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Raw scores from Layer 5 are actually important b/c they're explaining the marginal likelihood of the input. Unpredicted inputs should induce attention? Measuring the quality of the predictive code.

Table 1: Predictions for Fundamental Biomechanisms of Neural Computation

SNMC Feature	**Predicted Biology**	**Experimental Evidence**
Assembly and WTA units represent samples in sparse code. Units in scoring circuit represent scores in dense rate code.	In the brain, there should be a set of neurons whose rate encodes information and another set whose specific spike timing encodes information	Sparse temporal coding and dense rate coding of information are both common in multiple brain regions across many species. (13)
SNMC uses Poisson spike rates in a first-to-spike race to re-create programmatic sampling	In the brain, there should be mechanisms to create Poisson spike profiles rates are controlled the amount of preysynaptic input	EPSCs and IPSCs in all neural systems studied to date follow an exponentially-distributed spacing rule (i.e. the amount of events in a given time window is Poisson). Increased synaptic input yields a change in Poisson rate meaning probability of race victory should directly scale with input. (10, 15)
WTA detects winning asembly at each time step and inhibits other assembly spikes that time-lag the winner. SNMC speed and accuracy is vastly improved if this inhibiton occurs instantly.	In the brain, there should be a means of instantly inhibiting neighboring neurons when a neuron spikes.	Ephaptic coupling has proven to be an effective means of inhibition occuring at the speed of electrical propagation. (2, 19)
MUX unit can collect spikes from all assemblies but only outputs spikes from winning assembly. This allows scoring of each candidate sample without duplicating scoring circuitry for each latent variable value. MUX also allows routing of resampled variable states according to particle scores	"Central hub" neurons should be able to listen to only certain dendrites while silencing others, allowing parallel use of a spiking soma by many different inputs.	Dendritic segmentation of input channels is a newly discovered motif proposed for use in rerouting sensory information based on attention. (16, 17)
Scoring units must precisely count spikes from assemblies	Neurons should possess a mechanism for accurately counting spikes that induce EPSCs on their dendrites despite rapid exponential decay of synaptic currents.	NMDAR plateau potentials are a newly discovered non-decaying synaptic current lasting 50ms that can stack linearly with other arriving plateau potentials, providing a mechanism for short timescale counting of presynaptic spikes. (7, 8)

Table 2: Predictions for Large Scale Dynamics in the Brain

SNMC Implementation	**Predicted Biology**	**Experimental Evidence**
Sampling proceeds by discrete steps that occur each time assemblies receive input.	Activity in each PQ circuit should occur in a periodic fashion, with alternating up and down states.	Precisely timed local field potentials exist in regions like hippocampus and cortex.(3)
Each variable has its own P and Q mircocircuit. States of parent variables, regardless of modality, influence sampling by biasing assembly rates.	WTA units must project to other microcircuits in the brain that must be synched in time to form a unified latent state.	Cortical microcolumns connect across brain regions and are known to temporally synronize when communicating. Phase-locked microcircuits have been proposed as a solution to the "Binding Problem". (12)
Variables are hierarchically organized and are often sampled in order according to the specified generative model	Microcolumns involved in sampling should activate in a particular order each time sampling occurs in Q.	Traveling waves recorded in EEG proceed stereotypically from brain region to brain region. (6, 18)
With each pass of sampling, multiple latent variables are chunked within a single sampling step.	There should be an electrophysiological signature of steps and variable sampling within steps.	Gamma rhythms are often nested inside of single cycles of the theta rhythm. (5)

Table 3: Predictions for Cortical Microcircuit Activity and Connectivity

SNMC Implementation	**Predicted Biology**	**Experimental Evidence**
WTA units fire only sparsely at the beginning of a sample /score epoch to determine the race winner	Superficial cortical layers should be the most sparse firing of the cortical layers	Layer II/III fires the most sparsely of the cortical layers.(1, 14)
Assembly neurons receive input from observations and the winning state from the parent varibles' WTA	Layers should receiving input from sensory data should also receive input from other microcolumns	Layer IV of cortex receives sensory input from thalamus and intracortical input from Layer II/III (WTAs) of other microcolumns. (4)
WTA neurons control which assembly's spikes pass through the MUX.	Layers containing WTA should inhibit dendrites of MUX-mediating neurons	Layer II/III should send inhibitory projections to Layer V dendrites.(9)
Resampler passes latent states from resampled particles to assemblies	Brain regions with access to many microcolumns' input should project back to their microcolumns of origin, feeding back resampled latent states to sampling assemblies.	The cortical-basal ganglia loop contains this exact architecture. (11)