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A Quantitative Analysis of Axonal Growth and Connectivity in Cortical Neurons JAMES WHITE, Physics and Astronomy and Biomedical Engineering, Tufts University, ELISE SPEDDEN, SAWYER BERNATH, Physics and Astronomy, Tufts University, DAVID KAPLAN, Biomedical Engineering and Chemical Engineering, Tufts University, TIMOTHY ATHERTON, CRISTIAN STAII, Physics and Astronomy, Tufts University — Developing neurons extend processes (axons and dendrites), which are led by a distally positioned growth cone. The growth cone both secretes and senses signaling molecules, that may either attract or repel nearby growing processes. While knowledge on the qualitative effects of several secreted growth factors on axon development (e.g. axon length and number of neurons developing processes) are known, a more detailed mathematical model describing the process of axonal guidance remains to be developed. Towards this end, we have collected time-lapse microscopy data of the axonal development of cortical neurons. Image analysis provides information on the rate of growth, arc length, and curvature of the processes as a function of time and the spatial positioning of the neurons. These results will be discussed in relation to theoretical studies that model axon growth in response to varying gradients of attractive forces, representative of the effect that signaling molecules may have on axon guidance.

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