Electron microscopy Lecture

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Electron microscopy = EM

Transmission EM = TEM

Surface Scanning EM = SEM

Principals

X-ray spectrum

TEM
**TEM sample preparation**

**Fixation**
- Glutaraldehyde
- Paraformaldehyde

**Post-fixation**
- Osmium

**Buffers**
- Potassium phosphate
- Cacodylate \((C_2H_6AsO_2Na)\)

**Dehydration**
- Alcohol series

**Embedding**
- Epon
- LR White

**Cutting**
- 100nm sections

**Staining**
- Lead citrate
- Uranyl acetate

**Organelles**

**TEM**

**Actin**

**Microtubules**
Tissue: cellular ↔ extracellular

Cell-cell contacts

Bacteria
Extracellular matrix

Cell death

Expression of virus

SEM sample preparation

Fixation
Glutaraldehyde
Paraformaldehyde

Buffers
Potassium phosphate
Cacodylate
\((C_2H_6AsO_4Na)\)

Post-fixation
Osmium
Tannic acid
Critical point drying
Water
Alcohol or acetone series
Liquid CO₂

The phase diagram shows the pressure to temperature ranges where solid, liquid and vapour exist. The boundaries between the phases meet at a point on the phase diagram called the triple point. Along the boundary between the liquid and vapour phases it is possible to choose a particular temperature, and corresponding pressure, where liquid and vapour can co-exist and hence have the same density. This is the critical temperature and pressure.

SEM sample preparation
Sputter coating
10nm Gold
Conductivity
High contrast

SEM
Surfaces of larger objects e.g. Insects
SEM

Single cells

Cell-cell interaction

Secondary electrons

Back-scattered electrons

X-ray analysis

Energy-Filtering TEM = EFTEM

Electron Energy-Loss Spectroscopy = EELS

Element analysis
Single atoms
Oxidation state

Secondary Ion Mass Spectroscopy = NanoSIMS

bombardment of a sample with an energetic primary ion beam

displacement of ions from the sample

secondary ions

isotopic information of the sample surface