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Handling fragile needles

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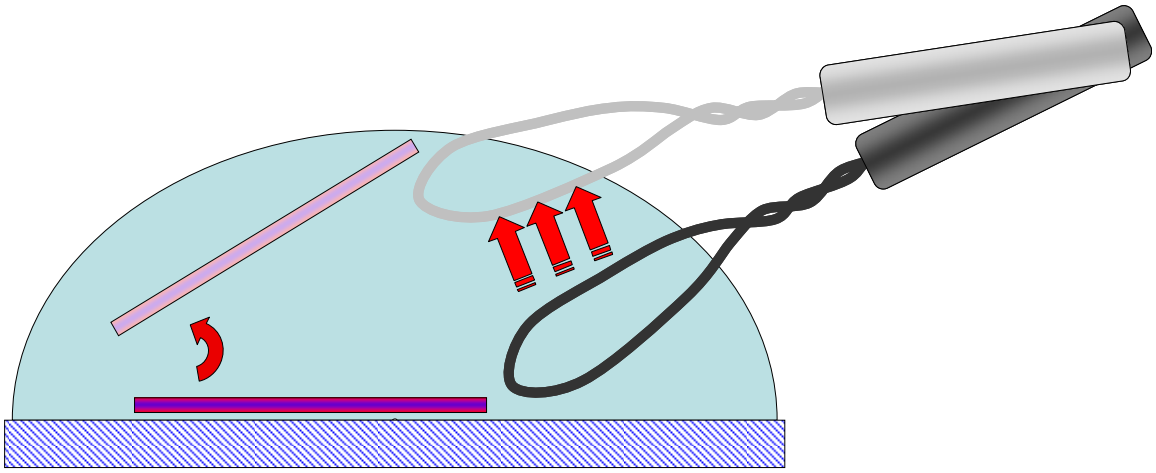
Practicing crystallographers frequently express the wish that all protein crystals should grow like those of lysozyme and that protein crystals should be as easy to handle as those of small molecules[*]. Unfortunately our wishes are rarely granted and we commonly have to handle delicate needles and plates. Having spent a small fortune on back-pain ointments (to alleviate the results of endless evenings bent over the scope fishing for fragile needles) I have found the following technique fairly useful in liberating most needles and needle-like crystals from their mother drops. There are several versious the technique however all of them take advantage of (1) the huge difference in mechancal strength of rod-like objects along *vs* across their principal axis; and (2) the natural predisposition of rod-like objects to position themselves along the flow lines of the surrounding liquid[†].

Now to business:

Begin by seecting an oval loop with the major axis several times larger than the minor axis. Invert the drop on its support and gently (yet quickly!) agitate the liquid in the drop near one end of the needle (but without touching the crystal itself!). This should cause the crystal to float upward and to turn.



After the crystal is properly positioned, quickly place the loop under the crystal and align the principal axis of the loop with that of the crystal.

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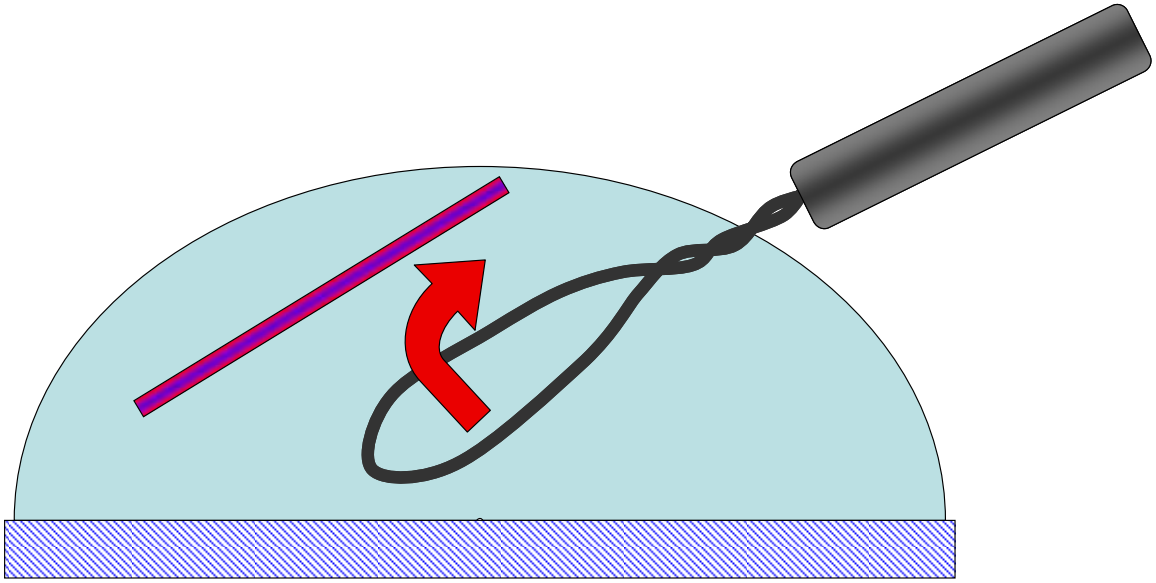
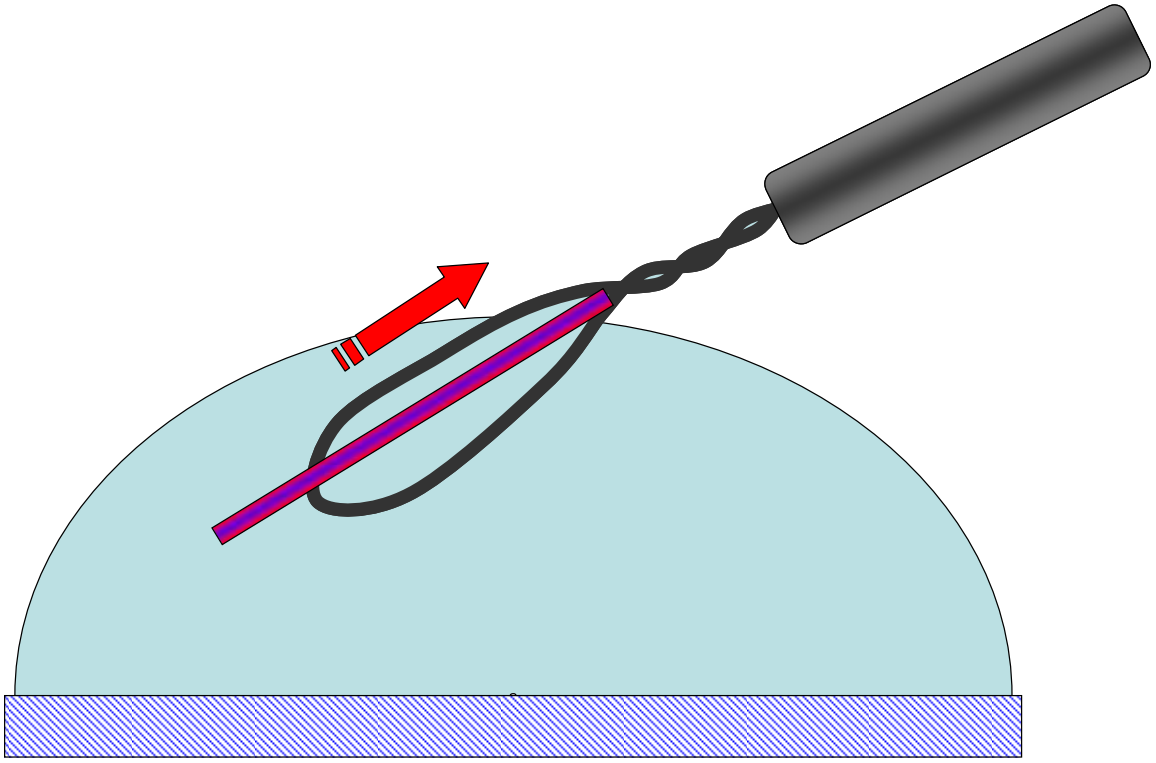
[*] Excluding perhaps crystals of certain metallo-organic hydrides which tend to spontaneously combust or even explode when exposed to traces of oxygen.

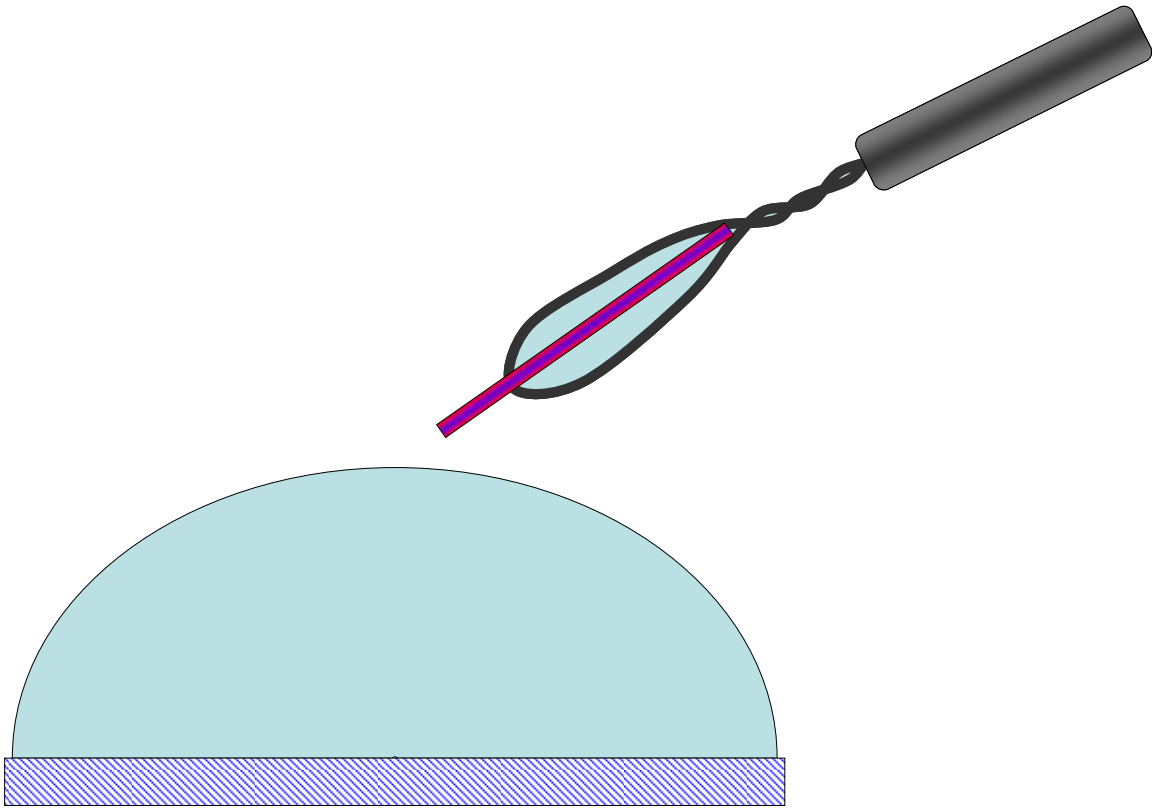
[†] This is also a partial reason for the need to glue sticks onto bottle rockets in order to convey a semblance of directionality to their flight.



With one smooth motion lift the crystal up and back (towards the stem of the loop) so that the loop drags the crystal out of the mother liquor along its principal axis. Take care to avoid pushing the crystal upwards through the surface of the drop – that is an almost certain way to break the needle. In other terms, let the loop do the work of breaking the surface tension, not the crystal.

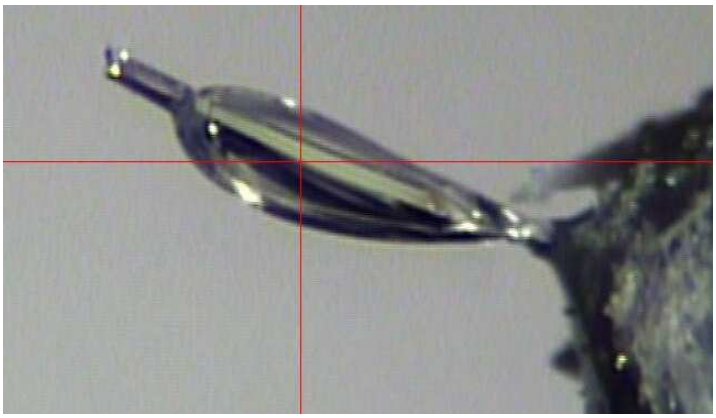


Pull the crystal all the way out, along its principal axis. If you have steady hands and the crystal is not excessively fragile, this should result in the needle self-aligning in the loop as shown below:



Assuming that you have adequate cryoprotectant in the drop, you should proceed with freezing (either in the cryo-stream or in liquid nitrogen, etc.). If you need to plunge the needle into cryoprotectant or oil, try to follow these directions in reverse – it is generaly better to cryoprotect needles *in situ*, since repeated handling is likely to break them.

The end result should look more or less like this:



Finally, this is what we're trying to avoid (little green stars represent stress points):