Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

splitting of a membrane compartment, is a central theme in biology that manifests during cell division, organelle biogenesis and vesicular transport. Fission involves the local application of forces to bend and constrict or thin down a membrane tube. Since bending requires the bilayer to deviate from its preferred planar configuration, fission is energetically unfavorable. Using reconstitution approaches that involve biochemical screens, we have discovered novel proteins that catalyze fission and have elucidated their mechanism and cellular functions. My talk will describe these recent developments.

947-Plat

Rapid Clinical Diagnostic Viral Detection with Saliva by a Novel Single Step Nested Mango-NASBA Assay

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The recent COVID-19 pandemic has clearly highlighted the necessity for rapid and fieldable diagnostic coronavirus tests. However, few such methods meet all requirements of rapidity, sensitivity, and affordability, which hiders the prevention of uncontrolled widespread transmission of SARS-Cov-2. Here, we report a new rapid clinical diagnostic test for viral RNA detection using a recently developed fluorogenic RNA aptamer, Mango. This assay is based on an isothermal amplification of ribonucleic acid termed NASBA (nucleic acid sequence-based amplification). The assay merely consists of three enzymes and two sets of primers. We have optimized this assay to increase its sensitivity, such that authentic COVID-19 viral fragments can be detected within <30 min in a single tube. Importantly, RNA extraction is not required for this assay, and the viral fragments are directly detected from saliva. The annealing step of primers can be also omitted, the target RNAs are amplified at low constant temperature. Taken together, the features of this Mango-NASBA assay satisfy all requirements for a rapid and fieldable clinical diagnostic coronavirus test. We anticipate that the implementation of such coronavirus test platforms will help control spread of viruses.

948-Plat

Erythro-VLP: Erythrocyte Virus-Like-Particles

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Novel therapeutic strategies are urgently needed to control the SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) pandemic. This virus belongs to a larger class of corona viruses currently circulating, which pose major threats to global public health. Here, I present the fabrication and characterization of Erythro-VLPs: Erythrocyte-Based Virus Like Particles, i.e., red blood cell based proteoliposomes carrying the SARS-CoV-2 spike protein.Erythrocytes can present antigens to the immune system when senescent cells are being phagocytized in the spleen. This capacity together with their high biocompatibility make RBCs effective vehicles for the presentation of viral immunopathogens, such as the SARS-CoV-2 S-protein, to the immune system.The proteoliposomes were prepared by tuning lipidomics and proteomics of the RBC membranes on a nanoscale. Epi-fluorescent and confocal microscopy, dynamic light scattering (DLS), and Molecular Dynamics (MD) simulations were used to characterize the liposomes and the insertion of the S-proteins. The protein density on the outer membrane was estimated to be 70 proteins/μm. The Erythro-VLPs have a well-defined size distribution of 222 ± 6 nm and exhibit dose-dependent binding to ACE-2 (angiotensin converting enzyme 2) in biolayer interferometry assays. This red blood cell-based platform opens novel possibilities for therapeutics for the coronavirus disease 19 (COVID-19) and because of its simplicity potentially also for other viruses in the future.

949-Plat

Identifying Enthalpic Barriers to Entropically-Driven Structural Disruption in Breast Cancers

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Tissues can span a large structural phase space, but only occupy a small set of configurations as interfacial tension-driven self-organization counters entropically-favored disorganization. Historical self-organization models often do not address structural variability and transitions commonly observed during morphogenesis and disease. In breast cancer, structural breakdown of the bilayered mammary epithelium, comprised of inner luminal (LEP) layer surrounded by an outer myoepithelial (MEP) layer, is directly linked increased patient risk upon invasion. Organotypic cultures of patient-derived human mammary epithelial cells self-organize in vitro, largely driven by differences in favorability of LEP and MEP interface with the extracellular matrix. The observed distribution of organoid structures closely aligns with Boltzmann statistics - a function of the underlying interfacial energies (enthalpy), geometric constraints (entropy), and mechanical fluctuations (activity) of the tissue. We predict that transformations which increase the probability of LEP occupancy in the basal compartment can destabilize tissue structure and promote invasion, consistent with observations in murine organoid models.To test these predictions experimentally, we examined the ability of 15 cancer-associated genetic changes to alter interfacial tensions of LEP and disrupt self-organization in reconstituted human mammary organoids. While most perturbations only minimally impacted self-organization, PIK3CA activation in LEP uniquely reduced their ECM interfacial energy and disrupted tissue structure. Modeling predicts that normalization of PIK3CA-LEP interfacial energy or decreasing overall tissue activity can correct tissue structure, which we confirm experimentally. Consistently, upregulation of basal adhesion (enthalpy) is observed during progression from in situ to invasive human cancers. Additionally changes in tissue composition (entropy) and remodeling (activity) are linked to changes in cancer risk post-pregnancy. Collectively, this statistical mechanical framework presents a new strategy for understanding and targeting cancer progression, emphasizing the importance of structural probability distributions rather than average structures.

950-Plat

Investigating DPPC Liposomes and Their Capacity to Assimilate 2,2',3,3',4,4'-Hexachlorobiphenyl, an Emerging Environmental Pollutant

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Persistent organic pollutants (POPs) are organic compounds that bioaccumulate in a wide variety of biological and ecological environments due to their resistive nature to chemical, thermal and photodegradation. The stability of POPs and specifically PCBs (a subclass of POPs) leave few options for environmental waste and water removal. Conventionally, liposomes have been used for their drug delivery capabilities, but here we investigated their potential for the entrapment and removal of this class of emerging environmental pollutants. Liposomes are small, nonpolar lipid bi-layered aggregates capable of capturing a wide variety of both polar and nonpolar compounds. Dipalmitoylphosphatidylcholine (DPPC)is a well-characterized lipid that can be derived from natural sources. It is a phospholipid typically found as a major component of pulmonary surfactant mixtures. To assess the utility of liposomes prepared with pure DPPC in capturing PCBs, they were prepared using probe-tip sonication for both direct and passive incorporation of a representative PCB compound, 2,2',3,3',4,4'-hexachlorobiphenyl (HCBP). Incorporation of HCBP was assessed using a combination of differential scanning calorimetry and UV-Vis spectroscopy. For direct incorporation in the presence of HCBP, it was apparent that liposome stability generally decreased compared to pure DPPC liposomes based on a corresponding decrease in the phase transition temperature, Tm, from 40.8 °C to 37.4 °C. Additionally, an analysis of passive incorporation by UV-Vis spectroscopy showed an increase in the incorporation of HCBP proportionate to the length of exposure time up to 24 hours. Both the decrease in Tm and substantial UV absorbance signal produced after the compound was extracted from DPPC liposomes are indicative of its incorporation and demonstrates the potential for the use of liposomes in sustainable environmental cleanup and water treatment technologies.