Prof. Joseph T.Y. Wong Laboratory

Cellular Growth and Macromolecular Phase Transitions

(complete health recovery by 2018)

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)

Li C and **Wong JTY** (2019) DNA damage response pathways in Dinoflagellates. *Microorganism* 7: 191

Wong JTY (2019) Architectural organization of dinoflagellate liquid crystalline chromosomes. *Microorganism* 7: 27 doi:10.3390/microorganisms7020027

Sun S, **Wong JTY**, Liu M, and Dong F. (2012) Counterion-mediated decompaction of liquid crystalline chromosomes. *DNA Cell Biol*. 12:1657-64.

Chan, Y.H. and **Wong, JTY** (2007) Concentration-dependent organization of DNA by the dinoflagellate histone-like protein HCc3. *Nucleic Acid Research* 35:2573-2583.

Chow, MH, Yan, KTH, Bennett, MJ, and **Wong JTY** (2010) Liquid Crystalline Chromosomes: Birefringence and DNA Condensation. *Eukaryotic Cell* 9:1577-1587.

Fojtová,M, **Wong JTY**, Dvořáčková, M, Yan, KTH, Sýkorová, E and Fajkus J (2010) Telomere maintenance in liquid crystalline chromosomes of dinoflagellates. *Chromosoma* [Epub: DOI: 10.1007/s00412-010-0272-y

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

Wong, JTY, New DC, Wong JCW, and Hung, VKL (2003) The Dinoflagellate Basic Chromosomal Proteins (HCCs) have homologies to bacterial DNA-binding proteins. *Eukaryotic Cell* 2:646-650.

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

Cellulose is the most abundant biopolymer on earth. Thecate dinoflagellates are well known for their ability to produce intricate cellulosic 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.*

Chan WS, Kwok ACM, **Wong JTY** (2019) Knockdown of dinoflagellate cellulose synthase CesA1 resulted in malformed intracellular cellulosic thecal plates and severely impeded cyst-to-swarmer transition. *Frontiers in Microbiology* 10: 546. 1010.3389/fmicb.2019.00546

Kwok ACM and **Wong JTY** (2010) Activities of a walled-bound cellulase is coupled to and is required for cell cycle progression in a dinoflagellate. *Plant Cell* 22:1281-1298

Kwok ACM, Mak CKM, Wong, FTW, and **Wong JTY** (2007) A novel method for the preparation of protoplasts from cells with internal cellulosic thecal plates. *Eukaryotic Cell* 6:563-567.

Lau RKL, Kwok, ACM, Chan, WK, Zhang TY, and **Wong JTY** (2006) Mechanical characterization of cellulosic thecal plates in dinoflagellates by nanoindentation. *Journal of Nanoscience and Nanotechnology* 7: 451-457

Kwok ACM and **Wong JTY** (2003) Cellulose synthesis is coupled to cell cycle progression at g_1 in the dinoflagellate *Crypthecodinium cohnii. Plant Physiology* 131:1681-1691.

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 G_1 was biochemically linked to G_2-growth control. Activities of a walled-bound cellulase was coupled to and was required for and G_2 growth progression (Kwok and Wong 2010).

Kwok, ACM, Zhang, F., Ma, Z, Chan, WS, Yu, VC. Tsang, JSH, **Wong JTY** (2020) Functional responses between PMP3 small membrane proteins and membrane potential**.** *Environ Microbiol*. doi: 10.1111/1462-2920.15027.

Lam CMC, Yeung, PKK, Lee, HC, and **Wong JTY** (2009) Cyclic ADP-ribose links metabolism to multiple fission in the dinoflagellate *Crypthecodinium cohnii. Cell Calcium* 45: 346–357

Yeung, PKK, Lam, CMC, Ma, ZY, and **Wong JTY** (2006) Involvement of calcium mobilization from caffeine-sensitive stores in mechanically induced cell cycle arrest in the dinoflagellate *Crypthecodinium cohnii*. *Cell Calcium* 39:259-274

Kwok ACM and **Wong JTY** (2005) Lipid biosynthesis and its coordination with cell cycle progression. *Plant & Cell Physiology* 12:1973-1986.

Wong JTY and Kwok ACM (2005) Proliferation of Dinoflagellates: Blooming or Bleaching. *BioEssays* 27: 730-740.

Kwok ACM and **Wong JTY** (2003) Cellulose synthesis is coupled to cell cycle progression at G_1 in the dinoflagellate *Crypthecodinium cohnii. Plant Physiology* 131:1681-1691

Chan, KL, D. New, D, Ghandhi, S, Wong, F, Lam, CMC, and **Wong JTY** (2002) Transcript levels of the Eukaryotic Initiation Factor 5A gene peak at early G1 phase of the cell cycle in the dinoflagellate *Crypthecodinium cohnii*. *Applied and Environmental Microbiology*: 68: 2278-

2284
Lam C, Chong C and **Wong JTY** (2001) A dinoflagellate Mutant (MF2) with high frequency of multiple fission. *Protoplasma* 216:75-79.

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

Mak, CKM, Yeung, PKK, Kwok, ACM, Wong YH, and **Wong JTY** (2008) Multiplex fluorimetric assays for monitoring algal toxins. *Journal of the Marine Biological Association of. United Kingdom.* doi: 10.1017/S0025315408002816,

Kai, AKL, Cheung, YK, Yeung PKK, and **Wong JTY** (2006) Development of single-cell PCR methods for the Raphidophyceae. *Harmful Algae* 5:649-

Yeung PKK, Hung V.K.L., Chan, FKC, and **Wong JTY** (2005) Characterization of a *Karenia papilionacea*-like dinoflagellate from the South China Sea. *Journal of the Marine Biological Association*. 85: 779-781.

Yeung PKK, Wong, FTW, and **Wong JTY** (2002) Mimosine, the allelochemical from Lucaena, selectively stimulates cell proliferation in dinoflagellates. *Applied and Environmental Microbiology* 68:5160-5163

Yip, ECH. and **Wong JTY** (2002) Fluorescence activated cell sorting of haemocytes in penaeid prawns. *Aquaculture* 204/1-2: 25-31.

Yip, ECH, Wong, YH, and **Wong JTY** (2001) Bacterial formyl peptide fMLP mediated chemotaxis and extracellular acidification in shrimp haemocytes *Developmental and Comparative Immunology* 25: 269-277.

Yeung, PKK, Wong, FTW and **Wong JTY** (1996) Sequence data of two small subunit ribosomal RNA for a South China strain of *Alexandrium catenella*. *Applied and Environmental Microbiology* 62:4199-4201.