Nervous systems generate behaviors through the coordinated activity of specific neural circuits. During development, these circuits are formed by growing nerve cells extending long projections called axons, which hook up with other nerve cells or with muscles to control locomotion. At the tip of each growing axon is the growth cone, which steers the axon to its target cells by responding to cues in the extracellular environment. Capitalizing on our advanced knowledge on the genetics of the fruit fly *Drosophila*, Thomas’s lab has identified key molecules in the axon’s navigation system that govern basic events common to all nervous systems, such as axons growing from one side of the brain to the other or projecting out of the nervous system to connect with muscles.

Crosstalk between the two sides of the nervous system is essential for many behaviors, from simple coordinated locomotion to the integration of higher cognitive functions. Its importance is underscored by the large number of nerve cells that project their axons across the midline to the opposite side. Thomas has identified a number of axon guidance molecules, including receptors on the growth cone that bind to specific ligands in the extracellular environment, guiding axons along specific routes across the midline. These receptors and ligands belong to larger families of related molecules that have also been found to guide axons in mammals. This means these guidance molecules are deeply rooted in who we are, whether we are a fly on the wall or a human being wielding a flyswatter.

Once the neural circuits are formed during development using the axon guidance molecules, how do they generate behaviors? The Thomas lab activates and inactivates specific nerve cells to understand the circuit that generates locomotion. Just like the axon guidance molecules, the principles of how circuits generate locomotion in flies will be important to understanding the neural basis of locomotion in higher vertebrates, including humans.

For more information, please visit www.salk.edu/faculty/thomas

From left to right: Suzanna Morina (with baby), Hong Long, Yi Leng, Shingo Yoshikawa, John Thomas, Run Shen, Clement Surel, Sophie Creysels