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Microcarriers have been widely used for various biotechnology applications because of their high scale-up potential, high reproducibility on regulating cellular behaviors, and their compliance with current Good Manufacturing Practices (cGMP). Recently, microcarriers have been investigated for stem cell expansion and differentiation, enabling potential scale-up of stem cell-derived products in large bioreactors. This presentation summarizes recent advances of using microcarriers for mesenchymal stem cell (MSC) and pluripotent stem cell (PSC) cultures in bioreactors. From the reported data, efficient expansion and differentiation of stem cells on microcarriers relies on their ability to modulate cell shape (round or spreading) and cell organization (i.e. aggregate size). Nonetheless, current screening of microcarriers remains empirical, and accurate understanding of how stem cells interact with microcarriers still remains unknown. Accurate characterization of biochemical and biomechanical properties of the microcarriers is required to fully exploit their potential in regulating stem cell fate decisions. Due to the evident variety of microcarriers, such detailed analyses should lead to the rational design of application-specific microcarriers, enabling reproducible effects on stem cell expansion and differentiation for large scale biological and biomedical applications in the pharmaceutical industry.