USING OPTICAL TWEEZERS FOR PROTEIN CRYSTAL GROWTH STUDIES

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The three-dimensional structure of a protein, which is used to deduce its biological function as required for drug design, is presently mainly determined by X-ray crystallography. However, the growth of suitable crystals has proved to be a major bottleneck as proteins are extremely hard to crystallize. Each protein has its own specific set of crystallization conditions, and no generic rule of crystallization exists. As a result, many crystallization trials must be performed on a target protein, of which only a small percentage typically yields promising results.

Optical tweezers [1] can trap and move dielectric materials non-invasively at length scales ranging from tens of nanometres to tens of micrometres, and thus are capable of manipulating protein crystals and, with restrictions, even single protein molecules.

![Fig. 1: Sequence showing the growth of an optically trapped lysozyme crystal on addition of protein concentrate. Scale bar: 10µm](image)

Our experiments show that protein (lysozyme) crystals can be held in an optical trap without measurable degradation of the crystal. This allows movement of the crystal under study away from interfering container walls and/or permits studies of modifications of single crystals while gradually changing the conditions of the growth solution. Based on these experiments we conclude that optical tweezers are tools that can help to overcome some of the problems associated with protein crystal growth.

We also show that our optical tweezers setup can also be used to determine optical properties, such as birefringence and refractive index, of the crystal.

REFERENCES