Selected published papers

**Liquid Crystalline Chromosomes: Phase Transitions and Self-Assembly.** At high concentrations, aqueous DNAs can form liquid crystalline phases. Biophysical studies suggested highly anisotropic organization, manifested as strong birefringence in dinoflagellates Liquid Crystalline Chromosomes (LCCs). LCCs encode some of the largest- eukaryotic genomes (up to 80 times human genome size) and most of the chloroplast genes except 16 “minicircle”-encoded plastid-encoded genome (smallest on record), but counter-intuitively had no detectable nucleosomes. Dinoflagellate histone-like proteins, which bear no relationship with core histones (Wong et al., 2003), organized DNAs in a concentration-dependent manner, including looping of DNAs and phase transitional events (Chan et al., 2007). Nuclear genomes, and their architectural organization (Wong 2019), need to be orchestrated with DNA damage responses and organelle duplication, both requiring contemplation with cellular growth.

Yan, KHT, Ng,JCN, Kwok, ACM, and Wong, JTY (2020) Knockdown of dinoflagellate condensin CcSMC4 subunit led to S-phase impediment and decompaction of liquid crystalline chromosomes. *Microorganism* (accepted)


Mak CKM, Hung VKL, and Wong JTY (2005) Type II Topoisomerase activities in both G1 and G2/M phases of the dinoflagellate cell cycle. *Chromosoma* 114:420-431


**Cellulosic Thecal Plates and Cellulose Synthesis: Crystallinity and Coordination with Cellular Growth**

Cellulose is the most abundant biopolymer on earth. Thcate dinoflagellates are well known for their ability to produce intricate cellulose thecal plates (CTPs), which are intracellular and three-dimensional, contrasting with extracellular and two-dimensional nature of plant cell wall. CTPs also have the hardness of wood (plant secondary cell wall) without requirement of lignin fortification. CTPs are deposited with precision, arrangements of which are used as taxonomic
characters, and have the hardness of wood (Lau et al., 2007). We are interested in the mechanism leading to deposition of CTPs and its potential biotechnological applications. Knockdown of a dinoflagellate cellulose synthase led to severe malformation of CTPs and impediment of life-cycle transition (Chan et al., 2019; Front. Microbiol.). Cell growth cycles require duplication of cell coverings, with correct apposition.


**Cellular Growth Cycles**

Cell sizes are regulated within a small range in response to prevailing nutritional status in most unicells, and in metazoan responsive to hormones and cell-cell interactions. In unicellular organisms, cell size affect buoyancy, sinking rates, cell harvesting and ecological niche. Wall polyssacharides and membranes increased non-stochastically with cellular growth progression, (Kwok and Wong, 2003, 2005). In nutritional shift conditions, a growth-dependent cyclic ADP-ribose transient as the switch between binary versus multiple fission (Lam et al., 2009); it was one of the few cases in which a growth-mitochondrial signal at G1 was biochemically linked to G2-growth control. Activities of a walled-bound cellulase was coupled to and was required for and G2 growth progression (Kwok and Wong 2010).


Kwok ACM and Wong JTY (2003) Cellulose synthesis is coupled to cell cycle progression at G1 in the dinoflagellate Cryptochodinum cohnii. Plant Physiology 131:1681-1691


Detection, Monitoring, Toxins, and Biotechnology
Dinoflagellates solve life-problems with very different solutions, many of which have strategic applications in biotechnology, including in disease and in health. Many species produce bioactive compounds, their detection and production will be helpful for harmful algal blooms and coral bleaching.


