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Biocomplexity Faculty Search Committee,
c / o Prof. Rob de Ruyter van Steveninck,
Department of Physics,
Indiana University,
Swain Hall West 117,
Bloomington, IN 47405-7105

Dear Members of the Search Committee,

I am writing this letter with great enthusiasm in support of Dr. Yong-Joo Jeong who is applying for a Faculty position at your Institution. Dr. Jeong is one of best post-docs I have had in my laboratory who has not only grasped a new area of research, but also made great strides in understanding the function and mechanisms of enzymes involved in DNA replication and transcription termination.

Research

Dr. Jeong has been working with a class of enzymes known as helicases that separate the strands of RNA or DNA. These are ubiquitous proteins found in all organisms and involved in almost all the processes of DNA and RNA metabolism. Helicases use the energy from NTP hydrolysis to translocate and either unwind a DNA, remove secondary structures in RNA, or displace proteins. My lab is interested in understanding the mechanism and function of helicases that are involved in DNA replication as well as transcription. Yong-Joo has focussed his studies on a special class of helicases that form hexameric rings.

Yong-Joo came to my lab with little training in transient state kinetics, but he has picked up the methods extremely fast and has received rigorous training in the area of enzymology. Transient state kinetic methods are unique tools of enzymology proven to solve enzyme mechanisms. With the genome being sequenced, protein targets will be identified soon, and Yong-Joo's training will be in high demand for obtaining fundamental information about target enzymes.

Yong-Joo has been studying two hexameric helicases in parallel to extract general mechanisms of these proteins. T7 helicase is required in DNA replication and it binds and hydrolyzes dTTP to translocate along DNA, and the second protein, the Rho protein is required for transcription termination and it hydrolyzes ATP to translocate along RNA and disrupt transcription. Yong-Joo has been studying these proteins at two levels. One, he wants to understand how the hexameric helicases unwind duplex nucleic acid. Second, he is involved in determining how the six subunits of the helicase coordinate their action (meaning NTP binding, hydrolysis, and product release steps) when they move along nucleic acid.

Yong-Joo has been able to show that T7 helicase unwinds DNA mainly by its ability to translocate unidirectionally and that the duplex DNA poses a barrier to the helicase's movement during unwinding. His recent results have shown the ring-shaped helicase unwinds DNA by the strand exclusion model and the exclusion of the strand from the central channel is crucial for processive unwinding. These are novel findings for several reasons, first the mechanism of ring helicases is not known and second, ring-shaped helicases bind to duplex DNA but his studies show that that mode of DNA binding does not support DNA unwinding. At present he is focussing on understanding the branch migration reaction catalyzed by the ring-shaped helicases. His work shows that the helicase has a very low processivity of translocation along dsDNA although a fast rate and the double rings are required to see branch migration along long stretches of DNA. In addition, he is collaborating with Dr. Taekjip Ha in coordinating single-molecule FRET experiments to study unwinding and branch migration.

Related to the dTTPase mechanism, Yong-Joo has solved the kinetic pathway of the dTTPase reaction in the absence of the DNA and this work has been published. Now, he has completed the measurement of the kinetic pathway in the presence of the DNA and in collaboration with George Oster's lab, the data has been analyzed by computational methods to derive the microscopic rate constants. His studies show that the NTPase mechanisms of both T7 helicase and Rho protein are very similar. Both proteins show cooperativity in NTP hydrolysis and the subunits coordinate their activities to hydrolyze NTP. He has recently showed that inactivating one subunit results in disruption of NTPase at other subunits. This work will be submitted in two or three papers shortly. Clearly, he has been very productive in the lab.

Capabilities

In less than three years Yong-Joo has accomplished what numerous graduate students and other post-docs have not been able to achieve. This is because he is a superb experimentalist. In addition, Yong-Joo is hard-working, critically thinking, and a talented individual. His work is very meticulous and of highest quality. Among the many post-docs I have in the lab and previously, he is the best in terms of meticulous work and productivity

Yong-Joo has been a good citizen in the lab. He has a pleasant personality and has no problems getting along with a multicultural group in the lab. Yong-Joo is a rigorous scientist and he emphasizes details in his presentations, which has been very useful in teaching new student in the lab.

I have no doubt that Yong-Joo will be able to handle his duties of teaching and research with great responsibility. He will also be a great colleague in your department and I recommend him with high enthusiasm for a position at your institution. Please feel free to contact me if you need further information.

Sincerely,

Smita Patel

Smita Patel
Professor of Biochemistry