Supporting Information

Magnetically Actuated Swimming and Rolling Erythrocyte-based Biohybrid Micromotors

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Supplementary Video 1: The RBCs and RBCBMs with (specific MNP binding) and without (non-specific MNP binding) biotin in the absence and presence of an external rotating magnetic field. The external field strength is 10mT rotating in the x-y plane, 4Hz.

Supplementary Video 2: Magnetically actuated rolling of red blood cell micromotors (RBCMs) in a 1X PBS solution near an underling substrate. The external field strength is 10mT rotating in the y-z plane.

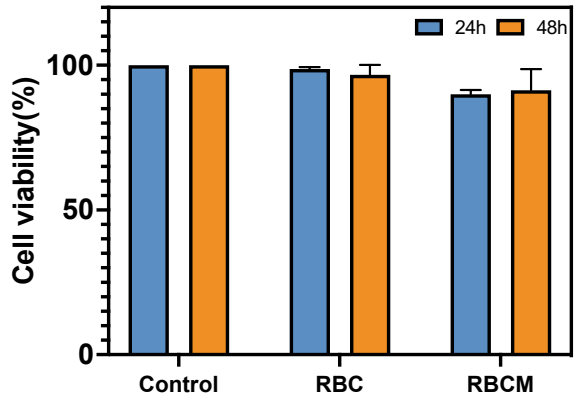
Supplementary Video 3: Magnetically actuated bulk swimming of red blood cell micromotors (RBCMs) in a 1X PBS solution ~50 μm away from a substrate. The external field strength is 10mT rotating in the y-z plane.

Supplementary Video 4: Demonstration RBCB micromotor magnetic stability under sustained external field actuation. The external magnetic field strength is 10mT, 4Hz. First, the external field is set to rotate in the y-z plane for 50 sec, resulting in RBCBM rolling near the substrate. Then, the field is set to rotate in the x-y plane for 5min. Finally, magnetic field is set to again rotate in the y-z plane for 50 sec.

Supplementary Video 5: Open loop control of RBCBM rolling near interface under a 10mT 4Hz magnetic field.

Supplementary Video 6: Open loop control of RBCBM swimming in bulk fluid under 10mT, 4Hz magnetic field.

Supplementary Figure:



To investigate the *in vitro* biocompatibility of RBCB micromotors, a set of MTT experiments were performed. The results indicate that HEK-293 cell viability was above 90% in all groups, including HEK-293 cells co-cultured with RBCs or RBCBMs for 24 and 72 hrs.