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The co-existence of spirals with multiple rates of rotation JOSEPH TRANQUILLO, Bucknell University — Two findings in homogeneous reaction-diffusion media are that a single spiral may break into multiple spirals and that rapidly rotating spirals push slowly rotating spirals to domain boundaries. These two findings together fail to explain how cardiac tissue can support multiple stable spirals with different periods of rotation. Numerical simulations are presented in which a thin inhomogeneous region forms a functionally protective barrier between spirals rotating at different rates. The only requirement of the insulating region is that it partially block alternating wavefronts from the fast spiral. Parameters of both reaction and diffusion can result in functional insulation and multiple insulating regions can result in the broad frequency spectrum characteristic of cardiac fibrillation. The results suggest that the healthy ventricle, although containing intrinsic inhomogeneities, is functionally connected, while disease may create functionally disconnected regions. This simple mechanism may shed light on why defibrillation and pacing are not always successful, and why some patients are more susceptible to a transition from tachycardia to fibrillation.

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