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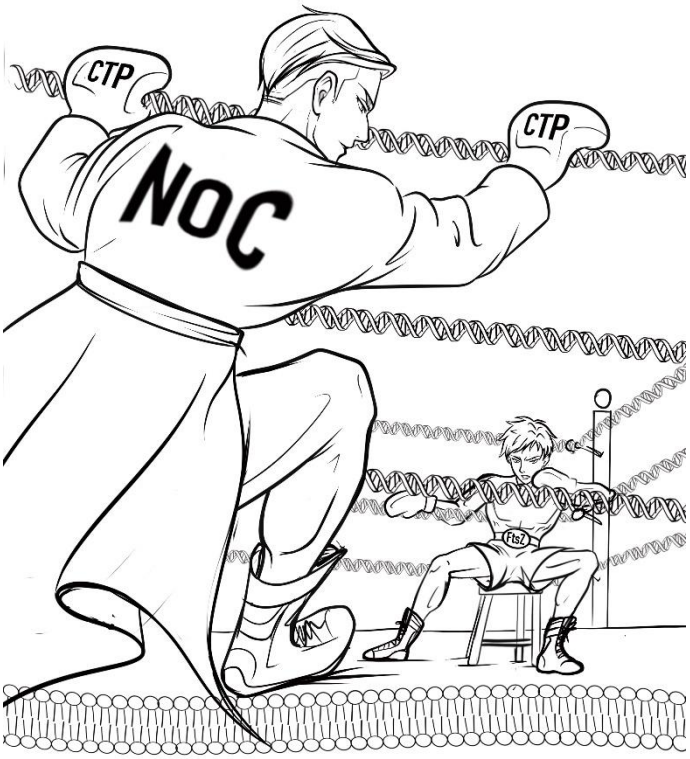
Cytidine triphosphate (CTP) and its new roles in bacterial chromosome segregation and cell division



The binding and degradation of high-energy small molecules, such as ATP and GTP, is widely exploited in biology to switch on/off biological functions. Surprisingly, CTP, another abundant building block of life, is rarely employed as a switch. A recent discovery showed that ParB is the founding member of a CTPase protein family and can bind and break down CTP to control inheritance of genetic material (chromosomes and plasmids) in bacteria. This discovery has prompted the field to revisit all experimental data and models from the past 25 years. The discovery also raises the possibility that CTP switches are ubiquitous in biology but currently under-appreciated. Here, we will present works in our lab that investigate the roles of CTP in regulating the function of ParB (roles in chromosome segregation), Noc (roles in bacterial cell division), and KorB (roles in transcription regulation). We will present structural and biochemical data, and the implication of the findings for bacterial cell biology and development will be discussed.