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| **Research Theme: Protein translation and exopolysaccharide biosynthesis** |
| **PhD Research Project Title: Protein translation and regulation in stress response and quality control, exopolysaccharide biosynthesis and regulation** |
| **Scholarship category (Please indicate the source of funding for this project):**  **In addition to SBS Research Student Scholarship and others (NPGS, A\*STAR etc.), we also have financial Scholarship by MOE Tier 2** |
| **Principal Investigator/Supervisor: GAO Yonggui** |
| **Co-supervisor/ Collaborator(s) (if any):** |
| **Project Description**  **a) Background:**  How the DNA code becomes life has been a long-standing mystery. Today, we know many of the most important biological processes relevant to this basic issue, all the way down to atomic level. Protein translation and regulation involving ribosome has been an interesting field for decades, given its central basis on underlying how the DNA code becomes life. Ribosome can be in diverse functional states involving many factors, understanding the detailed mechanism of ribosome function is important not only as a fundamental issue in life science, but also because many clinically relevant antibiotics target the ribosome. In addition, over two hundreds protein factors participate in ribosome biogenesis, its dysfunction would directly cause many diseases in human, even including cancer pathogenesis. Two macromolecular machines ribosome and translocon take a major role in membrane protein biogenesis via a process called co-translational translocation. Not like cytosolic protein biosynthesis, membrane protein biogenesis is much more complicated, cells have to employ delicate systems to modulate the quality of these proteins. Protein quality control process, particularly membrane protein biogenesis and quality, lags much behind, but the significance in human could be reflected by its direct correlation with cellular protein homeostasis and protein aggregates which may cause ageing-associated diseases (like neurodegenerative disorders). A better understanding of protein translation and regulation in stress response and quality control would have both scientific impact and practical significance such as biomedical disease prevention and treatment.  Bacteria and plants synthesize a wide range of exopolysaccharides which have been implicated in diverse biological functions, including structural components/building blocks, biofilm formation, pathogenicity, and so on. Furthermore, these exopolysaccharides have been widely used in industrial application and food additive. In contrast to the significance of exopolysaccharides, molecular mechanism of exopolysaccharides biosynthesis and thier regulation largely remains elusive.  **b) Proposed work:**  To address the issues and close the gaps as aforementioned, multidisciplinary and complementary approaches, including structural methods, biochemical, biophysical and functional investigation, will be employed to unravel atomic information of the functional complex (such DNA/RNA-protein complex) involving protein translation, quality control, exopolysaccharides synthase enzyme machinery as well as to elucidate the molecular mechanism. The lab, Institute and School are fully equipped for all aspects of molecular biology, protein chemistry, and structural-functional analysis. In particular, the recently advanced techniques Cryo-electron microscopy (Cryo-EM), free-electron laser (FEL) (including X-ray), could greatly help and benefit our research work. The research outcome would boost our understanding of protein translation and exopolysaccharide biosynthesis. Meanwhile, the detailed information of functional protein complex associated with disease and industry would be developed for antibacterial drug discovery and potential application such as food biotechnology. |
| **Supervisor contact:**  **If you have questions regarding this project, please email the Principal Investigator:** |
| **SBS contact and how to apply:**  Associate Chair-Biological Sciences (Graduate Studies) : [AC-SBS-GS@ntu.edu.sg](mailto:AC-SBS-GS@ntu.edu.sg)  Please apply at the following:  **Application portal:** <https://venus.wis.ntu.edu.sg/GOAL/OnlineApplicationModule/frmOnlineApplication.ASPX> |