

Crystal Growth Methods and Mechanisms

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What makes a crystal?

- Ordered
- Exotic variations:
 - Aperiodic
 - Liquid
 - Colloidal
 - Time crystals

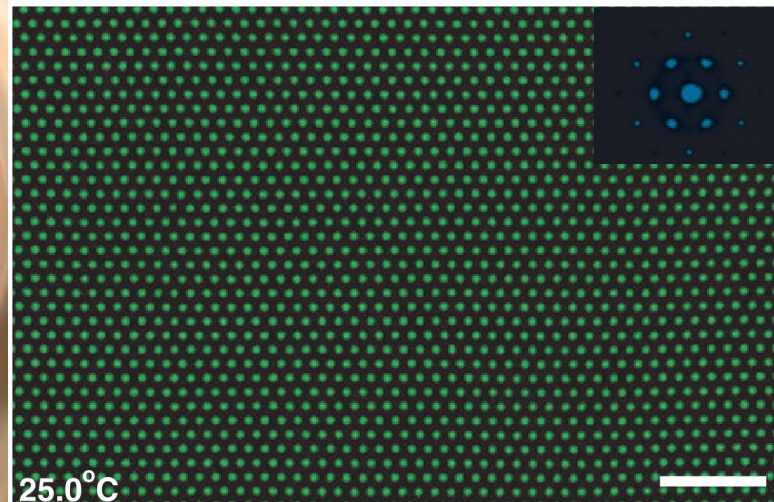
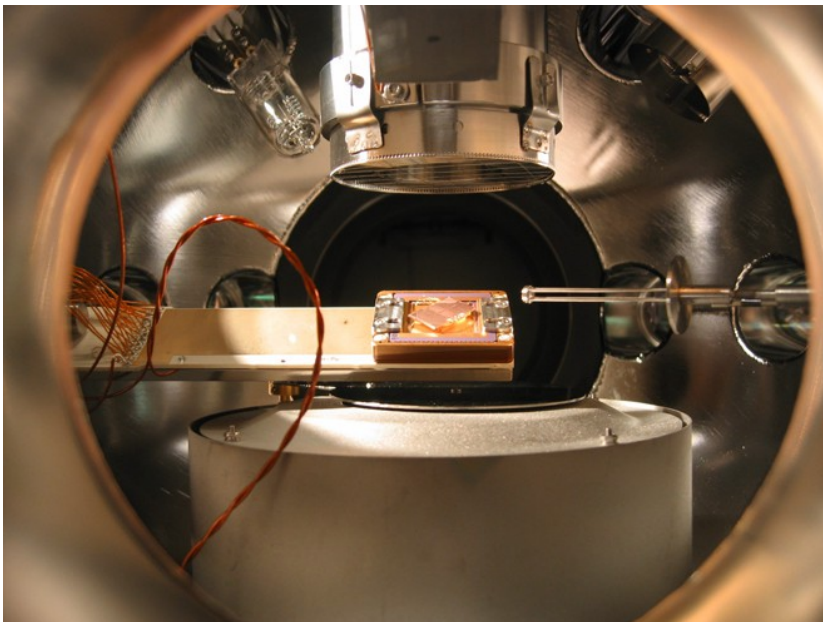
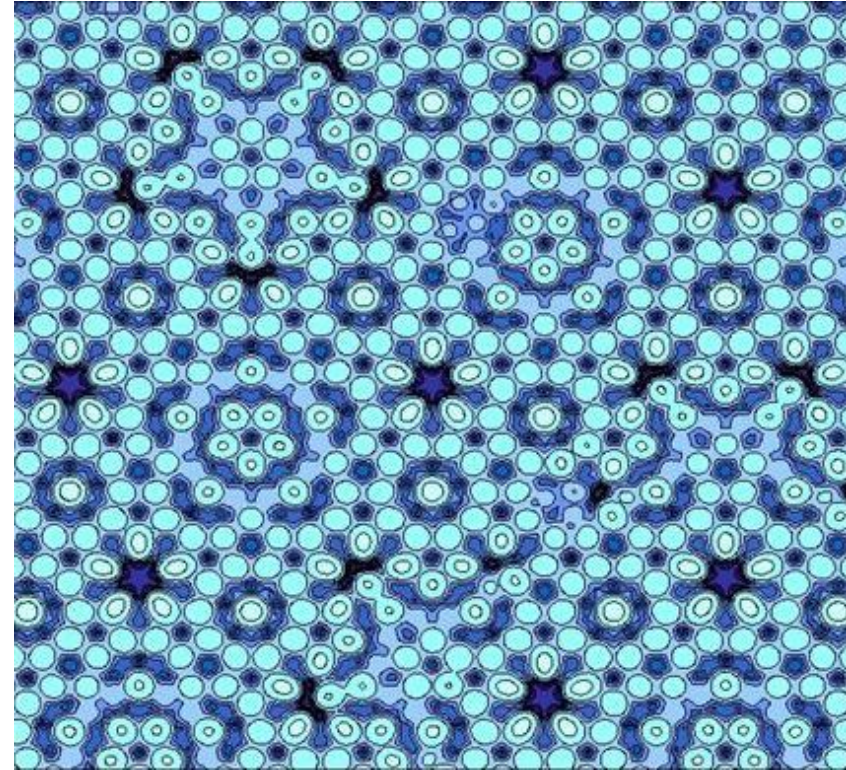
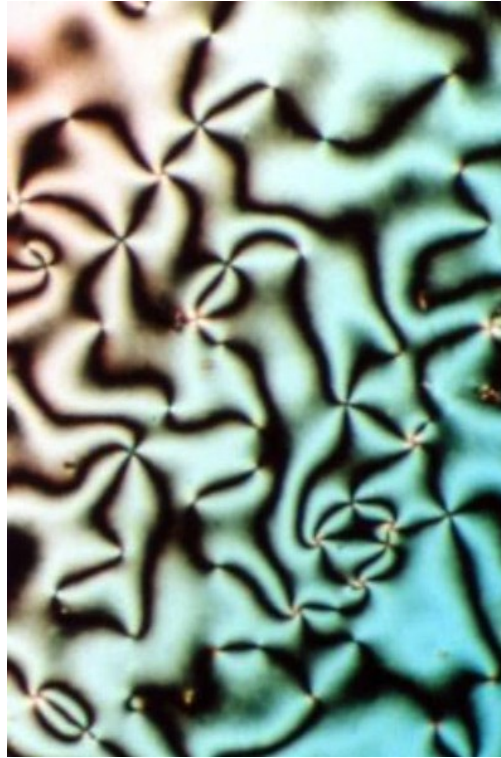
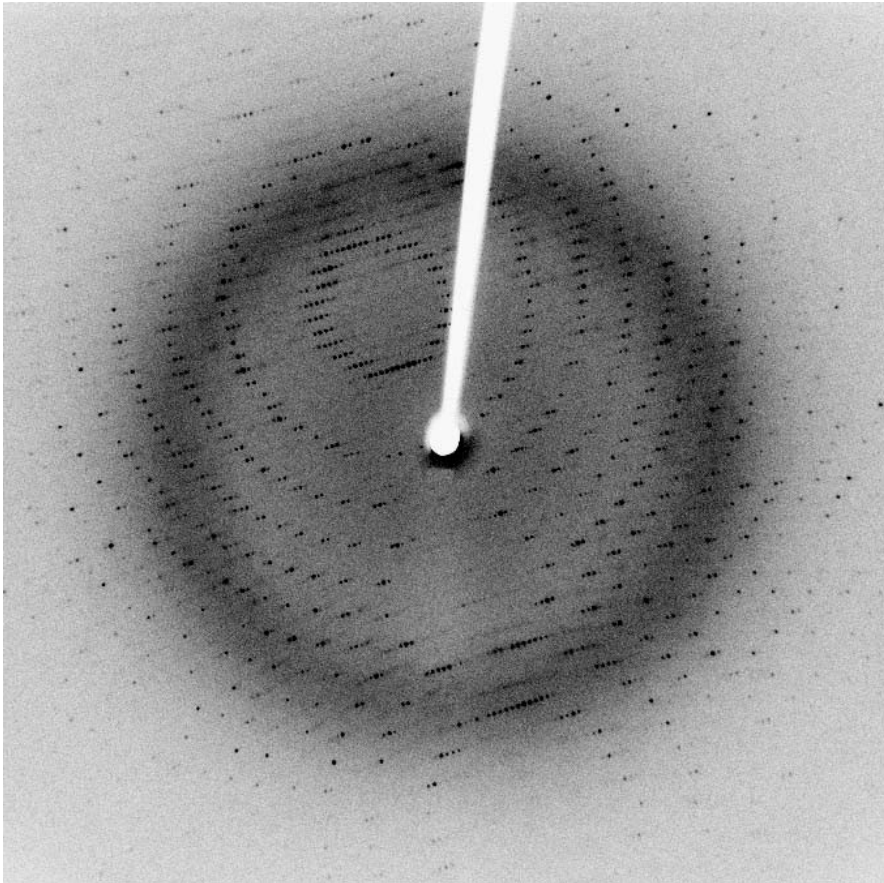


Fig. 1. Bright-field image of the NIPA particle colloidal crystal showing no defects; the slice is of the seventh layer from the cover-slip. Each bright spot corresponds to the central region of a 0.75- μm -diameter particle. Because of sample preparation and annealing, the primary defects are partial dislocations that exist in the interior of the crystal. Scale bar, 5 μm . (Inset) Bragg diffraction (wavelength = 405 nm) of the same sample.

Why study crystallization?

- Separation
- Fouling
- Characterization
- Production

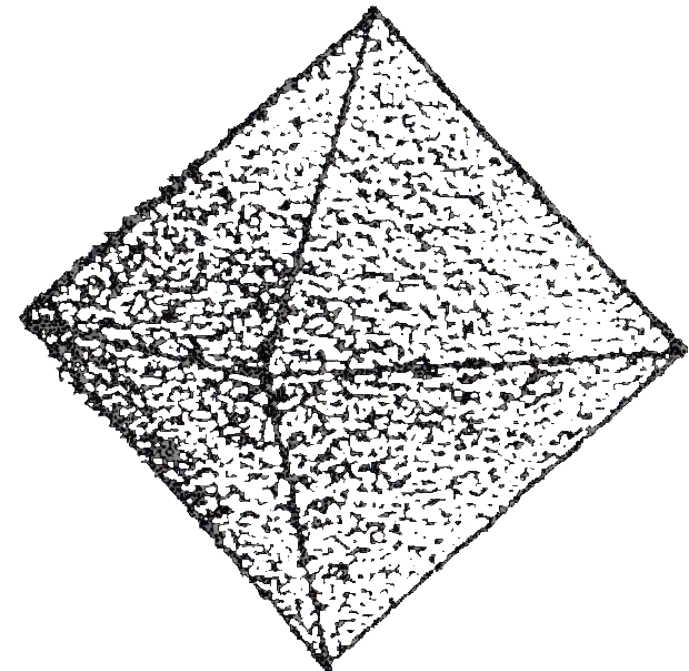
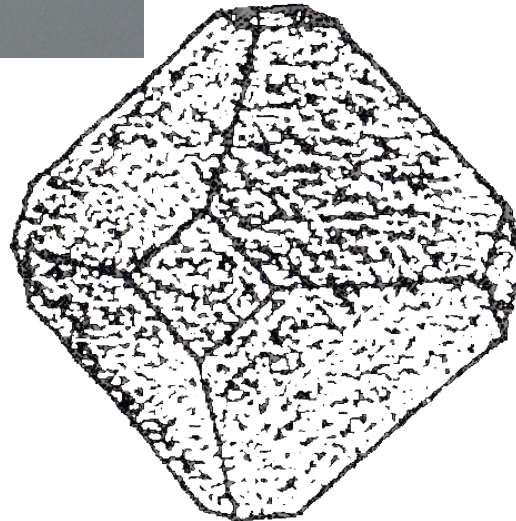
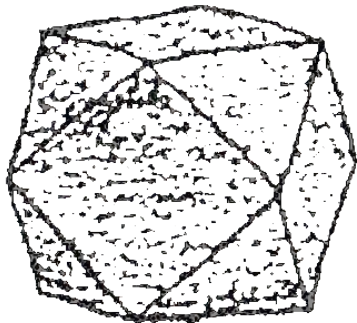
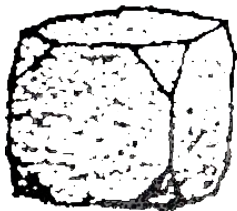
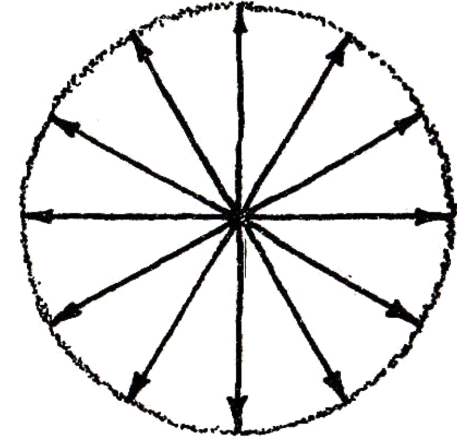
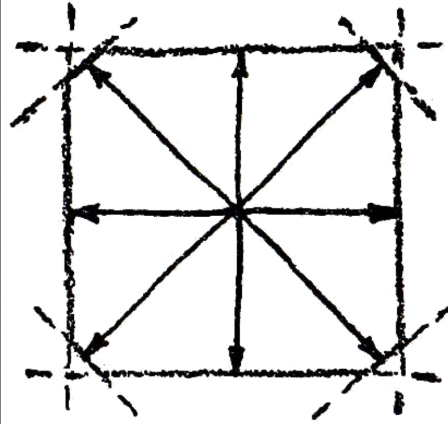


How do you grow a crystal?

- Solid growth
 - Annealing
 - Gel growth
 - Whiskering
- Melt growth
 - Freezing
 - Kryopoulos, Czochralski, and Bridgman techniques
 - Floating zone
- Growth from solution
 - Precipitation
- Vapor growth
 - Deposition
 - Vapor transport
 - Precipitation
 - Vapor-Liquid-Solid
- Other Considerations
 - Biomineralization
 - Naturally formed
 - Microgravity

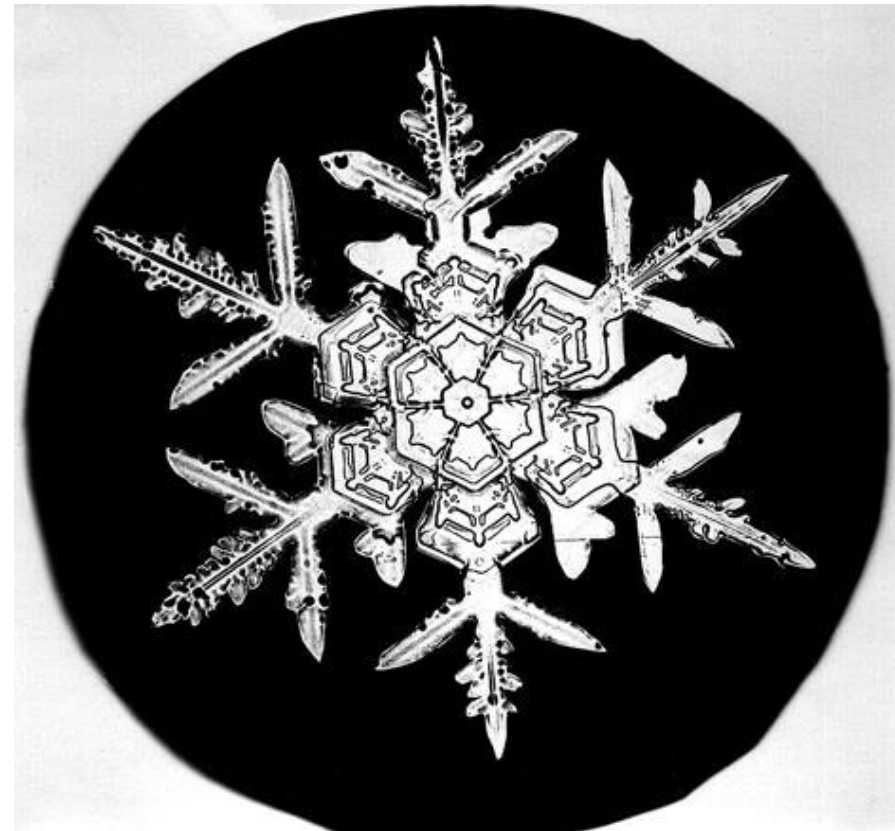
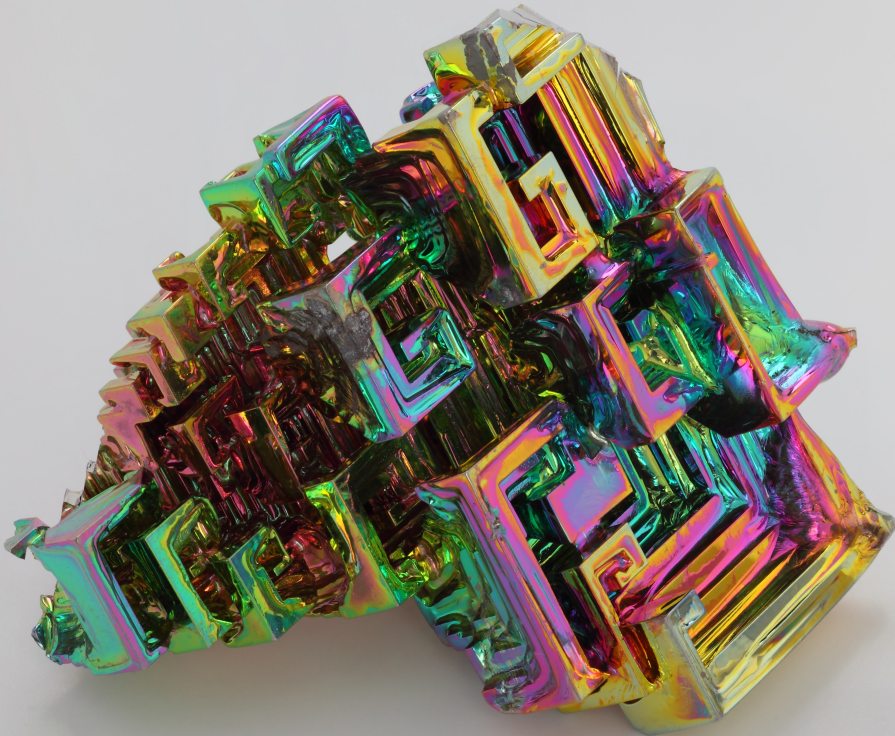
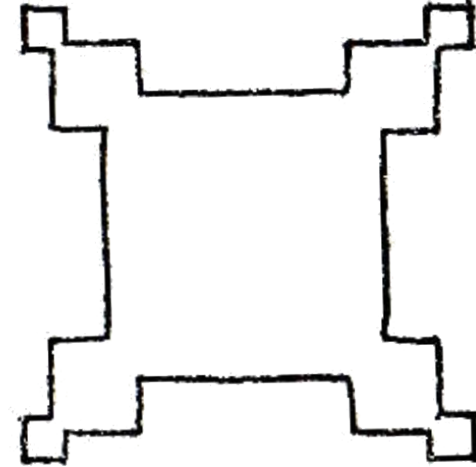
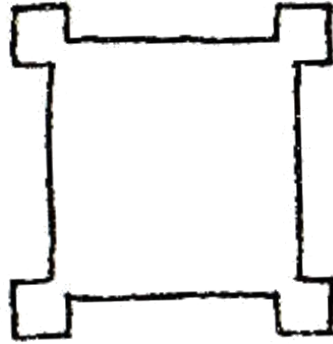
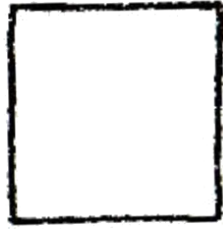
Crystal Growth Habits

Caused by anisotropy of growth rates.



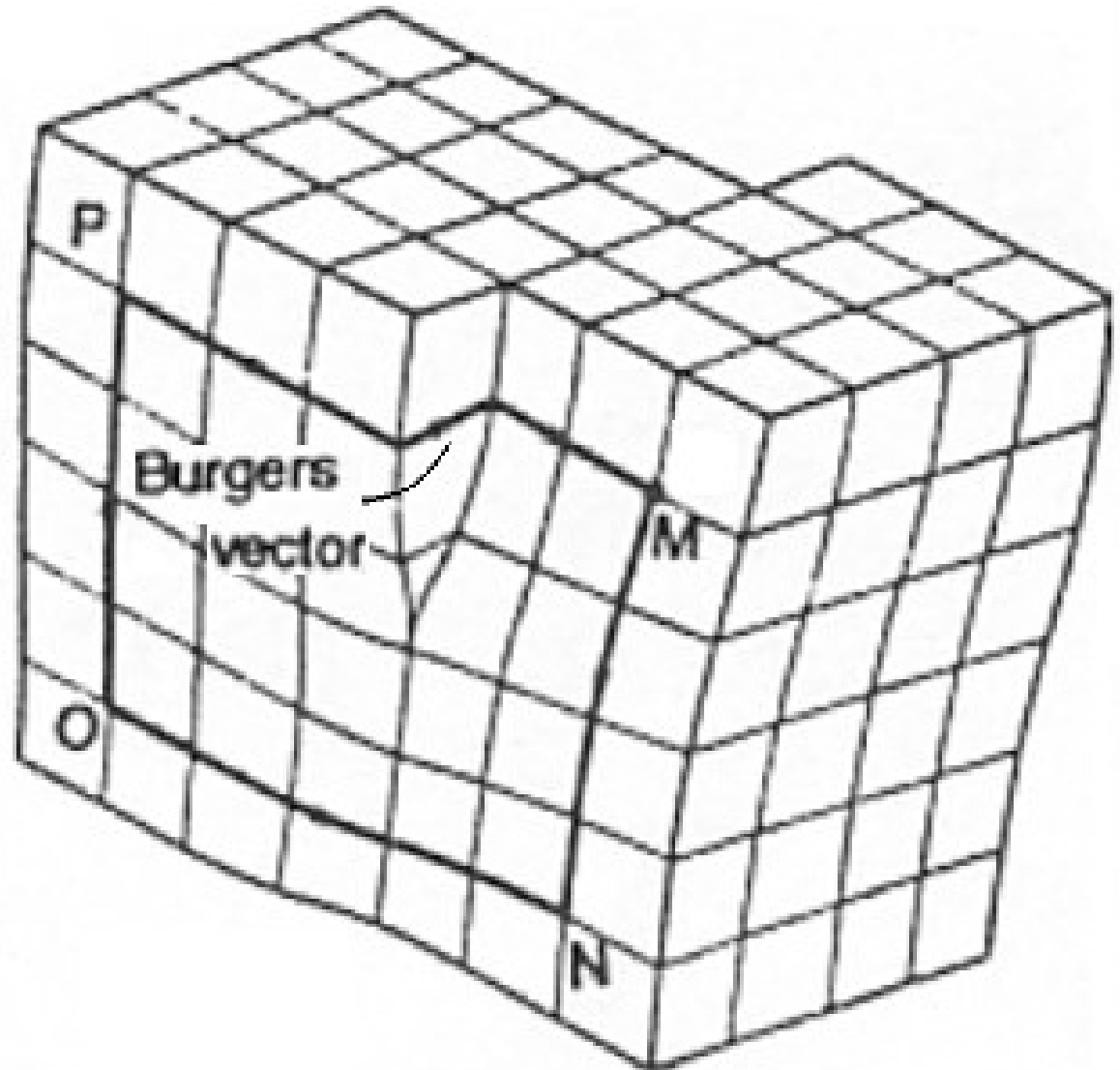
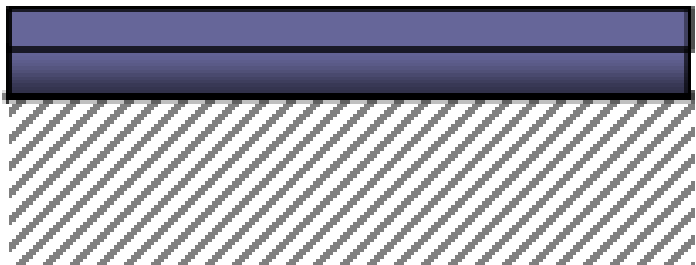
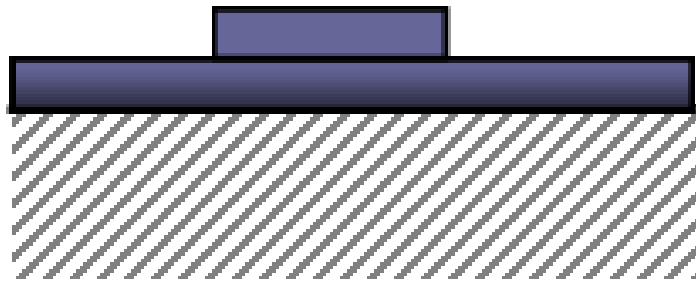
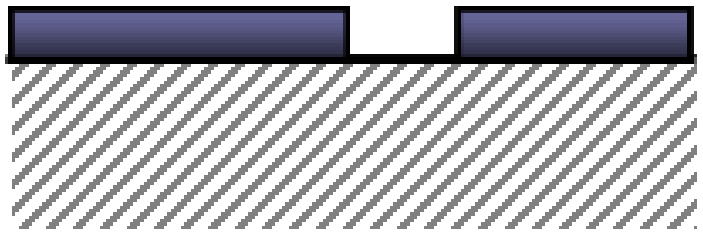
Hoppered and Dendritic Growth

Caused by concentration gradients across a surface.

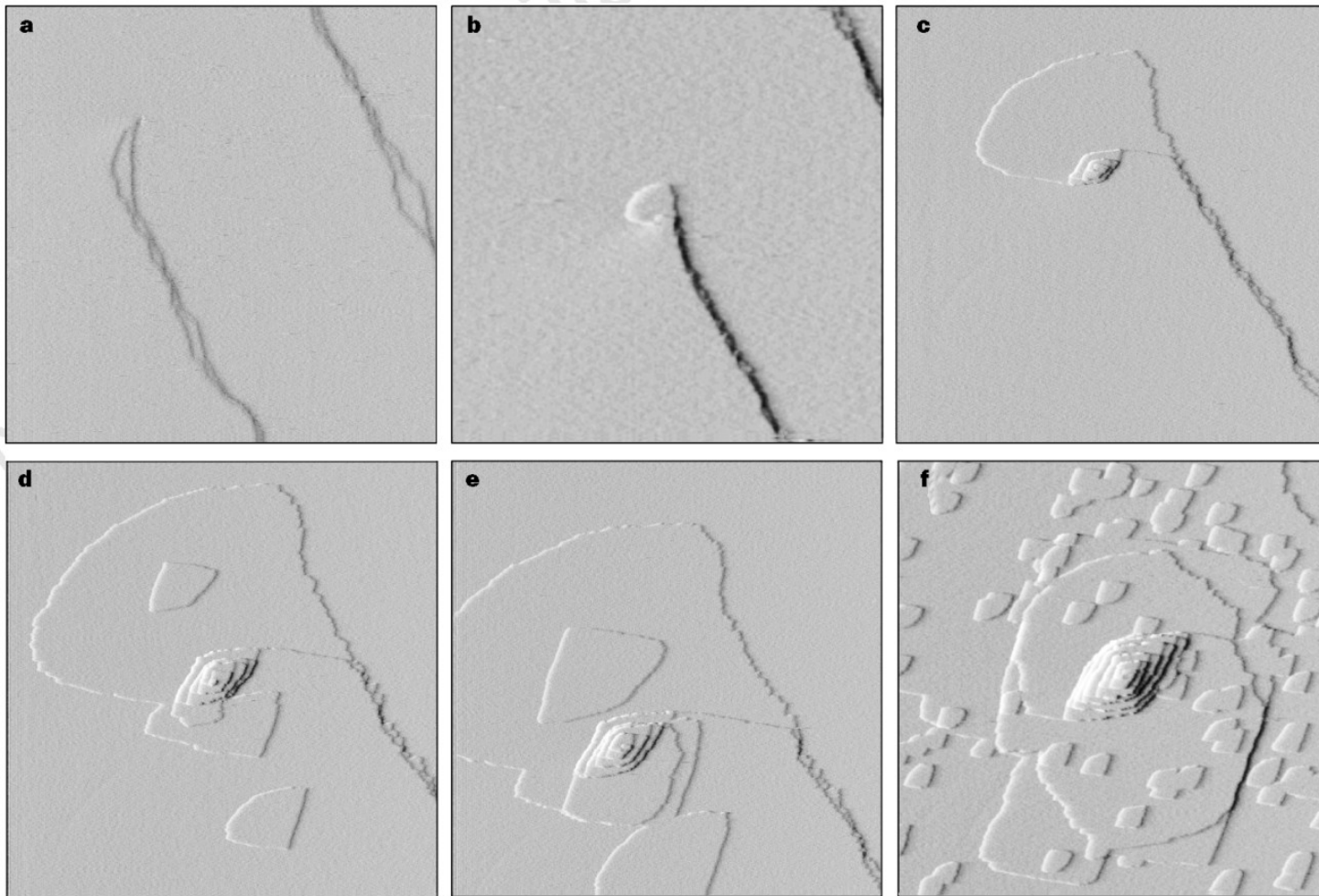


Epitaxial and Spiral Growth

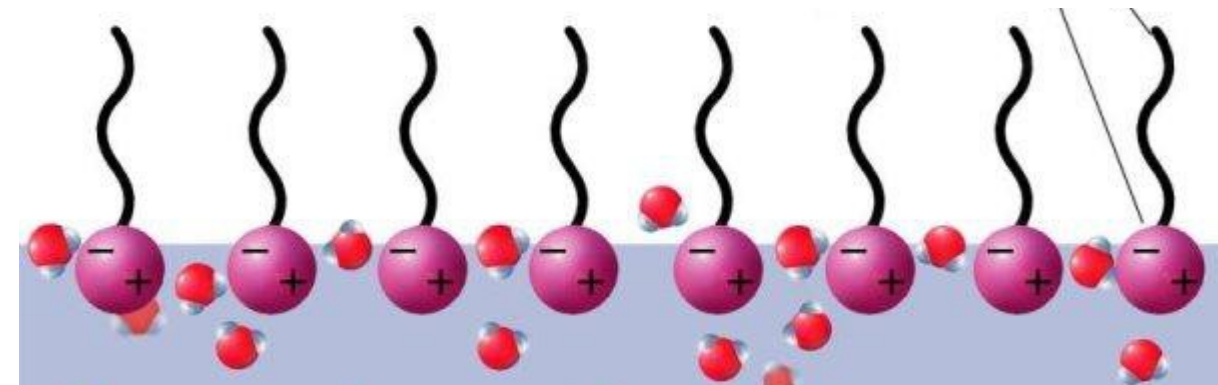
Burton-Cabrera-Frank theory



Proposed Research



AFM observation
of spiral growth



Gold-functionalized
Langmuir-Blodgett
film

Questions?