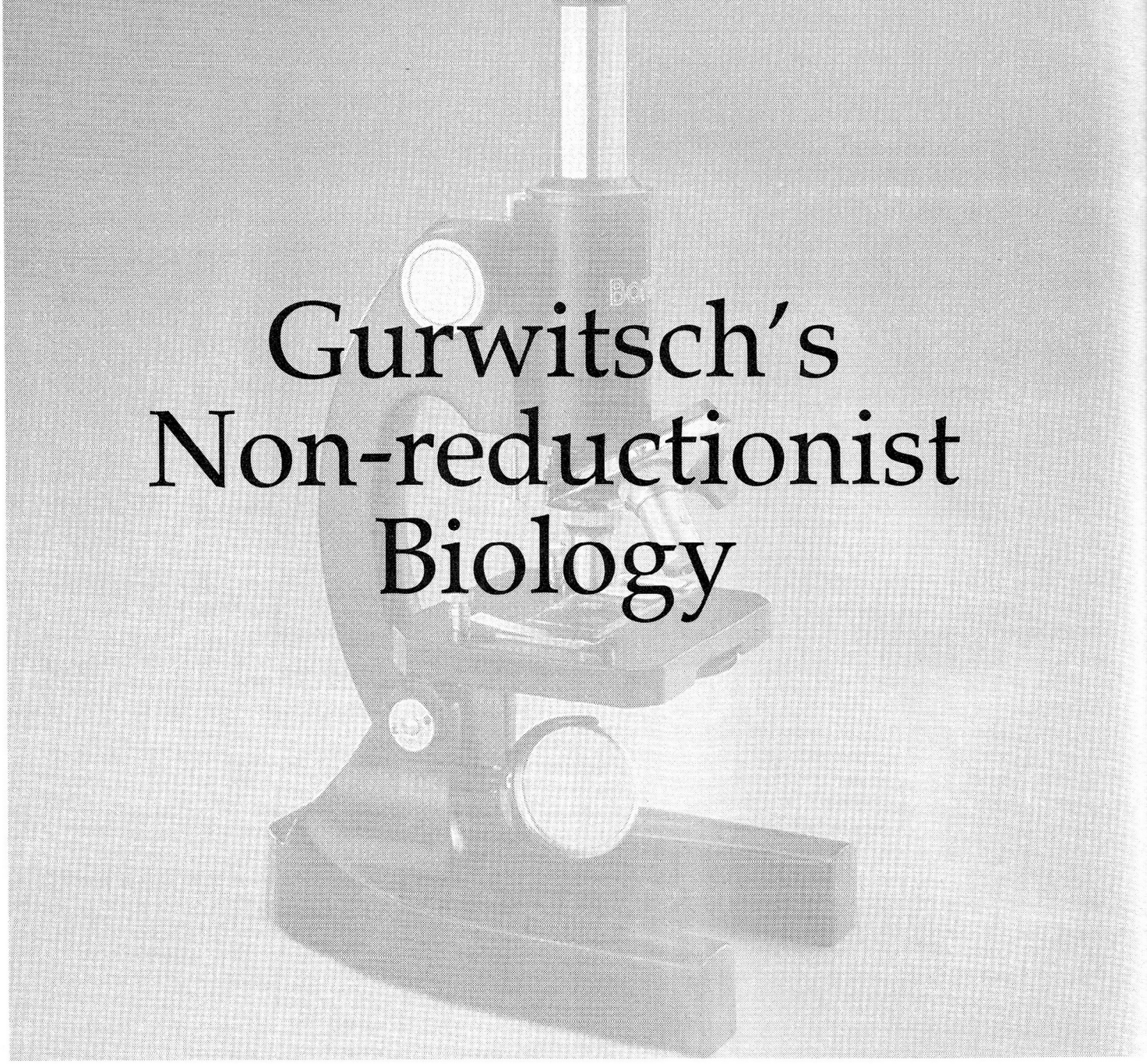

Gurwitsch's Non-reductionist Biology

Alexander Gurwitsch: Father of Biophysics

INTRODUCTION

The work of Alexander G. Gurwitsch is hardly known by scientists in the West today, yet he may rightly be considered as the father of biophysics. Gurwitsch sought the causality underlying living processes, and his experiments were the first to reveal part of the electromagnetic organization of the living state.

Gurwitsch concentrated on two main areas related to this problem. The first was the development of the embryo, and the second, the process of mitosis. Gurwitsch was fascinated by the experiments of Hans Driesch (1867-1941) in embryology, which emphasized the role of the embryo as a whole, in directing the course of development. Driesch had successfully separated a two-cell echinoderm embryo, and each half grew normally into a complete adult organism. From this, and other experiments, Driesch had ascribed to embryonic cells a property of equipotentiality, and raised the question of what caused the development to proceed. Driesch himself thought that the actual cause of this development process was unavailable to scientific analysis; Gurwitsch, however, used this as the starting point for his work in embryology. Although Gurwitsch adopted Driesch's conception of the whole organizing the development of the embryo, he remained a close friend of Wil-

helm Roux, (the founder of the mechanistic approach in embryology) who encouraged Gurwitsch to experiment, and always published Gurwitsch's papers in his journal.

One of Gurwitsch's important experiments in embryology, used a centrifuge to disrupt the organization of the visible structures of an early embryo. The embryos that were disrupted by this technique still developed normally, usually after reforming the visible structures in the cytoplasm. From this result, Gurwitsch hypothesized that the restoration of the visible structures in the embryo, was organized by "invisible structures," or, a dynamic force that remained undisturbed. From this hypothesis, Gurwitsch developed his conception of a "biological field," which was the electromagnetic organizing force of the living state, a concept he refined over the course of decades of experimental work.

Mitogenetic Radiation

Gurwitsch's study of the initiation of mitosis led to the discovery of "mitogenetic radiation" in 1923, for which he was widely known throughout the West in the 1930s. Gurwitsch had found that cells undergoing mitosis, emit radiation in the form of photons in the ultraviolet range, which could trigger mitosis in other cells. Using onion root tip meristems, which have a large population of mitotic cells, Gurwitsch tested whether a root tip brought toward another root meristem, could induce increased rates of mitosis. The result was a 20 to 25 percent increase in mitotic cells in the other root meristem. However, the effect could be eliminated, if a glass plate that absorbed ultraviolet radiation were inserted between the roots. These initial experiments were followed by hundreds more, using early photon detectors, and other methods, to analyze the spectroscopy of the emitted radiation.

This crucial discovery raised many questions as to what was the source of the emission of this photon radiation, and how such a small amount of energy could trigger a process as complex as mitosis. Gurwitsch viewed the living cell as a coherently organized system, containing "unbalanced molecular constellations," which required an input of metabolic energy for their existence. The disruption of metabolism in the cell, he said, will cause the breakdown of these molecular constellations, and the subsequent release of the stored energy.

To test this hypothesis, Gurwitsch observed the release of energy from dying cells, and also from reversible perturbations of metabolism, such as cooling and light narcosis. In each of these cases, the cells emitted photon radiation very similar to that found in mitotic cells. Gurwitsch called this "degradational radiation."

At that time, most scientists who were convinced of the phenomenon of mitogenetic radiation, did not know what to do further, and did not see the real physical and biological implications of the discovery. But Gurwitsch then took his investigations of mitogenetic radiation to the molecular level. Experimenting with solutions of purified proteins, he found that when weak electric and magnetic fields were applied to the proteins, and then removed, the proteins emitted ultraviolet photons, similar to degradational radiation. At this point, Gurwitsch's theory of the biological field came to maturity, as he could now explain the relationship of events from the molecular, cellular, and organismal levels.

Optical Biophysics

Gurwitsch's pioneering work formed the basis of "optical biophysics," and later investigations into the electromagnetic organization specific to living systems. Recent work on biophoton emission has shown that DNA is the major emitter and absorber of photon radiation in the cell, and this may be directly related to its important role in the regulation of growth and metabolism. Much of the current work that traces its conceptual lineage to A.G. Gurwitsch's biological field, focusses on the coherence of the living state, in restricting the random, thermal motion of molecules, thus making possible resonant effects triggered by small amounts of energy.

The scientific method employed by Gurwitsch runs contrary to the linear, Aristotelian approaches that dominate biology today. The study of Gurwitsch's ideas and his life's work thus may serve as a friendly guide for those who wish to break free of the Aristotelian axioms of today's science.

—Colin Lowry