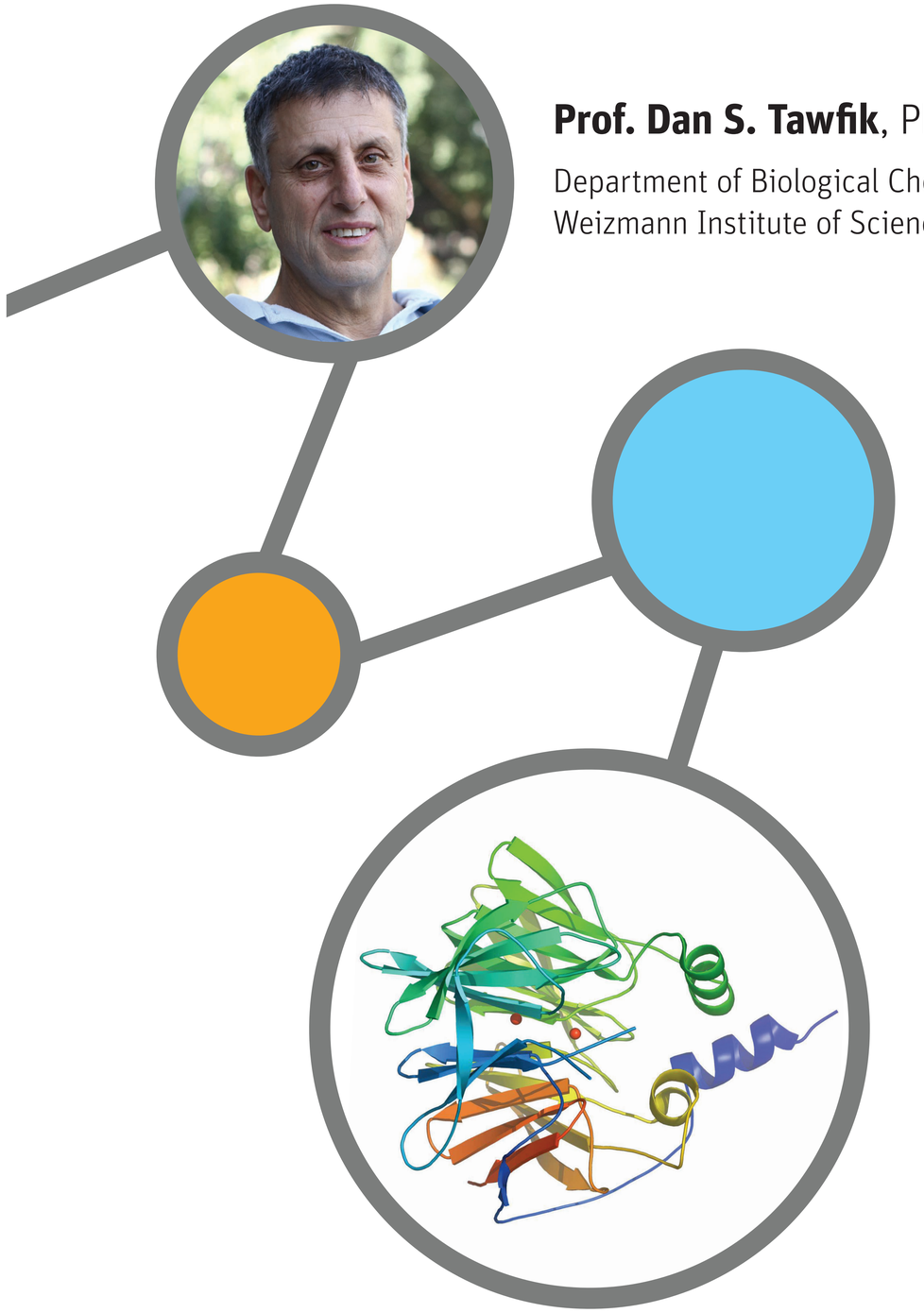

Prof. Dan S. Tawfik, PhD

Department of Biological Chemistry,
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Research accomplishments

Nature's enzymes are capable of rivaling any human-made chemical catalysts, accelerating reaction rates by many orders of magnitude with exquisite specificity and at ambient conditions. But they present a conundrum - despite being highly proficient and specialized towards one reaction, they are also highly evolvable, and readily adapt to catalyze new reactions.

Dan Tawfik's studies provided key insights regarding how enzymes work and how they adopt new functions. His research lies at the interface of chemistry and biology. It integrates a spectrum of scientific areas – synthetic chemistry, physical organic chemistry, biophysics, biochemistry and molecular and evolutionary biology. He applies Feynman's decisive test of: *What I cannot create, I do not understand*. By pursuing the generation of new enzymes in the laboratory he has established several fundamental principles in enzyme catalysis and evolution.

Tawfik highlighted the notion that catalysis can be obtained in primitive environments. His works have been instrumental in establishing the importance of promiscuous, coincidental activities that lie dormant within enzyme active-sites, alongside the enzyme's native, physiological function. His research unraveled the abundance, the molecular mechanisms and the unique evolutionary features of enzyme promiscuity, including the potential of neutral mutations to alter latent promiscuous functions and hence open the road to the acquisition of new functions. He has also provided in-depth understanding of the effects of mutations on protein stability and how these relate to the emergence of new enzymatic functions.

Tawfik's insights were also put to test by generating novel enzymes whose catalytic efficiency and specificity match those of natural enzymes. To facilitate the laboratory evolution of enzymes, he invented a novel technology that enables billions of biochemical and genetic reactions to be performed in parallel within femtoliter droplets. This technology became applicable in cancer genetics, digital PCR and high-throughput DNA sequencing. He has described the first implementation of computational design combined with directed evolution to obtain de novo engineered enzymes for unnatural reactions. Finally, his discoveries regarding the structure and mechanism of a human enzyme dubbed serum paraoxonase, enabled his laboratory to engineer the first enzymes providing effective protection against nerve agents.

פרס טבע למצוינות
על שם אלי הורביץ