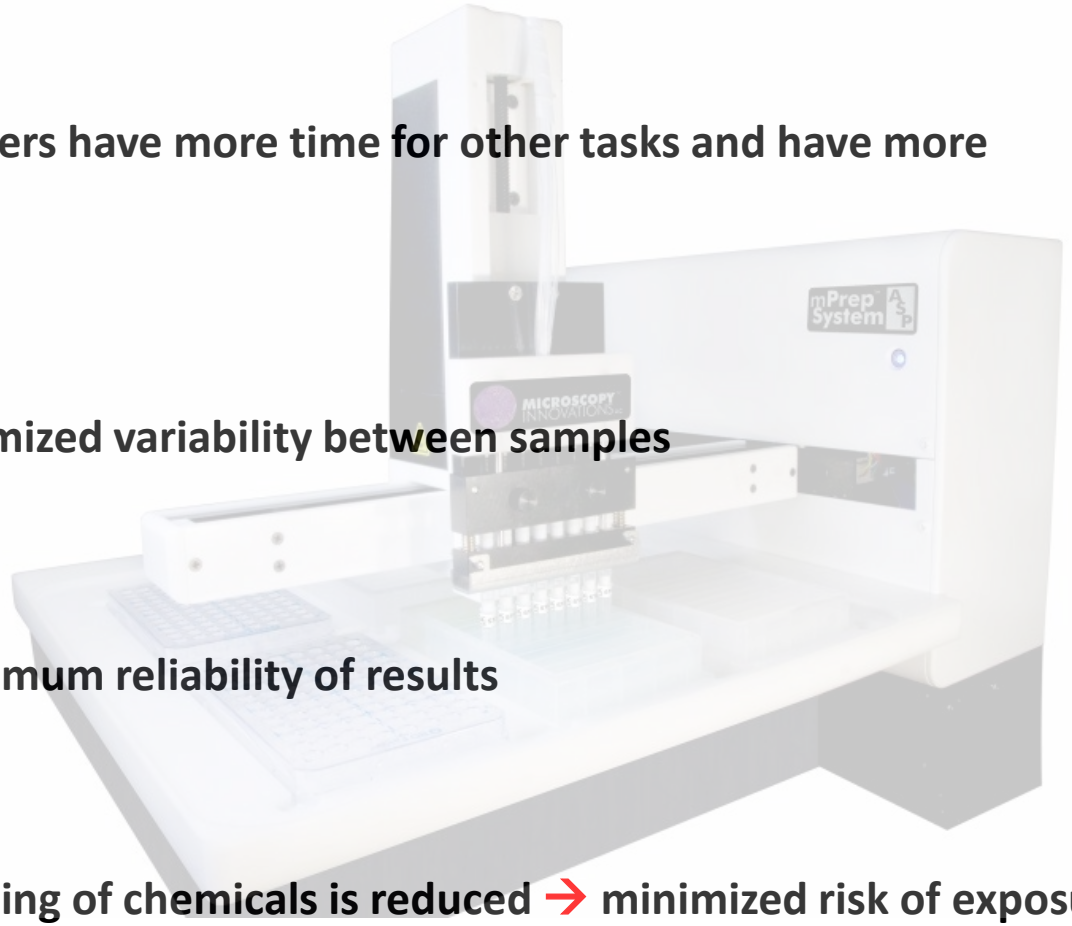
Benefits of automated sample preparation

Enhanced productivity

- high time efficiency and scalability → researchers have more time for other tasks and have more samples ready in less time

Improved consistency

- repeatable, standardized sample prep → minimized variability between samples



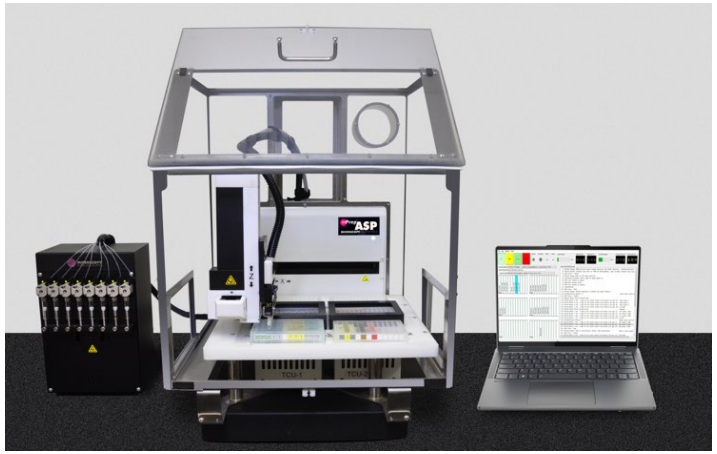
Reduced errors

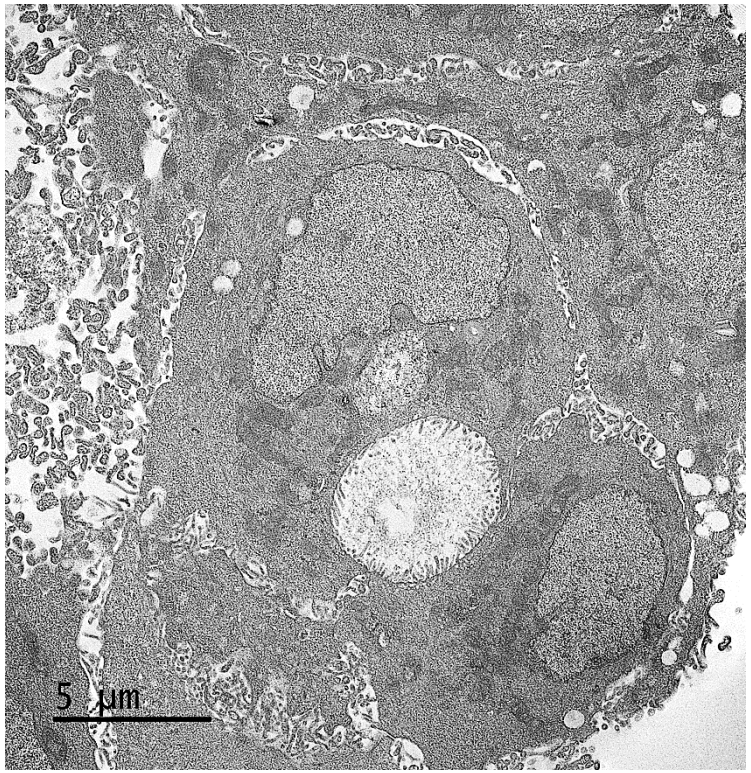
- manual handling errors are eliminated → maximum reliability of results

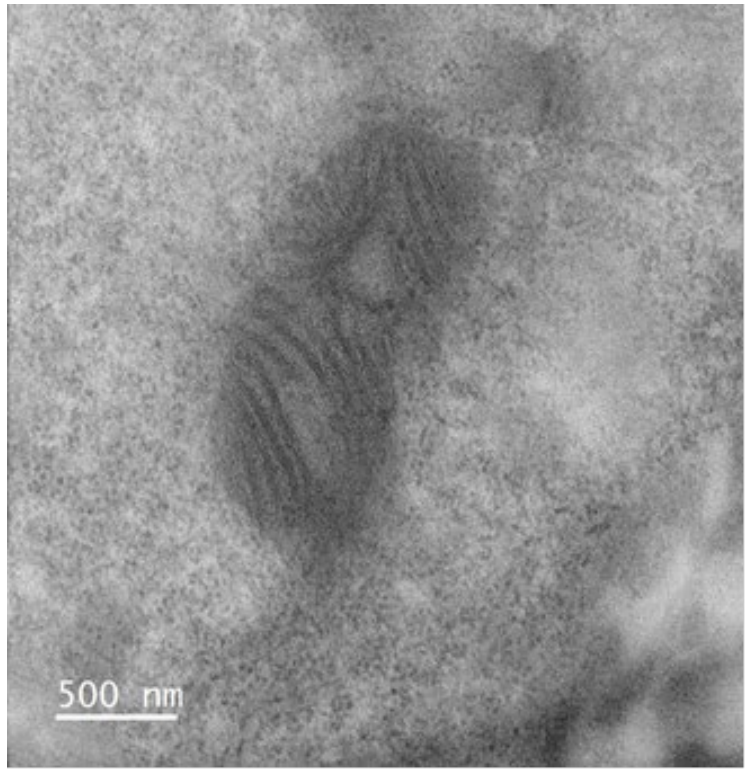
Increased safety

- APS is connected to exhaust and manual handling of chemicals is reduced → minimized risk of exposure of researchers to toxic chemicals and vapors

New BioCryo development: ASP protocol for cell monolayers on coverslips







TEM image of resin embedded HT29 cells and of a mitochondrion in a 300 nm thick section. The sample was processed with the ASP-1000. The image was recorded with the JEOL 3200FS.

The sample was provided by Yi Li, Shana Kelley lab, CZI.

Thank you for your attention!

Questions?

Contact:

Reiner Bleher, PhD

Research Associate Professor

Department of Materials Science and Engineering

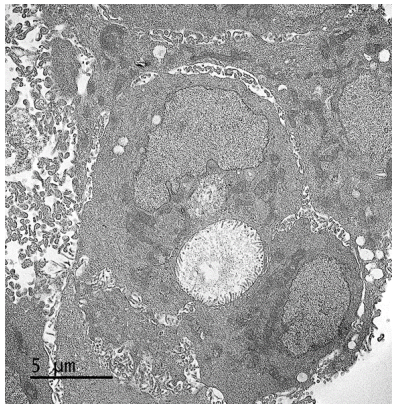
Northwestern University

Core Manager | **NU*ANCE*** | **BioCryo**

Office: Hogan Hall 5-156

Ph: 847.467.3540

r-bleher@northwestern.edu



https://nuance.northwestern.edu/facilities/biocryo/index.html