

MIT Chemical Engineering Department

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Personalized Medicine and the Design of Effective Treatment Diseases: A Process and System Engineering Perspective



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Abstract: Physiological life is subtended by biological control systems that operate across multiple length and time scales and which bear striking resemblances to engineering control systems. Consequently, a control engineering perspective of the function, organization, and coordination of these multiscale biological systems provides a framework for understanding the occurrence of diseases in terms of the malfunction of components of these biological control systems—with implications for the design of effective treatments and the prevention of diseases.

This presentation provides an overview of the central role of control in maintaining physiological life, and argues for the usefulness of a control engineering perspective of pathologies for diagnosis, design, and implementation of effective treatments—especially for personalized (precision) medicine for “optimizing health”. We present a control engineering perspective of this emerging approach to medical practice, which we employ to make the case for the role that process systems engineering will play in enabling health care delivery of the future. We illustrate the highlighted concepts and principles with a modest clinical example involving platelet count control for an immune thrombocytopenic purpura (ITP) patient.