

Best Practices

The conundrum of “appropriate data” in biomedical modeling

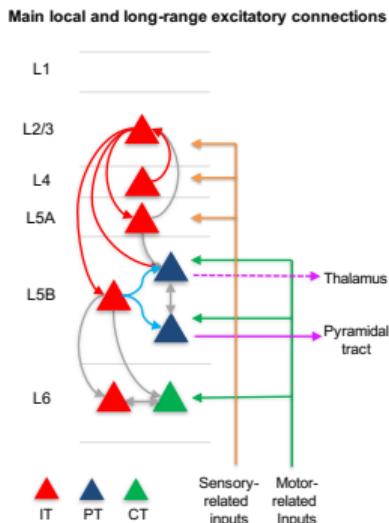
Bill Lytton

SUNY Downstate

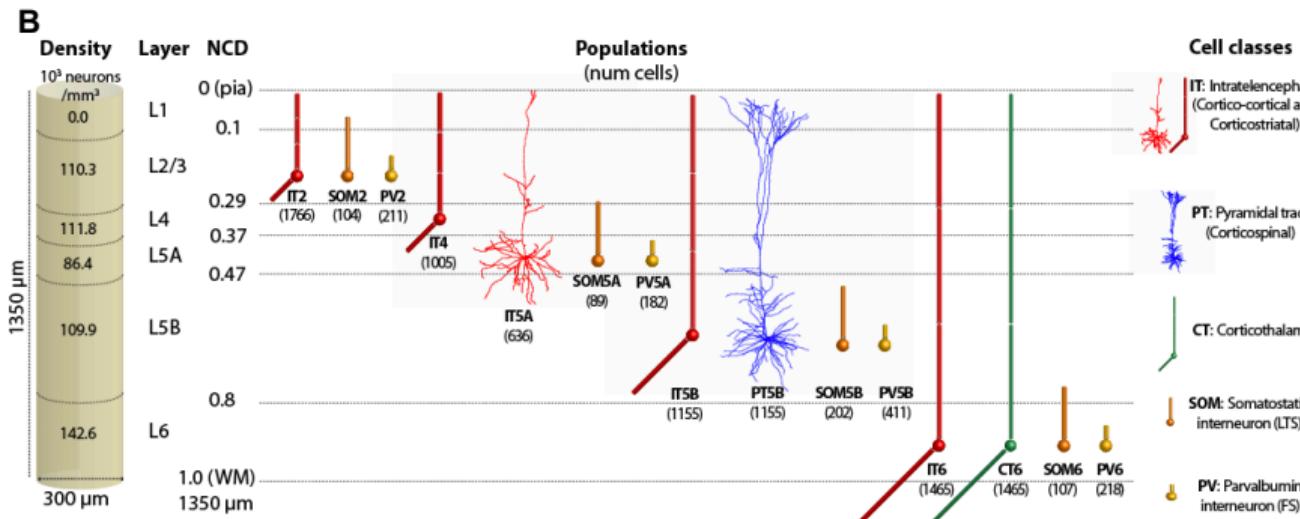
Mar 7, 2019 11:20

Many parameters

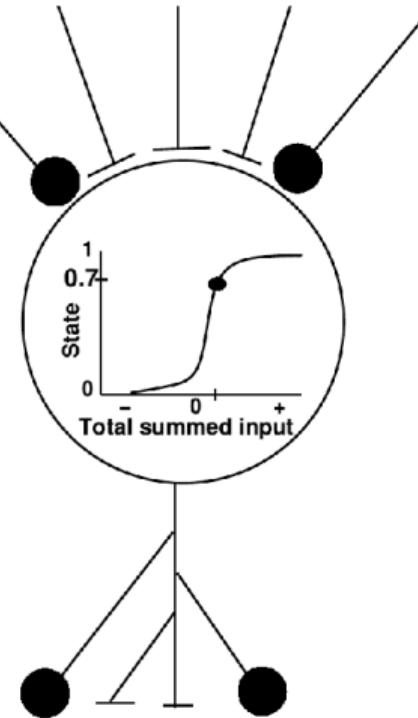
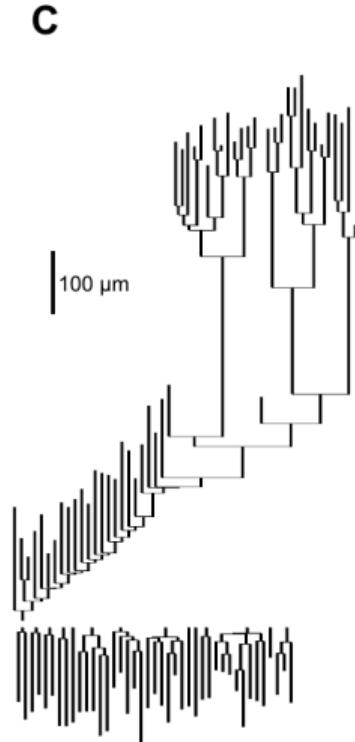
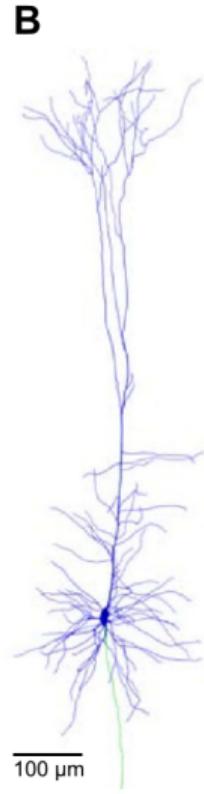
A



B

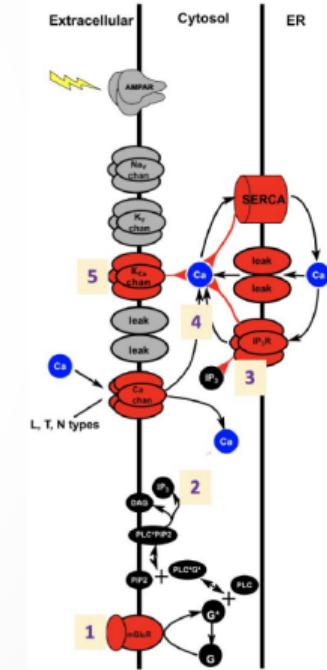
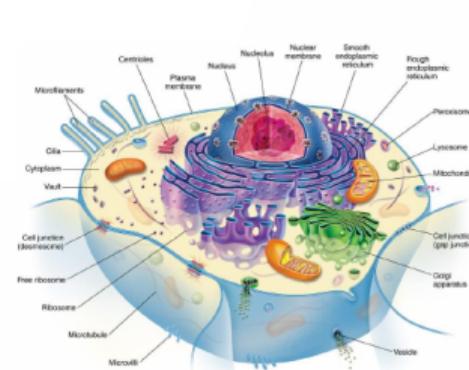
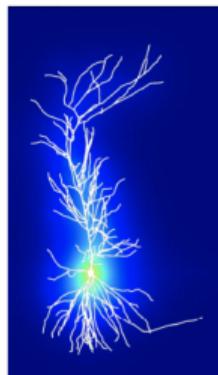
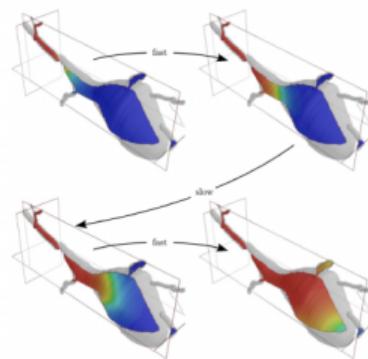


Splitters vs Lumpers

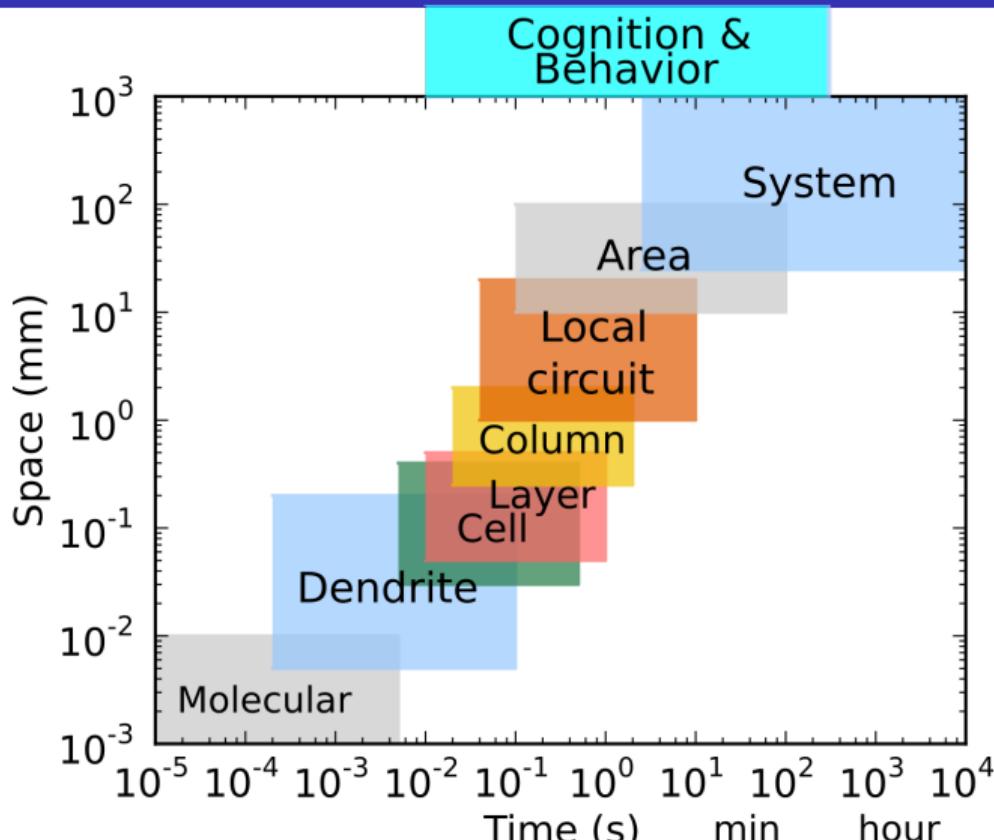


Chemophysiology \leftrightarrow electrophysiology

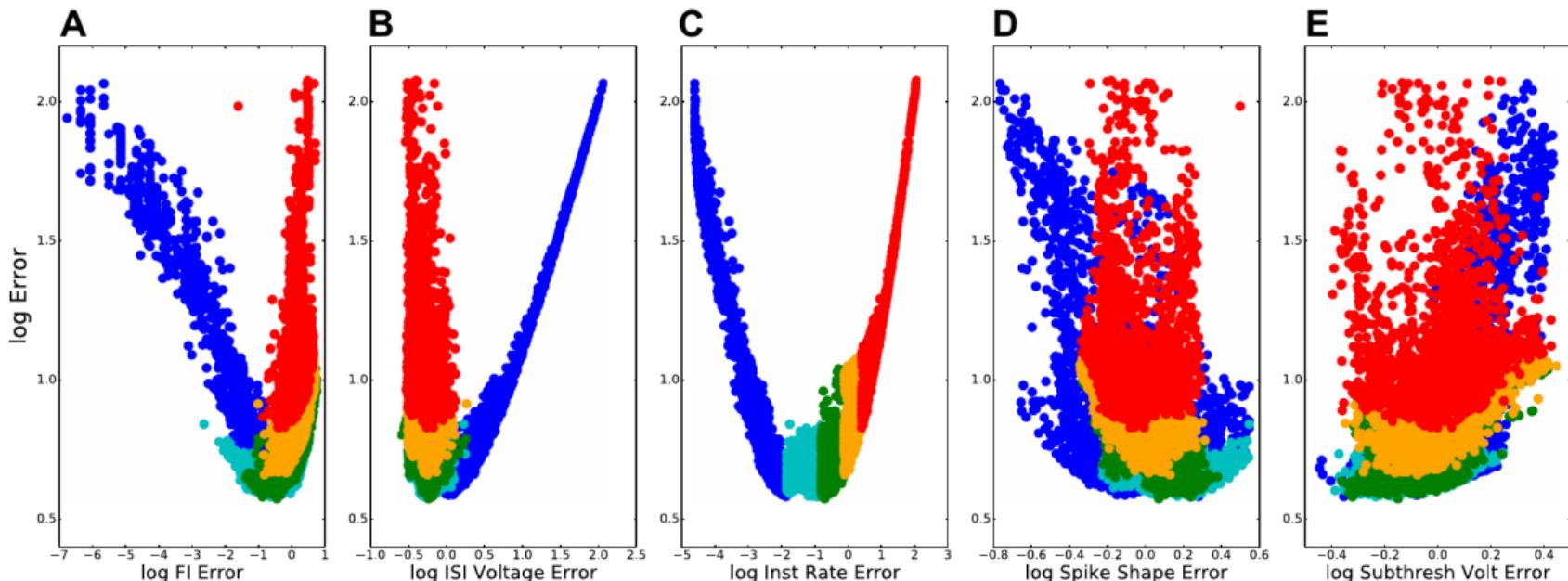
- Intra- and extracellular **diffusion** of ions, proteins (eg, calcium, potassium, IP₃, ...)
- Cell internal structures/**organelles** (eg, endoplasmic reticulum, mitochondria,...)
- Molecular **processes** (eg, phosphorylation, buffering, 2nd messenger cascades,...)
- **Interaction** with cell and network scales (eg, firing, plasticity, ...)



Neural scales overlap



Parameters don't play nice together



Original parameters from 1980s

TABLE 1. *Channel kinetics*

	Channel	\bar{g} , S/cm ²	z	γ	α_0, β_0	$V_{1/2}$	τ_{\min} , ms	T , °C	Exponent	Reference
Sodium channels ($E_{Na} = 50$ mV)	I_{Na}	2.0	3.3	0.7	4.2	-34.5	0.05	37	3	Wilson and Bower 1989
	I_{NaP}	0.00001	-3.0	0.27	0.09	-45	0.25	37	1	French et al. 1990
Potassium channels ($E_K = -100$ mV)	I_{Kd}	0.5	3.0	0.8	0.3	-35	1	24	4	Wilson and Bower 1989
	I_A	0.1	4.5	0.8	0.2	-35	1	24	3	Segal and Barker 1984
Mixed channel	I_M	0.0004	5.0	0.5	0.0008	-44	10	25	1	Halliwell and Adams 1982
	I_{AHP} (SK)	0.0002			see text				3	Pennefather et al. 1990
	I_C (BK)	0.03			see text				1	Moczydlowski and Latorre 1983
	I_{AR}	0.0024			see text				1	Spain et al. 1987
	Channel	\bar{p} , cm/s	z	γ	α_0, β_0	$V_{1/2}$	τ_{\min} , ms	T , °C	Exponent	Reference
Calcium channels	I_T	0.0007	3.43	0.5	0.06	-63	2.5	23	3	Coulter et al. 1989a
			-4.24	0.75	0.008	-83.5	18	23	1	
	I_N	0.006	3.0	0.5	0.1	-30	3	37	3	This study
	I_L	0.004	-4.0	0.7	0.025	-50	1	37	1	Kay and Wong 1987
					see text				2	

\bar{g} , conductance; \bar{p} , permeability; V , voltage; T , temperature; E , potential; I , current.

Parameter exploration & provenance tracking (ICGenealogy)

