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The Luck of Good Timing in Science: 60th Anniversary of the Belousov-Zhabotinsky Reaction

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The development of scientific knowledge is often aided by unexpected, lucky confluences of work done by independent researchers, often without knowledge of each other. For example, the first well-characterized oscillating chemical reaction, the iodate-ion-catalyzed decomposition of hydrogen peroxide, was discovered by William C. Bray and Herman Liebhafsky at UC-Berkeley in the 1920s. It attracted little attention at that time. The development of methods for the elucidation of chemical mechanisms was just beginning, and supporting theory consisted of little beyond the oscillatory Lotka-Volterra population dynamics model. However, Bray and Liebhafsky did gain a remarkable level of insight into their reaction. The situation was quite different 50 years later in the early 1970s with the confluence of several independent paths of research. Illya Prigogine and his coworkers in Brussels had developed an elegant theory of dynamic instabilities resulting from nonlinear interactions in chemical systems held far-from-equilibrium. This work seems to have sprung from the 1951 work of Alan Turing on morphogenesis. They found oscillations and pattern formation in simple but unlikely chemical models, and there was no experimental example of theory at the time. However, in 1959 the Russian Boris Belousov discovered a new chemical oscillator, the metal-ion-catalyzed oxidation of a organic acid by bromate. This discovery also languished because at that time because Prigogine was just starting his far-from-equilibrium work. However, in the late 60s the Moscow biophysics graduate student A. M. Zhabotinsky heard of the oscillating reaction and started working with it. Knowledge of the reaction, now called the Belousov-Zhabotinsky (BZ) Reaction, soon reached Brussels and via Robert Mazo arrived Eugene, Oregon in October, 1969. A year earlier I had started a postdoctoral work with Dick Noyes. We were a pair vitally interested and experienced in elucidation of chemical mechanism, and we were fascinated by the BZ reaction. We were indeed in the right people at the right place at the right time.

It took more than two years, but we did develop with Bandi Krs the Field- Krs-Noyes (FKN) mechanism of the BZ reaction. While we were doing it, Dick Noyes' systematic, bi-weekly perusal of Chemical Abstracts luckily yielded pieces of experimental data that were vital to FKN. A year or so later we reduced the FKN mechanism to a simple three-variable model, which we named the