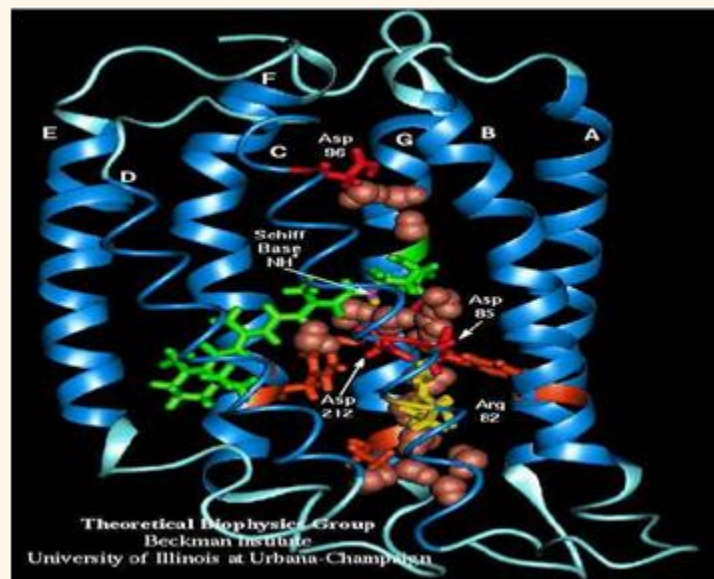


## Technology Systems Programme

### 3.) Bacteriorhodopsin (bR)

Rhodopsin, as the fundamental photosynthetic protein in the retina of the eye for vision purposes, was known for a long time. The fact that they can be produced using bacteria like the *Halobacterium Salinarum* was observed about forty years ago. The technique of making thin films of it for engineering and bio-engineering devices is a later development of about thirty years ago. These photoactive biomolecules are in great demand for the development of optical and electro-optical sensors, Optical switches, logic gates, Ultra Fast RAMs, Security and defense applications etc., In fact, many countries are intensely working on these molecules and on bacteriorhodopsin (bR) extracted from purple bacteria in particular. Most of the work are classified and there is little information available on its biosynthesis in open literature. There is a dearth of commercial sources for these molecules and where it is available, it is sold at an exorbitant cost. Ability to make and manufacture rhodopsin based photonic components for device applications go a long way in establishing technological supremacy in the areas of Molecular electronics devices. Realizing its potential, DST Technology systems group, on the advice of Molecular Electronics committee, began to support research in bR. The program was funded with following major objectives. (a) To prepare BR molecules from purple bacteria (b) bulk production through optimised process so that it is available at low cost (as compared to other semiconductor optoelectronic materials for similar purposes whose production is heavily capital intensive) (c) develop high-end photonic and opto-electronic devices based on the established photo-cyclic properties. The bio-degradability could be used to advantage in environmental concerns. Finally, this protein is of considerable interest to biologists and biochemists as a model membrane protein.



The methods for biosynthesis has been developed at IMTECH, Chandigarh and University of Agricultural Sciences, Dharwad. The IMTECH group is also collecting strains from different locations in India with an objective of having own local strains with possibly superior bR content and natural mutations. This group has the capability to produce pure bR of very high quality at a rather impressive yield of 10 mg/L culture. The group at SSSIHL, Prasanthi Nilayam has developed a bR-based image edge enhancer for early detection of breast cancer and brought a prototype developed under this program. The prototype developed under this programme has 4f geometry and is based on edge-enhancement technique. Similarly a group at IISc, Bangalore had developed bR embedded waveguide in Mach-Zahnder configuration for all optical switches. Similar efforts in the direction of application for logic gates using bR have been carried out at Dayalbagh Educational Institutes, Agra and ISER, Pune. In the next phase of the program, scaling up of production of bR and good quality bR films will be given priority.



Fig: Sample of Bacteriorhodopsin prepared at IMTECH, Chandigarh