**Step 2. Sample Classification** Step 1. Pre-training **Contextual learning in TCR cdr3** Filtering & Clustering Ε H Beta chain **BERT** cdr3 **BERT** H H Severe & T-cell [?] Moderate **Binding Patients** Score **Epitope**  $\otimes$ M **BERT** Binding Score  $Loss_P$  $\otimes$ Р Healthy patient **TCR TCRs** TCR classifier  $Loss_T$ Learning relationship with Epitope and TCR