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A model for the the inflammatory response to SARS-CoV-2 in the upper- and lower-respiratory tracts.

We create a two-compartment model of the upper and lower respiratory tract in order to model the progression of a viral disease such as SARS-CoV-2. The model includes viral replication, tissue damage, tissue healing, and an immune component. The immune component includes markers for inflammation as well as pro- and anti-inflammatory cytokines. We fit the parameters of the model to recent data on rhesus monkeys. We then characterize the dynamics of the model in cases where the outcomes are (i) clearance and return to health, (ii) inability to clear the virus, (iii) clearance, but high damage incurred by the inflammatory response. In the latter two cases, we examine how the timing of anti-viral or anti-inflammatory drugs impacts the outcomes. This work is joint with Ericka Mochan (Carlow University), TJ Sego (Indiana), Emmaline Rial and Lauren Gaona.