CryoCrystallography

A Primer for Young Scholars Program

What is CryoCrystallography?

- Introduce additives to crystal buffer
- Flash cool crystal to low temperature (T)
- Avoid the formation of ice crystals
- Flash cool water in glass state
- Collect x-ray diffraction data at low T
- Reduce x-ray damage to crystal

Why CryoCrystallography?

- Lower x-ray damage to crystal
  - Movement of free-radicals reduced
- Lower thermal motion in crystal
  - Lower molecular motion >>> sharper image
- No external scatterers around crystal
  - Lower background noise
- Lower heat damage to crystal
  - Lower thermal damage

How to do CryoCrystallography?

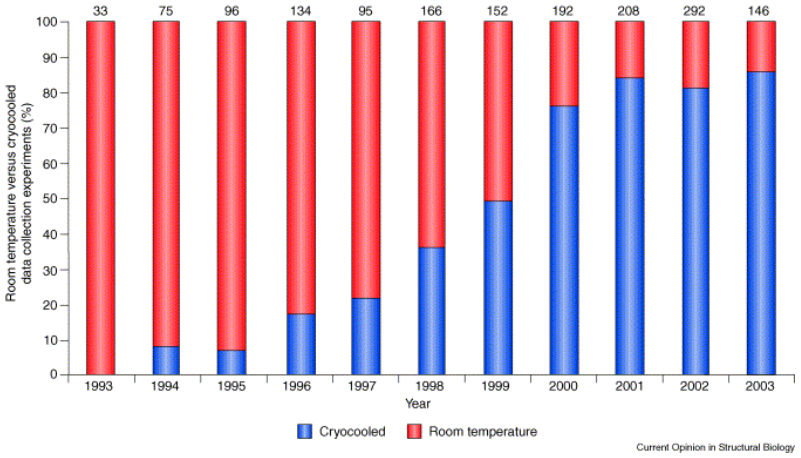
- Flash cooling with liquid cryogen
  - Plunge crystal in liquid nitrogen/ethane
- Flash cooling with gaseous cryogen
  - Introduce crystal in low T gas nitrogen stream
- Fast cooling rates are needed
  - In the order of 10^3-10^4 °C/s

How to do CryoCrystallography?

- Sample in a loop
  - Scoop crystal in buffer with a rayon loop
- Correct amount of buffer
  - Minimize amount of buffer with crystal
- Good and uniform cooling
  - Ensure laminar flow and fast cooling rate

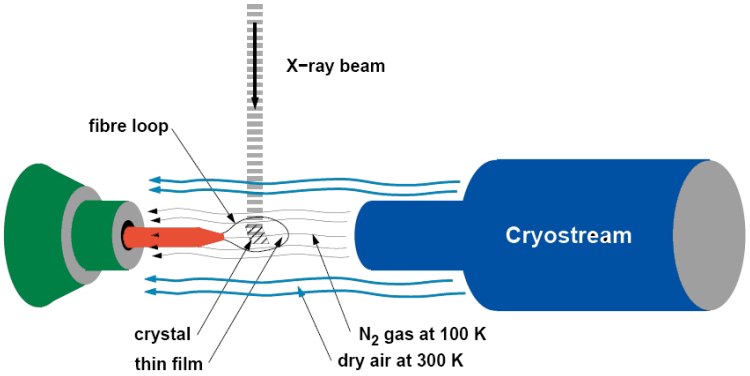
CryoCrystallography

E. Garman | Curr Opn Str Biol (2003)



Percent cryo and ambient experiments from 1993-2003

Th. R. Schneider (1997)



Typical cryo set-up

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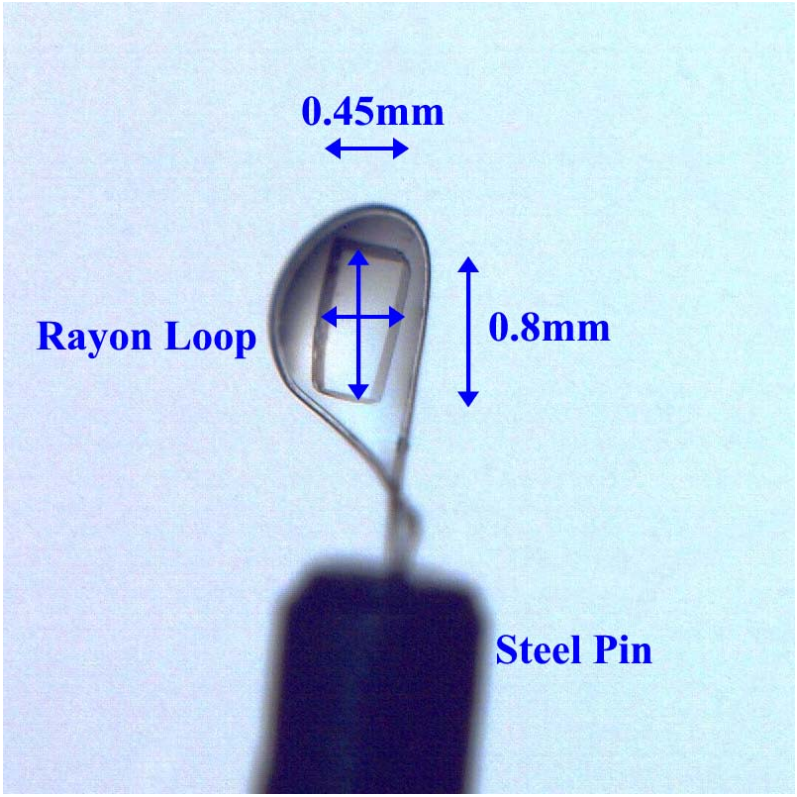
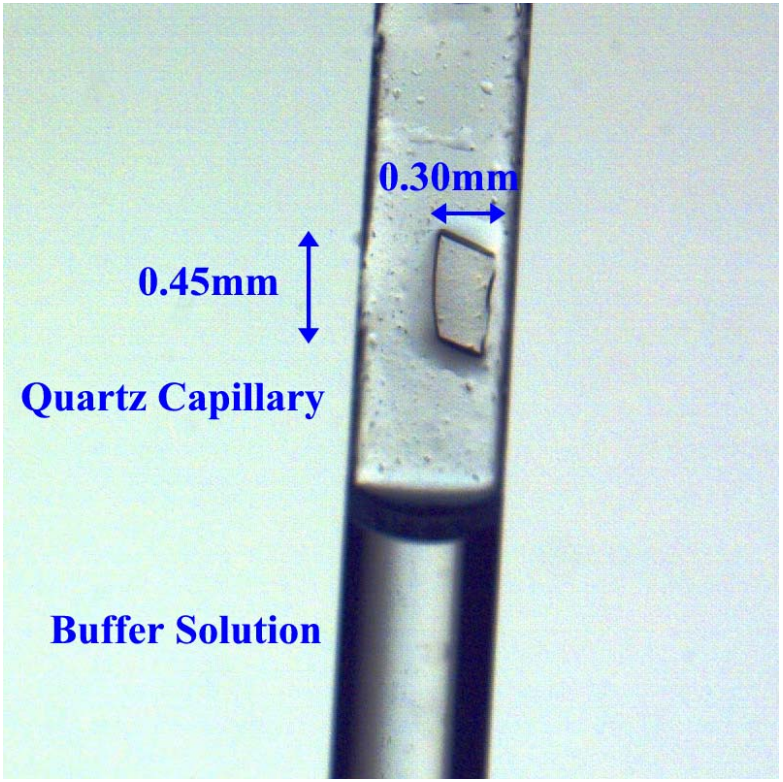
Crystal in a CryoLoop (Cryo T)



Crystal inside capillary (Ambient T)



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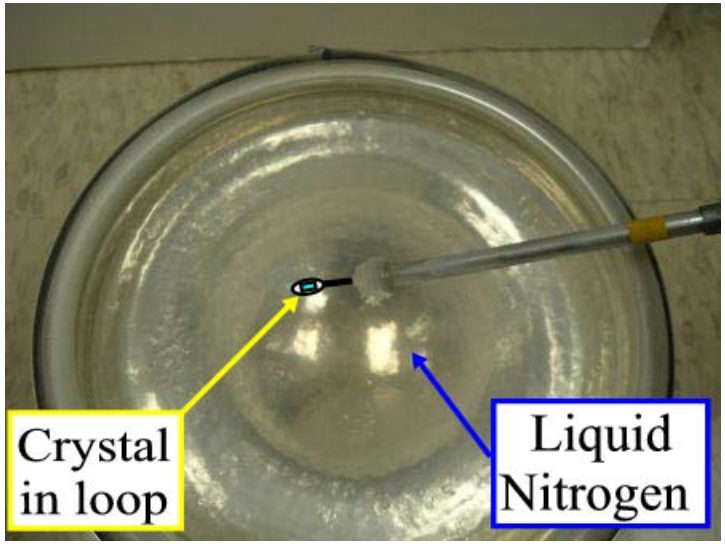
Flash cool with liquid nitrogen



Flash cool with gas nitrogen