Séminaire de Biologie

Quantitative High speed Live Cell Imaging Uncovers the last Twist and Torque of the Toxoplasma Parasite to Invade a Host feeding metazoan cell

jeudi 04 avril 2019

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11:00 AM

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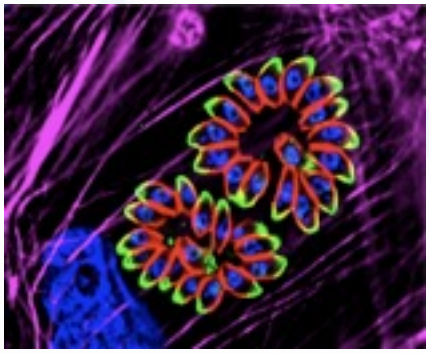
The several micron-sized Toxoplasma gondii eukaryote is an obligate intracellular protozoan that injects a multi-unit and multi-functional nanodevice into the facing host cell Plasma Membrane (PM), which connects the two cells through a circular Zoite-Cell Junction (ZCJ), and directs the folding of an unconventional parasite entry vesicle.

To better understand characterize this unique and highly transient parasite device, we have applied CMOS-based high-speed live fluorescence confocal imaging and captured the behavior of the toroidal-shaped device immediately post-insertion in the host cell PM with respect to the formation of a tight-fitting entry budding vesicle. Image analysis in conjunction with mathematical and kinematic modeling have allowed uncovering that the torus mechanically promotes membrane scission at the ZCJ-PM interface, releasing the sealed vesicle called Parasitophorous Vacuole (PV) that thereafter houses the intracellular parasite being and its progeny. While a specific twisting motion of the parasite drives forces, possibly with asymmetric distribution, to close the device at the ZCJ, it proceeds independently of the host cell membrane fission machinery orchestrated by Dynamins. Innovative experimental designs were developed to impede the twisting motion and analyze the consequences. They allow discovering that interfering with the torus closure induced impressive swelling of the budding entry vesicle and ultimately led to parasite death. We now propose that, in addition to functionally mimicking host cell Dynamins and accounting for PV birth, the invasive nanodevice closure sets T. gondii for rapid adjustment to intracellular lifestyle through the early burst of PV membrane remodeling and microdomain assembly.



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