Functional specificity and universal scaling in an analytical coarse-graining of protein dynamics.[1] JEREMY COPPERMAN, University of Wisconsin-Milwaukee, MARINA GUENZA, University of Oregon — Biology demands specificy in protein motions, which we describe in the dynamical modes of the Langevin Equation for Protein Dynamics (LE4PD). The LE4PD is a coarse-grained description at the level of a single site per amino acid tracing the protein backbone. Theoretical predictions are shown to quantitatively agree with experiment across picosecond to millisecond timescales, and provide insight into protein functions such as ligand binding and multi-protein assembly. We have discovered that underlying this dynamical specificity is a hierarchical scaling at the free energy level, constraining protein domains as a class. Microscopic critical stability maps the origin of the shared properties to the Kardar-Parisi-Zhang universality class.

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