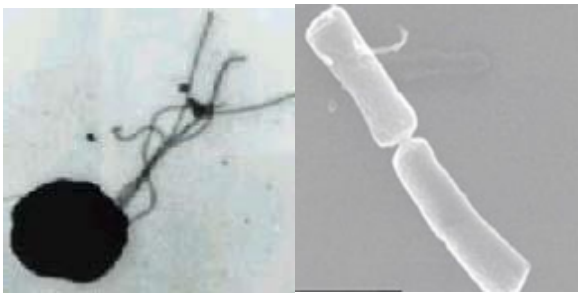
Naeem Rashid, PhD

Professor

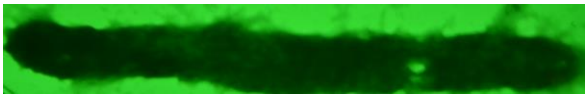
School of Biological Sciences

Through the research work in the laboratory, I try to teach students the morale and teamwork which are of crucial importance in human society. I urge the students to think globally, act locally, work hard and enjoy life. I am engaged in research on extremophiles, particularly thermophiles. Extremophiles are microorganisms that thrive in extreme conditions. Enzymes from extremophiles display unique properties. Among extremophiles, enzymes from hyperthermophiles are thermostable and denaturant tolerant. One of the most successful thermostable enzymes is DNA polymerase which is being used in the polymerase chain reaction for DNA amplification, DNA sequencing and diagnostic purposes. Thermostable enzymes are also being used in the chemical, food, pharmaceutical, paper, and textile industries. I am interested in recombinant production of industrially important enzymes from these microorganisms.

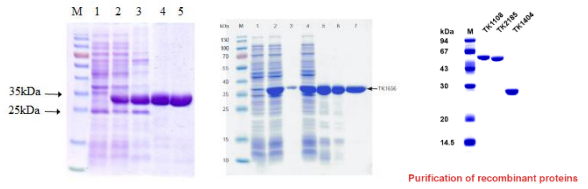
I have been mainly working on three microorganisms including *Thermococcus kodakarensis, Pyrobaculum calidifontis* and *Geobacillus thermopakistaniensis*. The first two microorganisms were isolated by my previous group in Japan. The third microorganism, *Geobacullus thermopakistaniensis*, was isolated from Pakistan by my present group.



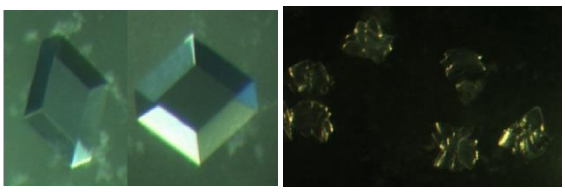
Thermococcus kodakarensis ***Pyrobaculum calidifontis***



Geobacillus thermopakistaniensis

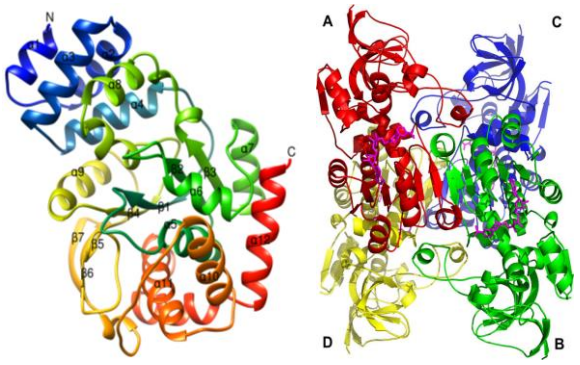


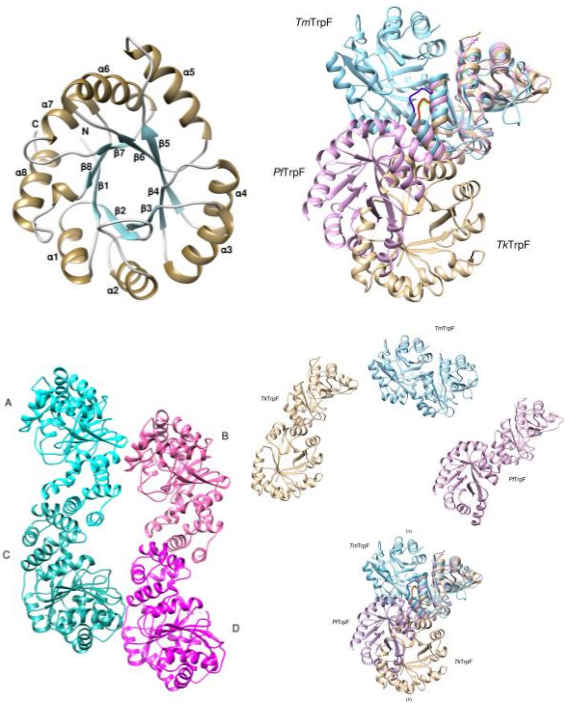
Production and purification of recombinant proteins



Crystallization of recombinant proteins

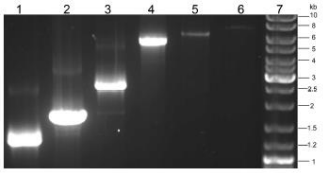
The genome sequences of all the three microorganisms have been determined. My ambitions are to determine the physiological roles of genes whose functions are unknown. I have experienced that functional prediction based on sequence data is not always true, and when so, I try to correct these predictions based on experimental evidence. We have found a novel and structurally distinct fructose 1,6-bisphosphatase in *T. kodakarensis* which was previously presumed missing in hyperthermophilc archaea. In addition, three open reading frames were annotated as phosphomannose mutase in the genome sequences of several archaea. We have functionally proved that one of them was phosphoglucose mutase with additional phosphomannose mutase activity. The second was phosphopentose mutase while the third one did not display any mutase activity. Furthermore, we have discovered a laccase and an alcohol dehydrogenase from *G. thermopakistaniesis* and *Bacillus subtilis*, respectively. A novel acidophilic, metal ion independent and hyperthermophilic pullulanase from *T. kodakarensis* has been used for the development of single step liquefaction and saccharification of corn starch. In addition, development of novel technologies using extremozymes are being attempted.





Structure determination of recombinant proteins

Production of maltose syrup using *Tk*-pullulanase



Application of DNA polymerase from *P. calidifontis*