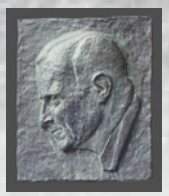

Karl Friedrich Bonhoeffer Lecture

Thursday, 8th August 2013 - 5 pm, s.t.

Manfred Eigen Hall,
Max Planck Institute
for Biophysical Chemistry

Am Faßberg 11, 37077 Göttingen

Prof. Dr. Xiaoliang Sunney Xie

Department of Chemistry and Chemical Biology,
Harvard University, Cambridge, USA

Life at the Single Molecule Level

DNA exist as single molecules in individual cells. Consequently, gene expression is stochastic. Recent advances in single-molecule imaging in living cells allow quantitative and system-wide descriptions of gene expression and regulation with single molecule sensitivity. It was found that low probability events of single molecules can have important biological consequences, such as the change of a cellular phenotype.

Point mutation and copy number variation, which are two major stochastic dynamical changes of DNA, can now be studied at the single cell level by whole genome amplification and sequencing [1, 2]. Experiments probing the biology of meiosis and cancer will be described. We demonstrate the proof of principle of selecting human oocytes in in vitro fertilization in order to avoid miscarriage and genetic diseases. We also show that individual circulating tumor cells can be sequenced, providing tumor genetic signatures for personalized therapy.

References:

[1] Li, Gene-Wei; Xie, X. Sunney: Central Dogma at the Single-Molecule Level in Living Cells, *Nature* **475**, 308-315 (2011).

[2] Zong et al.: Genome-Wide Detection of Single-Nucleotide and Copy-Number Variations of a Single Human Cell, *Science* **338**, 1622 (2012).

Host: Stefan W. Hell