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AN OBSERVATION OF SUSPENDED MICROCARRIERS' SECONDARY MOTIONS IN ROTATING WALL VESSELS VIA A CUSTOM DESIGNED DEVICE

Abstract

Background: Rotating wall vessels (RWVS), an ingenious apparatus for three-dimensional suspension culture, is wildly used to build a simulated microgravity-effect on cell. Independent researchers have proposed hypotheses to illustrate why RWVS can simulate certain aspects of microgravity. Many of the hypotheses stated that the culture condition in RWVS is determined by the cellular mechanical environment which is a result of low fluid shear and microcarrier's motion. The microcarrier's motions are consist of primary and secondary motions. Different from the well documented primary motions, such as the microcarrier's circulation around the RWVS axis and the radial motion, the secondary motions need more elucidation. In the present work, we tried to illustrate the obscure but important pattern of the spin of the microcarrier/cell about its own axis (one of microcarrier secondary motions), and the relationships between microcarrier's position, secondary motions and the rotating rate of the RWVS. **Methods:** In order to image microcarrier trajectories and details in RWVS, a real-time imaging system was designed to track the primary motion of the particles and record the trail of the secondary motion details. Microcarriers suspending in RWVS was continuously collected by CCD via a set of microscopic lens. The image processing was done by custom designed software. The microcarrier motions were then analyzed in different rotating rate and distinct positions. **Results:** Consisting with the previous reports, microcarrier primary motions included two basic patterns which are rotation and radial shifting. The radial speed of the primary motion and the spin speed of the particles (the secondary motion) were influenced by the vessel's rotation rate. The relationship between the spin rate and the vessel rotation rate was derived. **Conclusions:** This custom manufactured real time imaging system is an available approach to understand the cellular mechanical environment by tracking the primary motions and record the secondary ones. This system may potentially be used to investigate the real time cell image in RWVS, which may contribute to understanding the microgravity simulation effect of RWVS.

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