ENGINEERING CHARACTERIZATION OF A VERSATILE VERTICAL-WHEEL BIOREACTOR FOR CELL AND GENE THERAPY

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Key words: bioreactor, power, mixing, solids suspension

An ideal, versatile bioreactor for cell and gene therapy should be capable of growing cells across a range of formats, such as freely floating in suspension, in aggregates of various target sizes, and also on porous or solid carriers of various sizes. It should work well with cells and multi-cellular structures that are particularly shear sensitive. Ideally, it should be a well-mixed vessel with a homogenous culture environment. To achieve these low shear and mixing objectives, the bioreactor should be capable of suspending aggregates and solid carriers, as well as provide good mixing, at low power inputs per volume. Furthermore, in order to harvest attached cells when needed, it should also be capable of rapidly applying a uniform target high shear environment to viably remove cells from solid carriers.

To achieve these objectives, a single-use bioreactor system using an innovative Vertical-Wheel technology has been developed. The first design hypothesis was that a large vertical wheel, when rotated at relatively close clearance to a circular tank bottom, could provide homogeneous liquid mixing, as well as uniform suspension of solid carriers or cellular aggregates, at lower power input per volume than traditional stirred tanks. The second design hypothesis was that the same vertical wheel design could be used to viably harvest cells from solid carriers by simply turning up the rotation speed to a target level for a short period of time.

In this talk, we present data directly testing both of these hypotheses. Experimental data will be presented showing the measured power curves for the novel vertical wheel design, as well as the resulting power levels required to achieve uniform fluid mixing and suspension of solid microcarriers across a range of scales, from 0.5 liters to 80 liters. Data will also be shown regarding the ability of this system to viably harvest cells from solid microcarriers. Data regarding the performance of this system for the culture of several different cell types is presented as part of other talks and posters at this conference. In summary, clear evidence will be presented on whether Vertical-Wheel technology provides the most ideal, versatile bioreactor for cell and gene therapy applications.