

**NUS Graduate School for Integrative Sciences and Engineering
Research Project Write-up**

Title of Project : Mechanisms of regulation of inflammation, cancer metastasis, stem cells and metabolic disorders

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Short Description

Fu Lab NGS projects

1. ***Stem Cell Niche and Cancer Cell Metastasis:*** The objective is to find possible connections between endothelial cells and cancer cell metastasis and angiogenesis. We have evidence indicating that cell surface proteins from endothelial cells provide docking sites or a niche for cancer cells or stem cells to attach and “homing”. We are to reveal the mechanisms involving regulation of this niche function and to find ways to modulate this niche.
2. ***iPS Cells Reprogram and Epigenetic control:*** We are working on cell reprogramming mechanisms through STAT3 and other transcription factors. In particular, we are interested in finding what are epigenetic events which are required for reprogram differentiated cells to be stem cells. Both biochemical and genetic methods will be utilized in this study.
3. ***Epigenetic Control of Neurogenesis:*** Our recent studies have shown STAT3 is an essential factor in neuronal stem cell differentiation. This project is to identify how STAT3, through possible modulation of epigenetic changes, to exert its function in neuronal stem cells.
4. ***Regulatory Mechanisms of Obesity and Diabetes:*** Using animal models, we have shown before that the Leptin-STAT3 pathway controls body homeostasis. Now we will expand this project into molecular studies of STAT3 controlled genetic events involving body homeogenesis. Particularly, we will search the neuronal programs that are regulated through the leptin-STAT3 circuitry for metabolic control.
5. ***Protein Sciences for Epigenetics Studies:*** We are developing methodology for identification of protein modifications and complex formation in response to cell signals. We are trying to reveal biochemical codes for epigenetic events. We will use mass spectrum, protein structure analysis and other cutting edge technologies for revealing codes from signaling proteins to chromatin structure.

6. ***Bioinformatics and Computer Science in Application of Gene Family Co-Evolution:*** We intend to go back to the history of evolution of metazoan using molecular analysis of gene families. We develop and use current tools in study of gene family evolution to reveal how signaling and transcriptional networks are formed. We ask further what are the conditions of co-evolution of gene families that could lead to functional development of certain phenotypes. We will choose STAT family and other gene families involved in signaling and transcriptional regulation for initial studies.