1125-57-2239 **Eric G Samperton*** (egsamp@math.ucdavis.edu). *Computational complexity and 3-manifolds and zombies.*

We consider the computational complexity of counting homomorphisms from 3-manifold groups to fixed finite groups G. Let G either be non-abelian simple or S_m, where $m \geq 5$. Then counting homomorphisms from fundamental groups of 3-manifolds to G is $\#\mathsf{P}$-complete. It follows that determining when the fundamental group of a 3-manifold admits a nontrivial homomorphism to G is NP-complete. In particular, for fixed $m \geq 5$, it is NP-complete to decide when a 3-manifold admits a connected m-sheeted cover.

These results follow from an analysis of the action of the pointed mapping class group $\mathrm{Mod}_*(\Sigma_g)$ on the set of homomorphisms $X_g := \{\pi_1(\Sigma_g) \to G\}$. We build on ideas of Dunfield-Thurston that were originally used in the context of random 3-manifolds. In particular, we show that when g is large enough, there exists a subgroup of $\mathrm{Mod}_*(\Sigma_{2g})$ that acts on X_g^2 in a manner that allows us to produce gadgets encoding reversible logic gates. Our construction can be considered as a classical analogue of topological quantum computing. This is joint work with Greg Kuperberg. (Received September 20, 2016)