3DVC_Yellow2_Top-Down vs Bottom-Up

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Chandra: Top-down=Systems biology ;eg electrophysiology – collection of neurons form a forest, look at the collective properties and then go down to the individual neuronal process, then inside the neuronal process; each time refine the model by augmenting it. Use it to find out at very local circuit level how the circuit functions, outputs. Question driving the perspective is: how is memory encoded in this part of the brain?
Bottom-up= Reductionist – cluster processes at lowest level and move up. Definitive methodology.

Terry – 3rd way – inside out: look up and down and try to bridge. A different perspective.

Could look at top-down as reductionist – as refine.
Terry. Like trying to explain magnetism by electrons. What's wishful is that if I describe everything, everything will emerge. A map is beautiful – summarizes only what you need. Too much detail is confusing and you can't use it. Test: best map for getting from A-< B.: one map had everything, the other was simple. The second was much better.

Chandra – but if you don't know what are the important details, what do you include? Approach is often – how do you choose how to go? Nowadays – don't have principles that guide this decision – ad hoc – need to think about general principles to guide us – in which cases is top-down vs bottom-up better? Jury is out
Two camps presented today:
Andrew – bottom up: molecular level -> constituents
Sys Biol – I have some number of myocytes; for a certain tissue will take certain concentration of cell types and see if there are emergent properties

Emergent properties – how do you get things out that you didn't put in? Can't – it's just software;
Terry – you do: if you can get out what you want based on your model, means what you left out wasn't important
Or – you got lucky and your choice of parameters was fortuitous.

Wherever you start in the continuum, you're in the middle!
Sometimes have to just start where the data leads you

Eg – neurons: EM and light microscopy data; want to understand synapse – have to start at that level; what is the concentration of molecules – but don't have the data!

Chandra - Glycosylation, Art and CellPack – how do you pack the neurons; no way to interactively map this. May be led to the wrong path. Sometime the spatial realization is so complex that no method is possible to achieve this interactively.

But how will you use this model?

Chandra - Always – to understand form-function relationships, eg spines with narrow neck. Do you get disease with some minimum neck? What about the bulbous head? There are specific reasons; people have hypotheses.

Summarize this top-down bottom-up.

Both valuable, probably depends on the problem.

If you understand where the model is coming from, would help others to understand it – have people explain what motivated you to develop this model.

Ways of representing observations, claims, etc – when you look at all of these. Bottom up – let's gather as much data as possible. But big data divorced from human knowledge models can be dangerous. Will never be able to do purely data-derived ??? complexity. Need the data to go up, but need the models to come down. People fight over this – but process needs to go back and forth.