Eighty years separate the original description of the first of a number of observations made by Wedensky in neuromuscular tissue (the "Wedensky effect") and the demonstration of this phenomenon in the human heart. To most cardiologists the "Wedensky effect" is totally foreign; to a few it is an obscure electrophysiological property of tissue which appears of very little or no significance in clinical cardiology. Since the ignorance of the "Wedensky effect" is understandable, this editorial will begin with a statement of reasons (not to be confused with an apology) why this subject is being discussed at this time.

Foremost is the fact that the "Wedensky effect" has been described in the human heart. It appears to play a definite role, the magnitude of which remains to be defined, in the genesis of some of the clinical arrhythmias. It supports the concept that some ectopic rhythms can be due to a local change in excitability rather than conductivity (re-entry). It not only proves the existence of a dependency of some ectopic beats on a dominant impulse but also defines one possible mechanism of such dependency. Finally, it may stimulate a search for further examples of the "Wedensky effect" by an ever increasing number of electrocardiographers who pore over seemingly endless feet of records of functioning and malfunctioning cardiac pacemakers.

In 1886 Wedensky demonstrated in a neuromuscular preparation of the frog that a subthreshold stimulus becomes threshold in intensity and evokes a response if preceded by a "strong" stimulus, the "Wedensky effect." Its existence in the Purkinje fiber of the dog was described by Goldenberg and Rothberger who showed that a subthreshold or near threshold stimulus, capable of evoking only an occasional contraction, resulted in a 1:1 response if preceded by a strong stimulus. In 1966, Castellanos and his associates, using intracardiac pacing electrodes, demonstrated the "Wedensky effect" in the human heart.

Pertinent to the genesis of cardiac arrhythmias were additional observations on the nature of the "Wedensky effect," which demonstrated (1) that its duration is relatively long persisting for a period of as much as 200 msec after the "strong" stimulus in nerve tissue and 160 to 260 msec after the end of the T wave following the "strong" stimulus in the human heart, (2) that the magnitude of this phenomenon could be altered by changing the ionic milieu, and (3) that it can be elicited by interventions other than "strong" electrical stimulation (for example, in the case of nerve tissue by local application of NaCl crystals and in the dog heart purportedly by systemic administration of digitalis).
This history of the "Wedensky effect" is an example common to medical sciences where phenomena which at first appear to have no relationship to the clinical situation ultimately prove to be of clinical significance. With this thought in mind it is suggested that a search be made in cardiac tissue for another extremely important observation made by Wedensky in nerve tissue, namely the "Wedensky facilitation." Wedensky showed that, when an impulse arrives and is stopped at an area of complete block, the threshold of excitation of the nerve below the block is lowered. The lowering is cumulative and persists for a prolonged period of time. It was subsequently demonstrated that this increase in excitability beyond the block is due to an extrinsic potential produced by an electrotonic current. In the human heart this phenomenon might conceivably be observed in patients with heart block in whom malfunctioning of implanted cardiac pacemakers is due to subthreshold stimulation. According to the concept of "facilitation," the subthreshold stimulus would become threshold and excite the ventricle when the stimulus artifact is synchronous with, or closely follows, the P wave. The explanation in this instance is that the atrial potential lowers the strength of the stimulus required to elicit a ventricular response beyond the area of block. Such a phenomenon was thought to have been observed by the authors but must await further confirmation.

A third phenomenon described by Wedensky, namely the "Wedensky inhibition," at present appears even more remotely related to the mechanism of cardiac arrhythmias than do the "Wedensky effect" and the "Wedensky facilitation." However, the "inhibition" in some respects resembles concealed conduction of rapid supraventricular arrhythmias into the junctional tissue. Further correlative studies may prove the concealment of conduction in cardiac tissue to be similar to, if not identical with, the "Wedensky inhibition" seen in nerve tissue.

Charles Fisch
Kalman Greenspan

References