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QUANTUM CONTROL OF STEM CELLS

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Abstract: Reactive oxygen species (ROS) signaling regulates cell behaviors and tissue growth in development, regeneration, and cancer. Recent advances have highlighted the use of weak magnetic fields (WMFs, <1 mT) as one promising approach. Our work tests hypotheses based on spin state theory and the radical pair mechanism, which outlines how magnetic fields can alter the formation of radical pairs by changing electron spin state. This mechanism suggests WMF exposures should be able to inhibit or promote ROS formation in predictable manners dependent on field strength. Our data reveal that WMFs can be used for directed manipulation of stem cell proliferation, differentiation, and tissue growth in rational (if non-linear) ways for both loss and gain of function during regenerative growth. Our research has revealed the cellular effects of WMF exposure are highly dependent on ROS and identified superoxide as a specific ROS involved. Altogether, these data highlight the possibilities of using WMF exposures to control ROS signaling in vivo and represent an exciting new area of research.

Bio: Wendy Beane is a Presidential Professor of Innovation and Associate Professor of Biological Sciences at Western Michigan University. She is also the Director of WMU's Q-BITE (Quantum Biology Interdisciplinary Trainee Exchange), the US's first trainee exchange program in Quantum Biology that places graduate students and postdoctoral fellows as short-term guest scientists in Quantum Biology labs outside their own discipline. She obtained her Ph.D. in Cellular, Developmental, and Stem Cell Biology from Duke University and did her postdoctoral fellowship at Harvard and Tufts Universities in ion channel regulation of stem-cell mediated regeneration. Her lab investigates the mechanisms (signals) by which injury initiates stem cell proliferation, the role of reactive oxygen species in this process, and how the central nervous system of certain animals is able to regenerate. In particular, her lab is interested in non-invasive ways, such as weak magnetic field exposure, to control stem cell activity (and hence growth) in regenerative medicine and carcinogenesis.