In some circumstances, the eukaryotic cell cycle can be best described as a succession of contingent events. For example, in most somatic cells in culture, cell growth is followed by DNA replication, then more cell growth, then mitotic entry and chromosome congression, then sister chromatid separation and mitotic exit. The transitions from one cell cycle phase to the next are generally all-or-none in character and irreversible. Our goal is to understand how these irreversible switches between phases occur.
In other contexts the cell cycle is better described as an autonomous oscillation. For example, in the early Xenopus embryo, every ~30 minutes CDK1 is activated and this reliable rhythm is maintained even if DNA replication or mitosis is blocked. Our goal is to understand how this oscillator works.

The approaches we have taken to these questions include quantitative experimental approaches, computational modeling, and the theory of nonlinear dynamics. We hope to understand the design principles of these systems, and perhaps to gain insight into other biological switches and oscillators as well.

**Teaching**

**COURSES**

**2016-17**

- Biological Macromolecules: BIOC 241 (Spr)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Spr)

**2015-16**

- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Spr)

**2014-15**

- Cell Signaling: CSB 210 (Win)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Spr)

**2013-14**

- Cell Signaling: CSB 210 (Win)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Spr)

**STANFORD ADVISEES**

**Postdoctoral Faculty Sponsor**

Xianrui Cheng, Julia Kamenz, Minjung Kang, Connie Phong

**Doctoral Dissertation Reader (AC)**

Richard She

**Doctoral Dissertation Advisor (AC)**

Hokyung Chung

**GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS**

- Biochemistry (Phd Program)
- Biomedical Informatics (Phd Program)
- Biophysics (Phd Program)
- Cancer Biology (Phd Program)
- Chemical and Systems Biology (Phd Program)

**Publications**

**PUBLICATIONS**

- **Thresholds and ultrasensitivity from negative cooperativity** *SCIENCE*
  
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