Great.

Late again.

I really thought I would be on time today.

Oof

should have caught the door.

Hello everyone. I'd like first to thank the university, and your professor, for inviting me. Is everyone looking at me?

I think people are looking at me.

At my home university, every area of research is usually contested. I'm slouching, aren't I?

Sorry.

Really wish people filled into the middle of the rows.

And I would like to preface the rest of my talk by introducing the topic of my talk: SEROTONIN.

This space will provide QR codes to sources and further reading for the enthusiastic reader.
You may know serotonin as the "feel good" hormone, but it's more complicated than that.

We're not that predictable, are we?

Never.

Called SHT in jargon, serotonin is a neuromodulator-it regulates the activity of neurons by dialing up or down certain 'knobs' called receptors.

And maybe, sort of,

tired.

Receptors are like little pumps attached to the membrane of a neuron. When serotonin binds to a receptor, it turns on the pump, letting ions and other molecules flow-excitatory or inhibitory—that neuron.

I need to do something about this.

Serotonin neurons are localized in the dorsal raphe nucleus, an ancient structure deep in the brain, whose axons reach out to many different parts of the cortex.

Bziip

Loud. But.

I have a bar in here somewhere

Of course, it's at the bottom.

When, for any number of reasons, these serotonin neurons activate, their axons release serotonin in the cortical areas they project to.

serotonin stays around the synapses connecting local cortical neurons for a while, and modulates their activity.

Is that it...?

More on:

Neuromodulation of brain states:

Map of serotonin receptors in the human brain:
In treatments for depression, SSRI drugs (selective serotonin reuptake inhibitors) block the reabsorption of serotonin, so it hangs out longer at the synapse.

This seems to help with depression, but nobody knows exactly why.

Psychedelic drugs like LSD bind especially well with the 5HT-2A receptor, among others. Even though they bind in a minute quantity compared to the natural activation by serotonin...

While the serotonin produced by the brain activates all of the many 5HT receptors, humans like to activate specific receptors by using special drugs.

And that's my portable battery

Check Out:
The many faces of serotonin receptors:
The neuroscience of psychedelic drugs and 5HT-2A:
The 5HT2A receptor is so powerful that clinically depressed patients were relieved of all symptoms after just one session with psychedelics, where all other treatments failed.

It hijacks the brain by opening a “window of opportunity” to rewire your neural circuitry.

I think that I found it...

like heating up an amorphous piece of clay to form a new shape, say, a tea pot. It kicks you out of your bad habits and old patterns of self-referential thoughts, and into new and healed states.

Yes!

Wait, how do I get it open?

Current theories about psychedelics suggest they might change the balance of our perception between the signals our senses transmit to our brain from the outside world,

and what our brain “expects” to see based on our prior experiences.

Usually the two are balanced. This is why, if I were to show you many images of pastries...

you would think you see a blueberry muffin at first, before realizing it is a dog! A cutie!

Observe:

FDA hail Psilocybin as “breakthrough” for major depression:

Talk on mysterious link between serotonin, behavior, and neural plasticity.

Psychedelic therapy:

Puppies or pastries?
When your brain is on psychedelics, your usual expectations may lose their grip, or your sensory inputs may weaken. Then you interpret the world around you in a new way...

Nearly

Common side effects of activating the 5HT-2A receptor include:

Look at that texture

Distorted perception of time.

Dissolution of the ego—that constant internal chatter. The "I" that experiences things, they fade away...

Consider:

A theory of hallucination: The REBUS of psychedelics: Visual responses in mice: Subjective accounts of psychedelic experiences:
One way we study the impacts of this activation are using simulations of the human brain, on a neuromorphic chip.
While we simulate a human ‘mind’ and record its perceptions, we can dial up or down any receptor in its neural network, including serotonin receptors. Our friend 5HT-2A is the knob shown here.

By dialing up the activation of 5HT-2A in the network simulation, we can study how psychedelic drugs hijack neural activity, how this change in brain activity leads to altered perceptions.

and how this knob shifts the balance between ‘bottom-up’ sensory inputs and ‘top-down’ expectations, and induces hallucinations.

This allows us to study both the internal and external experiences of dialing up the 5HT-2A receptor.

got questions?

Neural network simulation of your brain on LSD:

Controlling the speed of perception in neural networks:
We're not that predictable, are we?

Never.

To illustrate these concepts, here is a simulation taking place during this very lecture.

This is my lecture from the point of view of someone whose SHF-2A's receptor is increased throughout the talk.

... sorry, it should be playing now.

I really thought I would be on time today.

meet the authors
Audra's work:
Luca's research: