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The work of Kaskel et al. not only represents a big step forward in the controllable synthesis of various well-defined hollow hybrid carbon spheres with template-free strategy, but also achieves a breakthrough in development of novel anode materials with improved rate capability and stability for potassium storage. Their work also sheds light on the synthesis and manipulation of hollow hybrid materials for widespread applications where hollow cavities and confined ultrafine nanoparticles are required, such as metal-sulfur batteries, dendrite-free metal anodes, and confined catalysts/supports.

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the transient decrease in neutrophil count, and abnormal liver function. On the other hand, corticosteroid may also cause avascular necrosis and/or osteoporosis among patients with severe acute respiratory syndromes (SARS). Biomimetic carriers, which take advantage of the inherent ability of cells to interact with their environments, can specifically target the disease sites and reduce side effects. Thus, developing a suitable biomimetic carrier for immune-modulating drugs may provide an alternative for effective treatment with reduce side effects.

The Wang group and the Gu group have published numerous works on platelet-mediated drug delivery. Platelets are small blood cells (1–3 μm) with excellent inflammatory targeting ability. However, using platelets as carriers may accelerate the inflammation and progression of pneumonia. To solve this conundrum, the two groups developed a platelet-derived extracellular vesicle (PEV) platform. PEVs are nano-sized membrane vesicles (100–150 nm) derived from platelets (Figure 1). The existence of CD41 on PEVs confirmed that the PEVs were derived from platelets, while some cytosolic proteins, such as actin, were lost in PEVs compared with platelets. PEVs inherit the inflammatory targeting ability of platelets but do not aggravate the inflammation and progression. Therefore, PEVs are promising biomimetic carriers for anti-inflammatory drug delivery.

In the work of Wang and Gu, researchers first verified the targeting ability of PEVs to inflammatory lungs in vivo. They injected DiD-labeled PEVs intravenously into acute lung injury (ALI) mice. Near-infrared (NIR) fluorescence imaging showed that PEVs recognized inflammatory M1-type macrophages and other inflammation-associated cells. On the contrary, PEVs did not bind to healthy lung tissue, indicating an excellent inflammation-targeting ability of PEVs.

Researchers then evaluated the performance of PEVs as drug carriers. They loaded PEVs with an anti-inflammatory drug TPCA-1 (TPCA-1-PEVs) to calm CSS by downregulating IL-6 from monocytes. Enzyme linked immunosorbent assay showed that the levels of IL-6 and tumor necrosis factor alpha (TNF-α) in the ALI mice were significantly lowered at 20 h after intravenous injection of TPCA-1-PEVs (1 mg/kg of TPCA-1). Furthermore, the inflammatory cell infiltration of mice receiving TPCA-1-PEVs was significantly reduced compared with that of untreated ALI group and free drug treatment. Thus, TPCA-1-PEVs stand a chance of treating patients with CSS, including those severe cases infected by SARS-Cov-2.

The work of Wang and Gu revealed PEV as a useful biomimetic platform for targeting inflammatory sites and PEV-based drug delivery approach for treating CSS. Regarding SARS-Cov-2, the PEV-based nanodrug might offer an attractive alternative to the treatments in use or under development (e.g., serum of human donors recently recovered from SARS-Cov-2 infection, monoclonal antibodies, vaccines, and antiviral small molecules). PEV-based nanodrugs may also have potential to treat various inflammatory diseases such as atherosclerotic plaque, rheumatoid arthritis, and skin wound. One can also envision its use to control cytokine release syndrome (similar to CSS), one of the side effects in CAR-T therapy.

WEB RESOURCES
COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University, https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6
Template: COVID-19 pandemic data, https://en.wikipedia.org/wiki/Template:COVID-19_pandemic_data

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Combustion Power in your Pocket: A Case for Portable Pyroelectric Energy Conversion

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The pyroelectric effect has been rarely considered as a pathway toward portable electric power. Now, in a study published in Cell Reports Physical Science, Hanrahan et al. show chip-based pyroelectric combustion that has the potential to supersede Li-ion battery technology in terms of energy density and device lifetime.

The demand for portable electrical power is ever increasing. However, achieving high energy density and extended lifetimes remain significant challenges. The current strategy focuses on electrochemical energy storage, with Li-ion battery technology being omnipresent in modern lives. Nevertheless, electrochemical energy storage has a limited energy density, and significant further improvements in lifetimes might not be feasible.1 Moreover, contemporary battery technology has been criticized for its environmental footprint when the entire device’s life cycle is considered, particularly because recycling is rarely practiced.2,3 As such, new approaches toward portable power should be considered. A study by Hanrahan et al. published in Cell Reports Physical Science now reports on a new portable-energy concept that relies on traditional fuel combustion paired with pyroelectric energy conversion that could provide “high-energy-density portable power.”4

The pyroelectric effect describes a voltage that arises in certain naturally polarized materials when they experience temperature gradients. The generated voltages during rapid heating and cooling can be considerable, and the theoretical Carnot limit of pyroelectric energy conversion has been estimated to be above 80%.4,5 Despite this, pyroelectrics have been primarily used for sensing applications and have occasionally been incorporated in waste heat-recovery concepts. The use of the pyroelectric effect as a primary energy-conversion mechanism has been rarely considered. The reason for this is that the generated pyroelectric power is proportional to the temperature and electric-field gradient, leading to the technically challenging requirement of rapid temperature changes paired with high electric fields exceeding 100 kV cm−1.6 However, if pyroelectric energy conversion is combined with the combustion of energy-dense fuels such as methanol (44 MJ kg−1), even low energy-conversion efficiencies result in a comparably accessible electrical power density to state-of-the-art Li-ion batteries (~0.8 MJ kg−1).7

The study by Hanrahan et al. introduces a pyroelectric device that relies on a thin film of lanthanum-doped lead zirconium-titanate, also known as PLZT.4 PLZT is a well-known piezoelectric...