
The impact of biological uncertainty on our understanding of complex biological systems. Cancer as a paradigmatic case.

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Abstract

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Understanding life implies explaining the mode of organization of living beings. Cancer compromises the normal structure and function of tissues, cells and genes so that it appears as a multilevel phenomenon. The biology of cancer is thus giving us interesting insights on the organization of a biological system and its hierarchical phenomenology.

My thesis is that understanding the dynamics of this physio-pathologic process implies making explicit the characteristics of biological uncertainty from an epistemological and conceptual point of view, and that acknowledging the explanatory relevance of systemic perspectives allows us to overcome tensions between mechanistic and evolutionary models of complex multi-causal diseases. The argument follows the analysis of some features of the biology of cancer and some experimental problems that biological uncertainty arises in experimental practice.

I thus first analyze how the notion of uncertainty characteristic of biological complexity contributes to the emergence of the systemic perspectives in cancer research and in contemporary biology in general. Secondly, I spell out some characteristics of this systemic perspective, looking at the convergence of interpretative models of cancer and diabetes towards concepts that focus on the dynamic control of levels of biological organization. Finally, some implications for the relationship between different explanatory models of complex diseases are discussed, and reasons for an integrative approach in biomedicine explored.

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