et al., 2015). While recent work has suggested that regional variation in certain topological properties of connectomes such as degree, clustering coefficient, and betweenness centrality, can be accounted for based on the geometry of the brain (Henderson and Robinson, 2014), our findings support the view that strong spatial constraints alone are insufficient for explaining all topological aspects of brain networks (Kaiser and Hilgetag, 2006; Bullmore and Sporns, 2012). This conclusion stands in contrast to other reports (Ercsey-Ravasz et al., 2013; Song et al., 2014) suggesting that geometric models are the sole generative mechanism underlying the connectome's formation and evolution. Instead, we find that in order to accurately reproduce the connectome's topology our models required information about node's pairwise similarity (homophily), which agrees with earlier modeling studies of the primate connectome (Costa et al., 2007a) and human functional brain networks (Vértes et al., 2012).

The final component of this report was an application of network modeling to human lifespan data, which revealed that geometric constraints weakened while energy and the mismatch of clustering and edge length distributions all increased with age. Collectively, these results indicate that the MI model is becoming an increasingly poor model of the connectome as participants become older. One possible explanation is that connectome patterns become increasingly random with age, making it impossible for any wiring rule to model the connectome precisely. Alternatively, it could also be the case that there are proportionally more long-range connections later in life (Lim et al., 2015), and therefore, with advancing age, connectomes cannot be reproduced as accurately with a wiring rule that shows preference for short-range connections. Indeed, this appears to be case; placing each participant's connections into bins (10 mm width) according to connection length and correlating bin counts with age we found that bin count was negatively correlated with age up to around 70 mm (Figure