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Fluid Dynamics Prize Talk: The Reactive Flow of Ideas[1]

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This presentation describes the evolution of our understanding of several key ideas in reactive flow from *Ignorance* to *Discovery* to *Application* and then again, to *Ignorance*. These key ideas describe the interactions of shock waves and turbulence with reaction fronts, and explain mechanisms for dynamic changes in the fundamental nature of the flow. They explain how flames undergo transitions from small ignition sources to turbulent flames to detonations, and how these energetic reactions waves may decay and die. Applications of the key ideas have been used to explain phenomena ranging from supernova explosions to catastrophic accidents in chemical plants. They have also helped to develop strategies for ensuring safety when we deal with energetic materials, and to create engines for high-speed flight. Now, however, we are at a turning point: By combining experimental observations with the most recent results of theory, advances in computational algorithms, and the ability to do large-scale numerical simulations, discrepancies arise that challenge well-established equations and approaches, both fluid and chemical. And so we must now ask: *What is the origin of these discrepancies? What do we do next?*

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