**Text for editing, demo edit 1, Module 1.7 (optional)**

Immortality is an alluring concept. Some scientists believe that it will be possible to "upload" one's mind by recreating the circuitry of the brain in silico. Before we can upload brains, we first must reverse-engineer neural circuitry and begin by creating a circuit map.

Electron microscopy provides the only possible method through which we're able to clearly visualize synapses and follow neural processes. Volumetric reconstruction of neural tissue using electron microscopic resolution is necessary to map neural circuitry. Focused ion-beam scanning electron microscopy (Knott et al. 2008) gives excellent quality images, but fails to process tissue pieces larger than 40 microns in diameter. Thin sections imaged with transmission electron microscopy succumb to the damaging effects of manual handling and section distortion. Thus, it's most prudent to use a method that images the block-face directly and is capable of imaging large block-faces. Serial block-face scanning electron microscopy (SBEM; Denk and Horstmann 2004) provides both necessary components.

Using SBEM, Dr. Kevin Briggman and associates (Briggman, Helmstaedter, and Denk 2011) recently mapped the connections between starburst amacrine cells and bipolar ganglion cells in the mouse retina to better understand the wiring specificity, elucidating the cellular circuit between starburst amacrine cells and direction-selective bipolar retinal ganglion cells.

By staining a 200-micron piece of retina, which contained the entire arborization field of a starburst amacrine cell with an extracellular stain that could outline cells and neural processes in SBEM, Briggman was then able to reconstruct neural processes. Based on morphology, he assessed the locations and sizes of putative synapses on these processes.

Unfortunately, synapses were invisible within the data because the tissue was only stained with an extracellular, electron-dense stain and some synaptic features are intracellular. In an effort to address this ambiguity, Briggman then stained a second piece of tissue where synapse-associated features were stained and visible. He then correlated the extracellular morphology found at synapses between the first and second pieces of tissue.

This is the first example of relatively large neural circuit reconstruction and it solved controversy about exactly how starburst amacrine cells are wired to be directionally-selective. The next steps in whole-brain circuit reconstruction will be large sample preparation (Mikula, Binding, and Denk 2012) and imaging on a whole-brain SBEM for mapping the whole mouse brain as a first mammalian complete connectome (Seung 2011).