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Physical control of carrier-mediated ion-transporters by entrainment of their turnover rate[1] WEI CHEN, CLAUSELL MATHIS, ZHIHUI FANG, JASON MAST, KARIM HAMIDI, PATRICK KELLY, University of South Florida, MAX EVE, Massachusetts College of Liberal Arts — In the past, tremendous efforts have been made to physically activate carrier-mediated ion-transporters, such as Na/K pumps. However, the outcome is not significant. Recently, we developed a new technique which can effectively and efficiently control the pumping rate by introducing a concept of an electronic synchrotron accelerator to the biological system. The approach consists of two steps. First, a specially designed oscillating electric field is used to force or synchronize individual pump molecules to run at the same turnover rate and phase as the field oscillation frequency. Then, by gradually changing the field frequency and carefully keeping the pump synchronization we can entrain the pump molecules so that their pumping rate can be progressively modulated, either decelerated or accelerated, following the field frequency to a defined value. Based on theoretical analysis of the underlying mechanisms involved in the technique, computer simulation of the entrainment process, and intensive experimental studies we have realized significant activation of the Na/K pumping rate up to ten-folds quickly in less than ten seconds.

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