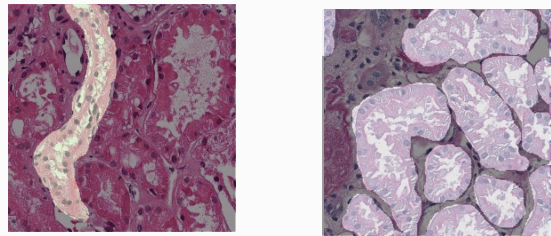
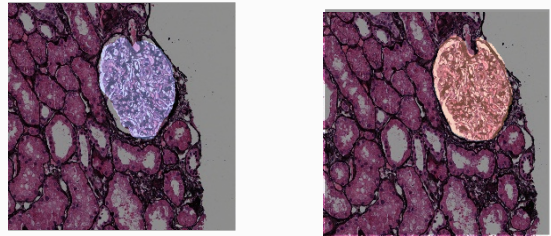


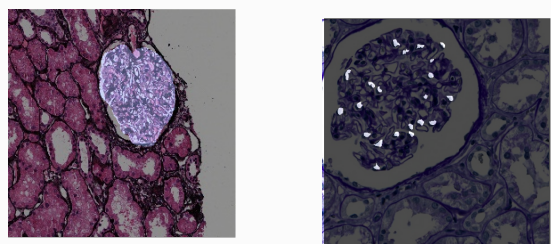
Medulla is **mutually exclusive** with cortex.
Scale ratio is **balance**.



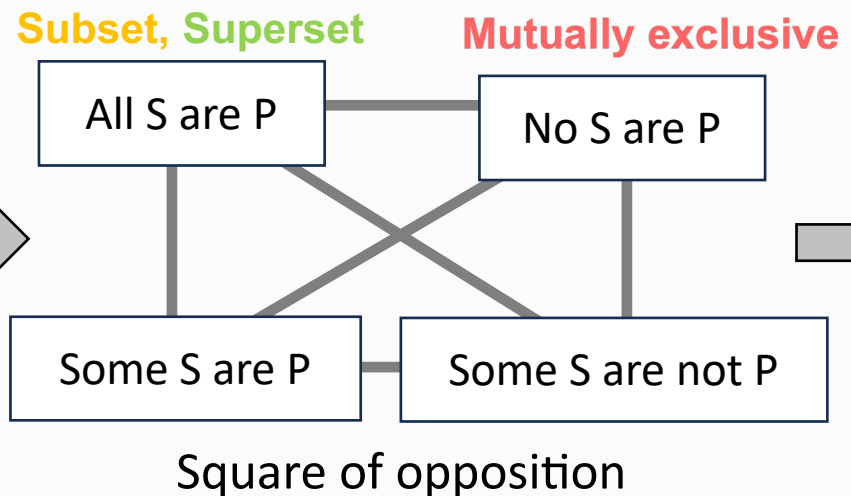
Distal tubular is **mutually exclusive** with proximal tubular.
Scale ratio is **imbalance**.



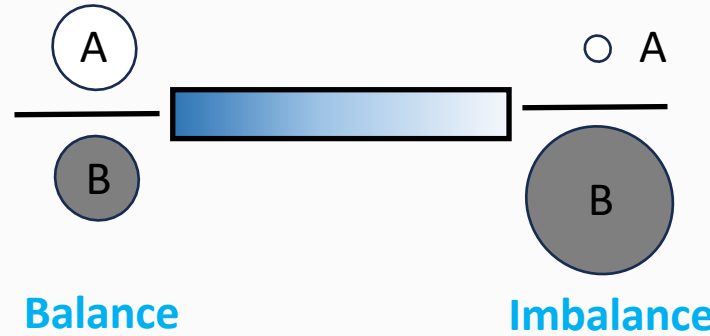
Tuft is **subset** of capsule.
Scale ratio is **balance**.



Tuft is **superset** of podocytes.
Scale ratio is **imbalance**.

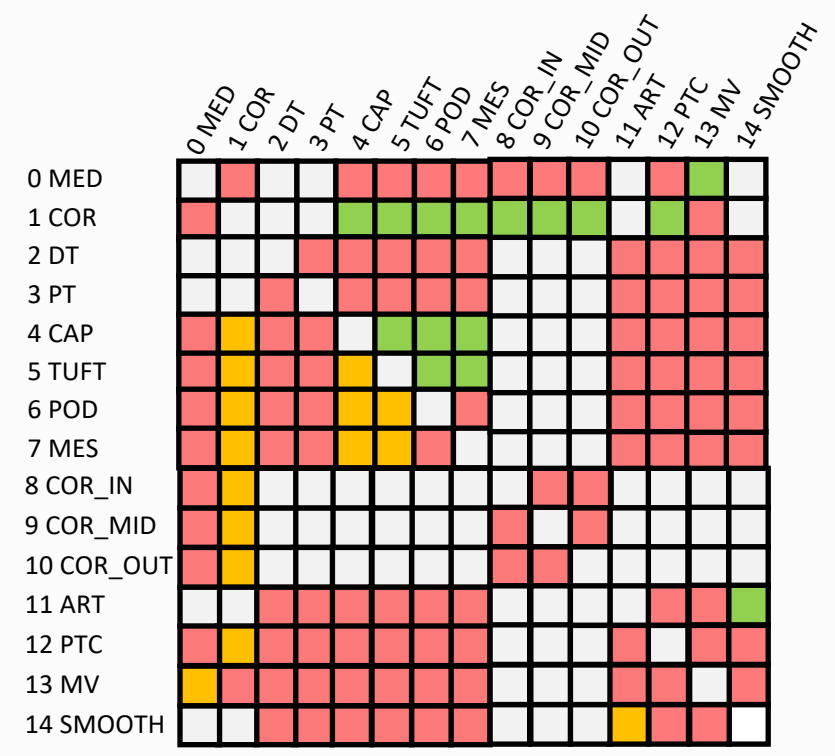


$$\text{Scale ratio} = \frac{\text{Area rate A}}{\text{Area rate B}}$$

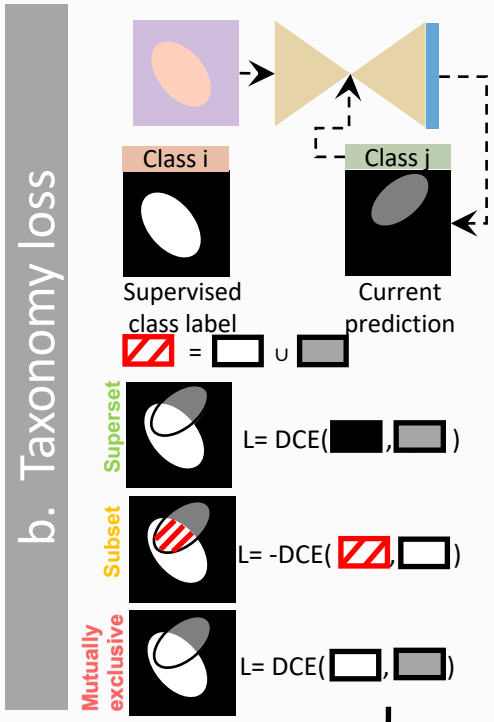
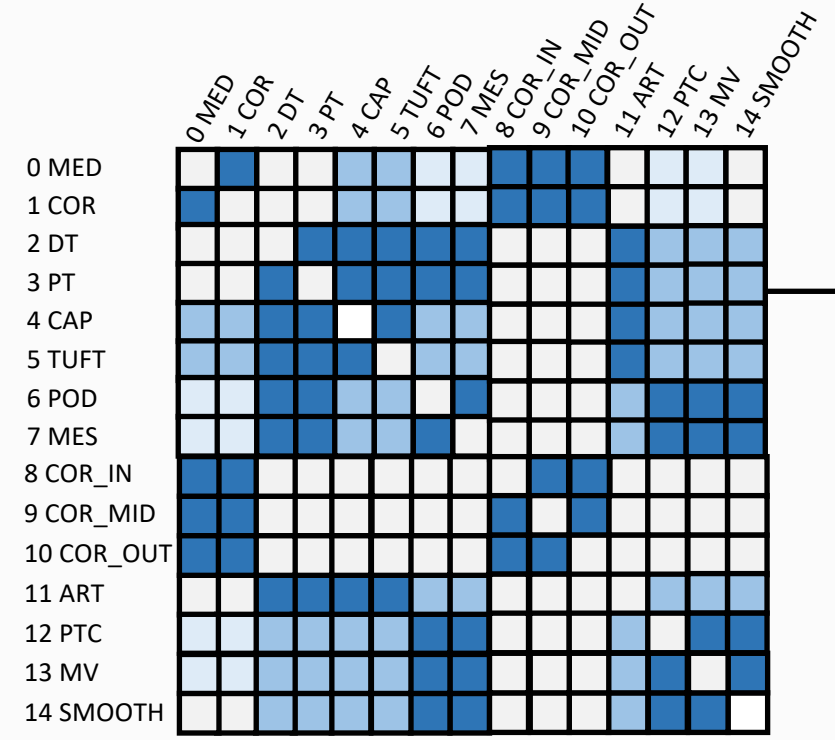


Clinical knowledge

a. Hierarchical taxonomy matrix



c. Hierarchical scale matrix



$$L(i, j) = S(i, j) \times L_{\text{hats}}(i, j)$$

$L(i, j)$ is the final hierarchical taxonomy loss between class i and j , weighted with the scale ratio $S(i, j)$.

Computational modeling