Revolutionary new materials with tailored properties and functionalities, such as the ability to maneuver, detect, and respond to conditions in the environment are in demand for high tech applications. For example, maneuvering, detecting and responding are important operations for: the release of surfactants in porous media for oil recovery, the sequential release of growth hormones for tissue engineering and for the controlled motion of soft robots. However, the ability to maneuver is challenging because of obstacles and obstructions in pathways that can prevent cargo from being transmitted to a targeted location. Detection is crucial for directed delivery of a payload to an intended site. And finally a triggered response such as releasing the cargo’s payload or causing a reaction is necessary to impart change on the immediate surroundings. However, producing dynamic forms of matter that can maneuver, detect and respond to their environments is still a major challenge. In this talk, I will show our latest developments in generating state-of-the-art active materials using microfluidic techniques that we recently invented. These double emulsions go beyond the standard motif of spherical double emulsions and introduce modernity into the double emulsion configuration. For example, we controllably construct double emulsions whose payloads contain multiple compartments, diverse and distinct constituents, and ordered complexity of the interior space. In addition, we also generate a wide variety of stable non-spherical double emulsions. Finally these double emulsions can be triggered from outside sources to release or coalesce their payload by using stimuli-responsive materials. Importantly, these revolutionary new materials, as reported here, provide the means to address and solve difficult problems encountered in biological and physical situations.