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The Atavistic Model of Cancer: Evidence, Objections, Therapeutic Value

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As cancer progresses tumor cells dedifferentiate. In the atavistic model this dedifferentiation is interpreted as a reversion to phylogenetically earlier capabilities (Davies & Lineweaver 2011). Since there is an identifiable order to the evolution of capabilities, the more recently evolved capabilities are more likely to be compromised first during cancer progression. A loss of capabilities based on the phylogenetic order of evolution suggests a therapeutic strategy for targeting cancer – design challenges that can only be met by the recently evolved capabilities still intact in normal cells, but lost in cancer cells. Such a target-the-weakness therapeutic strategy contrasts with most current therapies that target the main strength of cancer: cell proliferation. Here, we describe several examples of this target-the-weakness strategy. Our most detailed example involves the immune system. As cancer progresses, the atavistic model suggests that cancer cells lose contact with the more recently evolved adaptive immune system of the host (the basis of vaccination). The absence of adaptive immunity in immunosuppressed tumor environments is an irreversible weakness of cancer that can be exploited by creating a challenge that only the presence of adaptive immunity can meet. Thus, we propose the post-vaccination inoculation of disease at dosages that the recently evolved (and vaccination-primed) adaptive immune system will be able to destroy in normal cells, but not in the immunosuppressed microenvironment of tumor cells.

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