140200 Torchcell Main Model Setup

$$\hat{f}_\theta : \widetilde{\mathcal{G}} \times \tilde{\mathcal{E}} \times \widetilde{\mathcal{P}} \to \mathcal{Y}$$

$$\hat{\theta} = \arg\min_\theta \mathbb{E}_{(\tilde{G},\tilde{E},\tilde{P},y)\sim D} \left[\mathcal{L}\left(\hat{f}_\theta(\tilde{G},\tilde{E},\tilde{P}), y \right) \right]$$

Where:

- $\widetilde{\mathcal{G}}$: cellular graphs with vertex/edge features
- $\tilde{\mathcal{E}}$: real-valued environment vectors
- $\widetilde{\mathcal{P}}$: perturbation operators
- $\mathcal{Y}$: phenotype space
- $y \in \mathcal{Y}$: observed phenotype
- D: data distribution over $(\tilde{G}, \tilde{E}, \tilde{P}, y)$
- $\mathcal{L}$: loss function
- θ: learnable parameters