

Dopamine – Fuel to Heaven or Hell



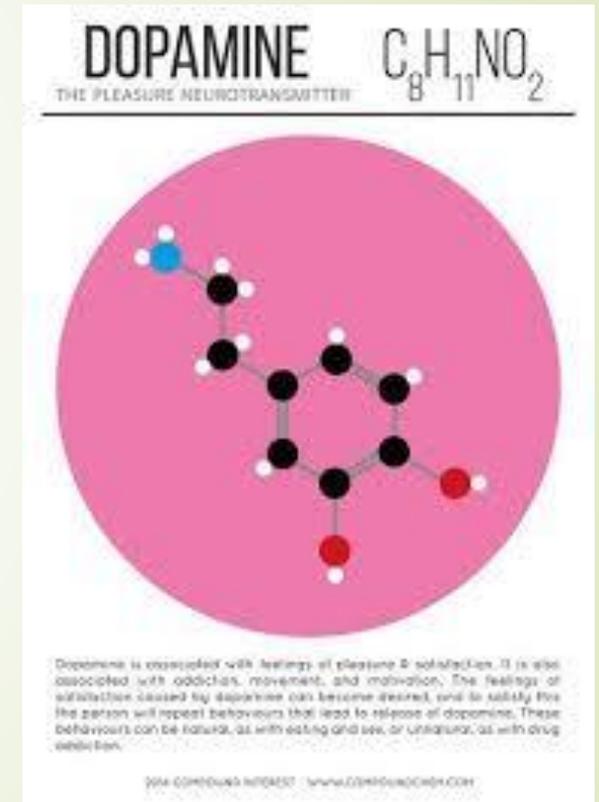
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A disciplined mind leads to happiness
And an undisciplined mind leads to suffering
Dalai Lama

“The views expressed are those of the author and do not reflect the official policy of the Department of the Army, the Department of Defense, or the U.S. Government.”

How the Brain Gets Hooked on Behavioral/Process Addictions

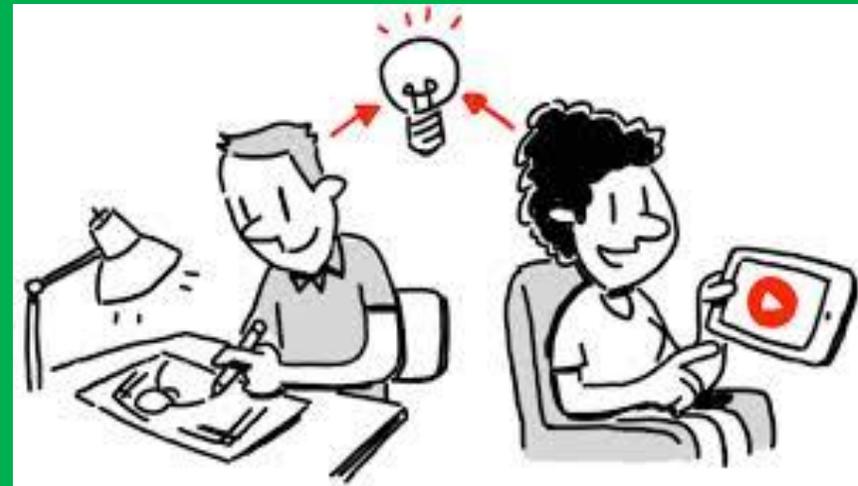
- As Kardaras(2016) stated in his book, *Glow Kids*, in order to fully understand addiction, we need to understand the **brain's reward system** and the impact of dopamine on that reward pathway.
- Specifically, how much dopamine is activated by a substance or behavior is correlated directly with the **addictive potential** of that substance or behavior.
- **Dopamine**, as many of us know, is the “feel-good” neurotransmitter that is the most critical and important part of the addiction process. Dopamine was **discovered in 1958 by Arvid Carlsson and Niles-Ake Hillarp** at the National Heart Institute of Sweden.



Functions of Dopamine

► Dr. Susan Weinschenk (2009) noted that **dopamine** is created in various parts of the brain and is critical in several brain functions to include:

- Thinking
- Moving
- Sleeping
- Mood
- Attention
- Motivation
- Seeking and reward

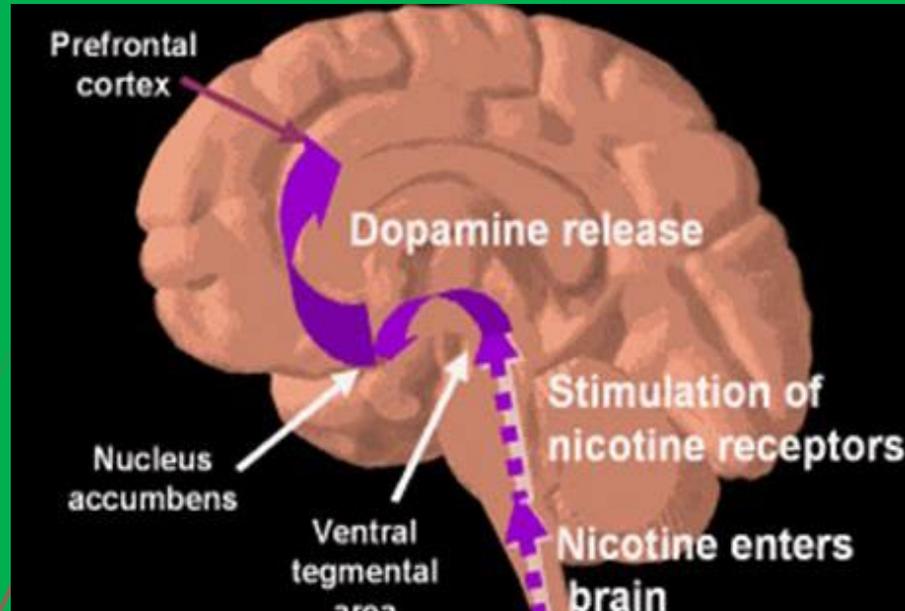


Inspired to watch because of Dopamine

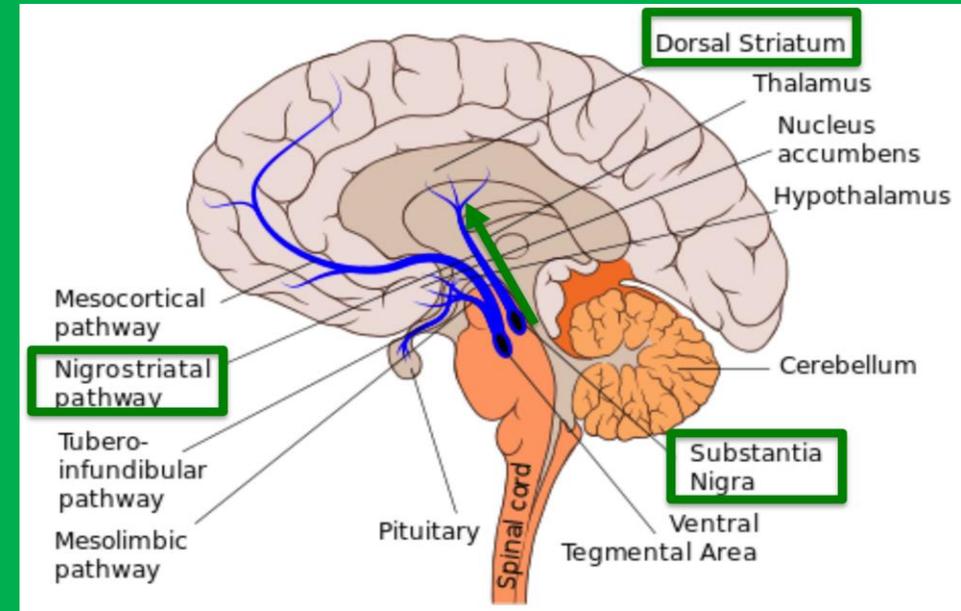
Two Main Dopamine Reward Pathways

Mesocorticolimbic for motivation and reward

Nigrostriatal for movement



The **Mesocorticolimbic Pathway** transports dopamine from the **VTA** to the **nucleus accumbens**, **amygdala**, and **prefrontal cortex**. The nucleus accumbens is found in the ventral medial portion of the striatum and is believed to play a role in reward, motivation, desire, and even the placebo effect.



The **Nigrostriatal Pathway** travels from the **substantia nigra** to the **striatum**. The nigrostriatal pathway is important for facilitating movement.

Dopamine is both a neuromodulator and neurotransmitter

➤ According to Stanford neuroscientist Dr. Andrew Huberman, dopamine is both a **neuromodulator** and a **neurotransmitter**. The main difference between neurotransmitter and neuromodulator is that a neurotransmitter is a chemical messenger released by a **neuron** to affect either one or two post-synaptic neurons or another **specific effector organ** whereas a neuromodulator is a chemical messenger released by a neuron to affect a group of neurons or effector organs with a specific receptor.

➤ Furthermore, a neurotransmitter directly affects the postsynaptic partner to produce a quick, **rapid effect** while a neuromodulator indirectly affects the post-synaptic partner, especially through a second messenger to produce a **slow but long-lasting effect**. Dopamine can be released **locally** or **volumetrically** (a large dump). When it is released volumetrically, it affects many neurons. Very concerning, dopamine can ultimately affect **gene expression** according to Dr. Lieberman.

Click here to listen to Dr. Lieberman's excellent lecture on dopamine:

https://www.youtube.com/watch?v=QmOF0crdyRU&t=2s&ab_channel=AndrewHuberman



Dopamine and DeltaFosB “Keep doing it!”

- Highly salient activities, in this case addiction, lead to the accumulation of **DeltaFosB**, a protein that activates the genes involved with addiction. The molecular changes it potentiates are almost identical for both sexual conditioning and chronic drug use. Specifically, DeltaFosB rewires the brain to **crave IT** whatever **IT** is.
- In a sense, **dopamine** is like the **foreman** on a construction site barking orders and **DeltaFosB** is the **worker** on the site. Dopamine is yelling, “This activity is really important, and you should do it again and again.”
- DeltaFosB is responsible for ensuring that you **remember and repeat** the activity.
- This repeated process produces what is called **sensitization** which is based on the principle, “**Nerve cells that fire together wire together**” as noted by Canadian researcher Donald Hebb in 1949. Repeated activity strengthens cell connections.



Dopamine and CREB – “Slow it Down, Silver!”

- ▶ As the brain recognizes that it needs a rest, it will kick out **CREB** in an effort to slow things down (Wilson, 2014).
- ▶ In essence, **DeltaFosB** acts like the **gas pedal** and **CREB** functions as the **brakes**.
- ▶ **CREB** specifically **inhibits** dopamine and endogenous opioids in an effort to take the joy out of the binging/addictive behavior or substance so that you can give it a rest.
- ▶ This numbed pleasure response that is induced by CREB is often identified as **desensitization** which leads to **tolerance** - the need of increasingly higher doses to achieve the same effect. Tolerance is a key factor in addiction.



So, we see that chronic overstimulation can lead to two opposite effects:

01

Increased dopamine activity (wanting/seeking it more) –

sensitization via **DeltaFosB**

02

Decreased dopamine and opioid activity (liking it/enjoying it less) –

desensitization via **CREB**

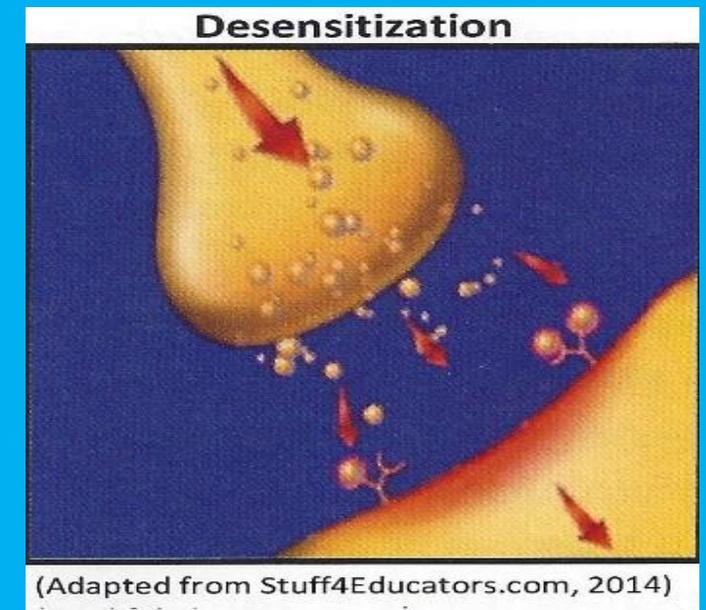
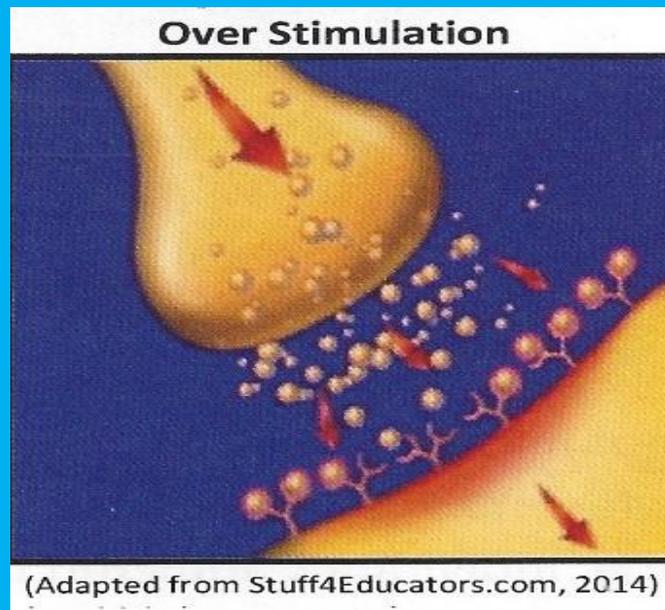
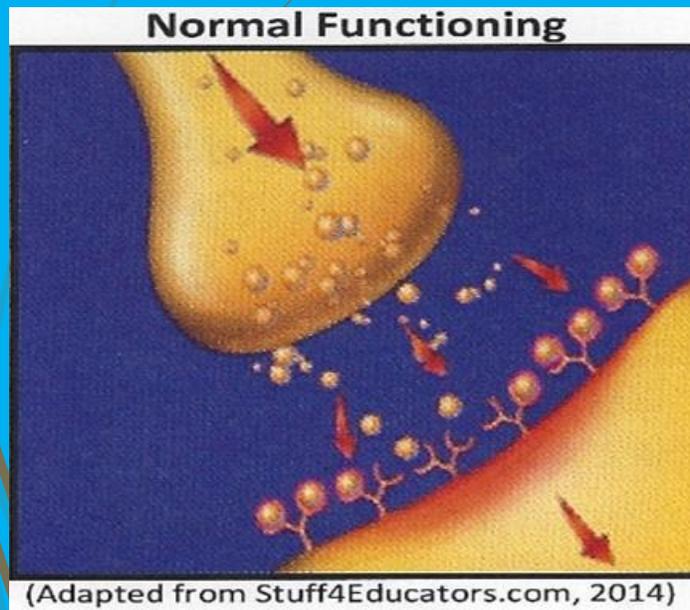
BOUGHT THE **BMW** BUT STILL WANTING THE **DUCATI** DIAVEL



DOPAMINERGIC DOWNREGULATION AT THE SYNAPTIC LEVEL

Click here to listen to an excellent clip on downregulation by FreeMedEducation:

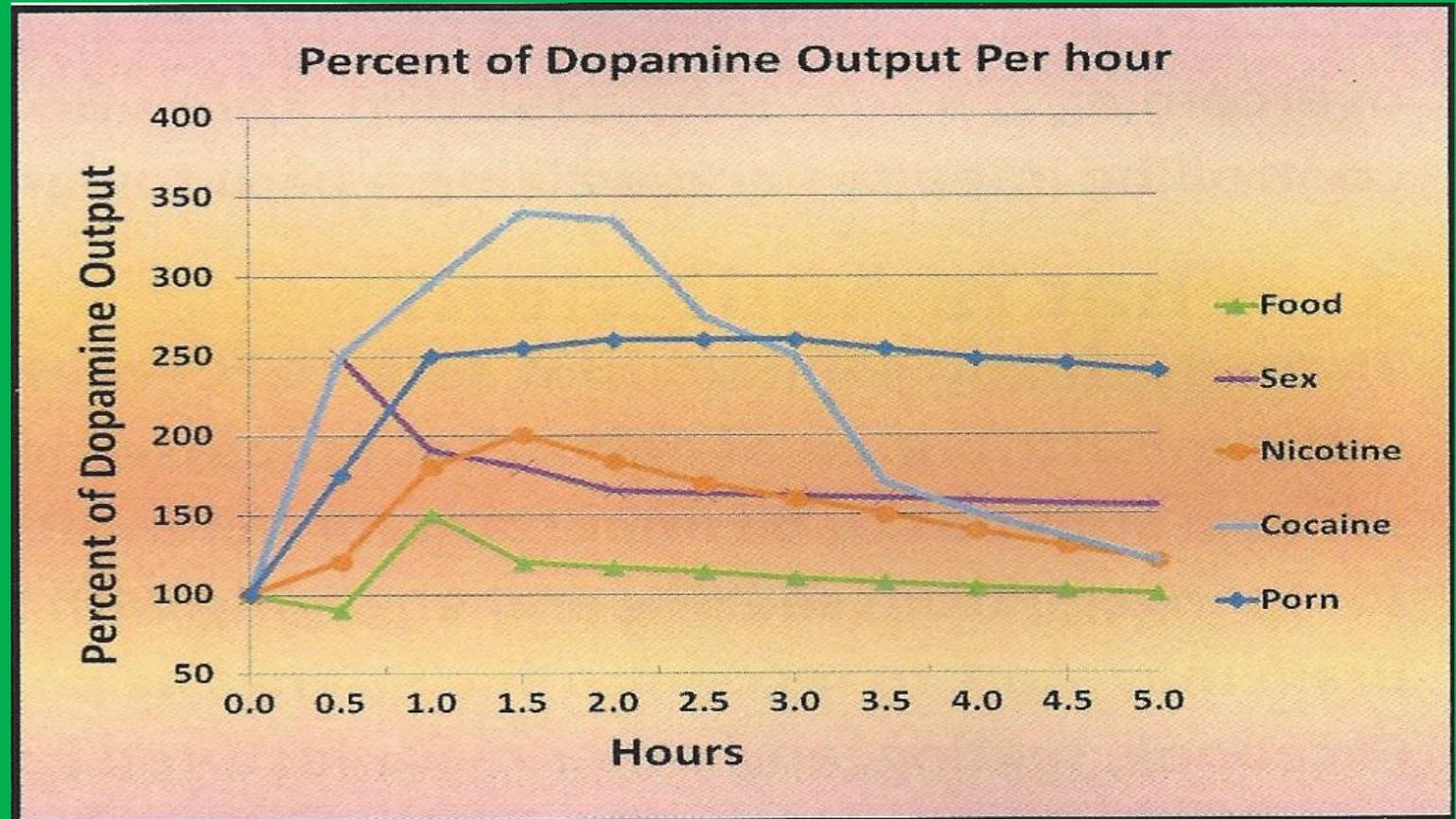
https://www.youtube.com/watch?v=ayjQ5MvSMYU&ab_channel=FreeMedEducation



What Cranks Us Up?

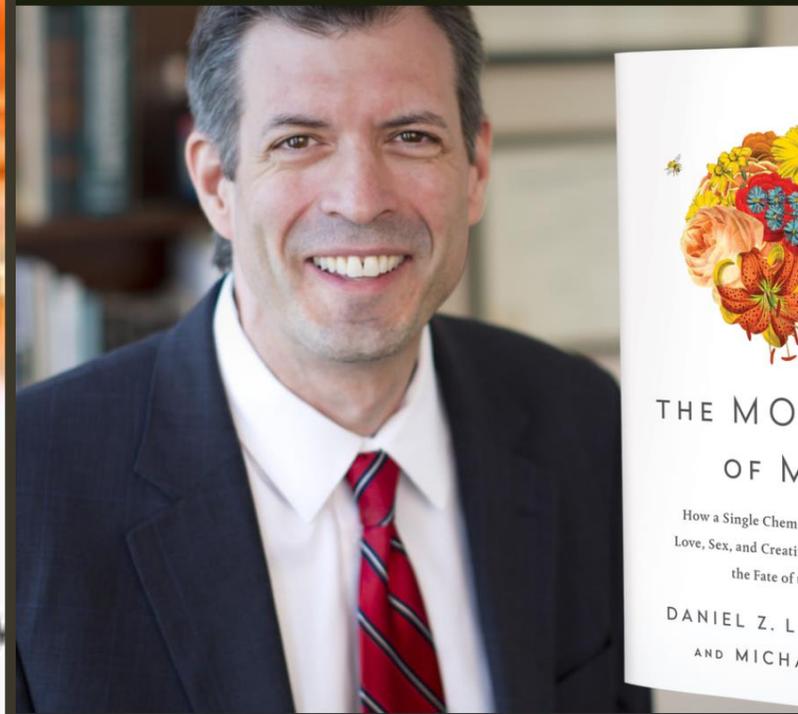
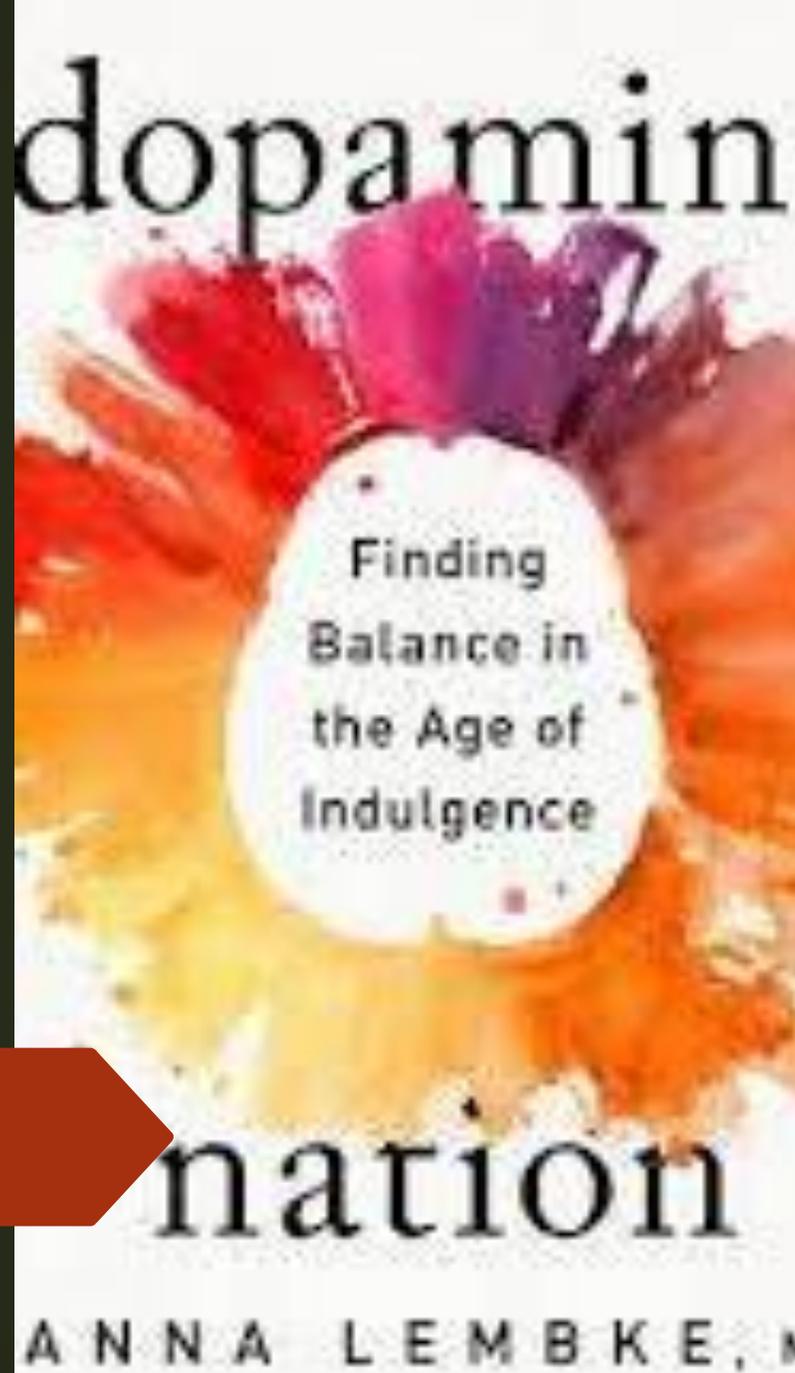
Summary of dopamine increases:

- ▶ Food – 150% increase
- ▶ Nicotine – 200% increase
- ▶ Snorting cocaine – 350% increase
- ▶ Sexual intimacy – 250% increase
- ▶ Pornography – 250% increases and stays elevated for longer – even when compared to cocaine

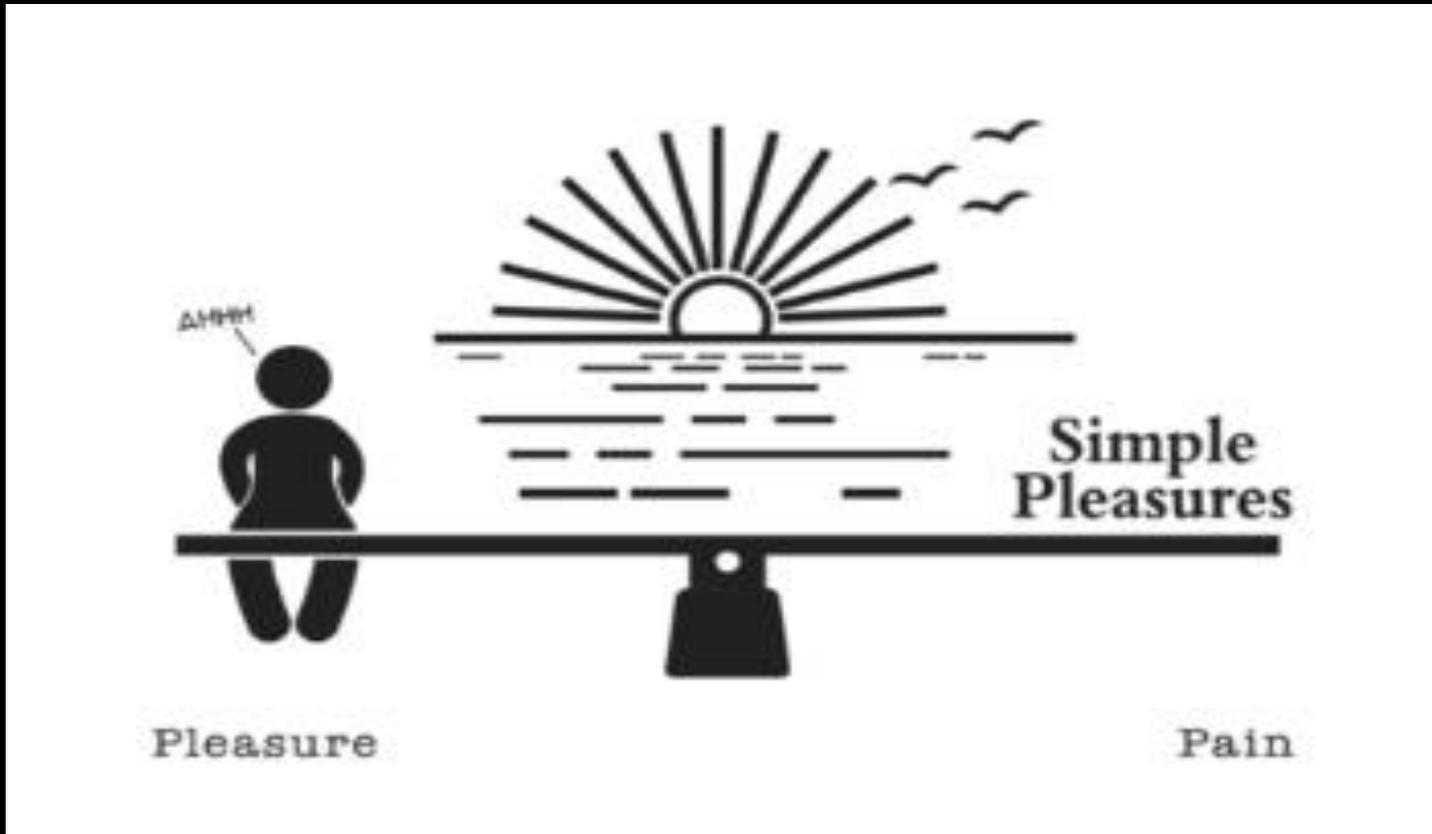


(Di Chiara & Imperato, 1988; newlifehabits.com, 2010)

The next few slides are from groundbreaking work of [Dr. Anna Lembke](#) and [Dr. Daniel Lieberman](#) and give us additional insights into how dopamine impacts the addiction process.



Pleasure and Pain Nicely in Balance



➤ According to Stanford Psychiatrist, Dr. Anna Lembke, dopamine which acts on **pleasure** neurocircuits, and **pain** are related and help create a homeostatic balance in the brain and body.

The following slides are based on Anna Lembke(2021) *Dopamine Nation* book.

Click here to watch her excellent YouTube video:

https://www.youtube.com/watch?v=5Pu82wZRZwo&ab_channel=AndreaSamadi



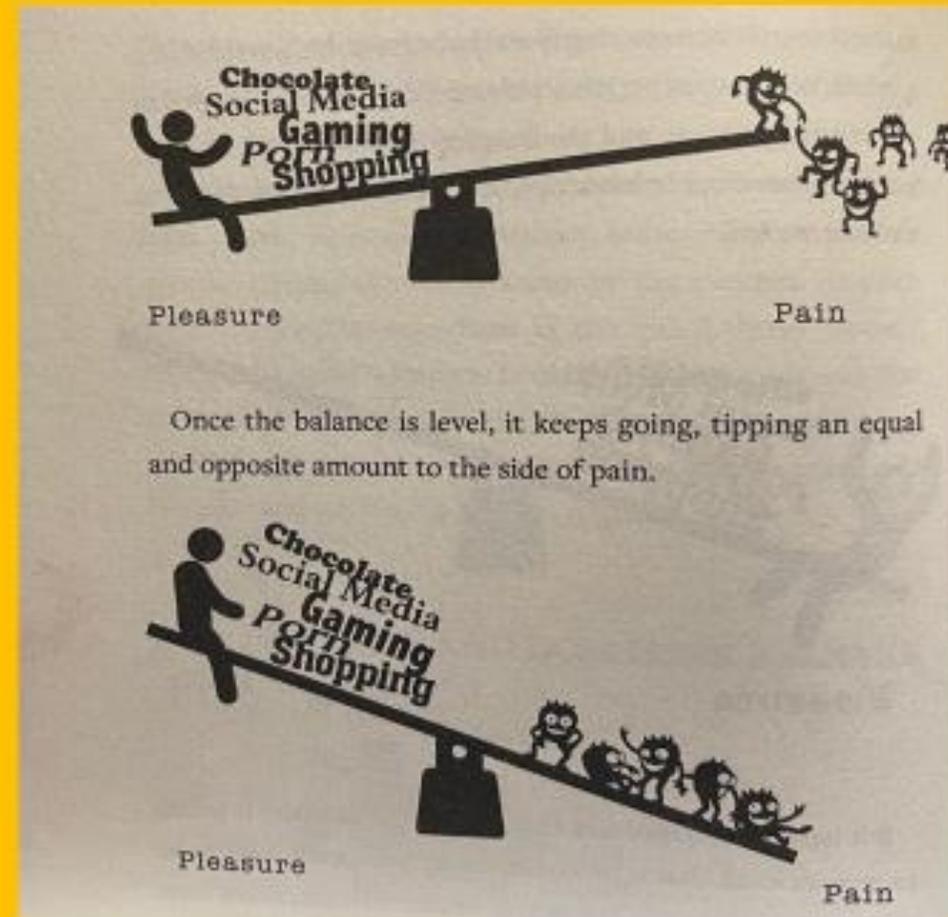
Our brain down-regulates our dopamine to bring us back to homeostasis (gremlins jumping on the lever).

As we actively seek pleasure, pain gremlins begin to jump on the teeter totter to try to restore homeostasis balance.

Anna Lembke (2021)

https://www.youtube.com/watch?v=5Pu82wZRZwo&ab_channel=AndreaSamadi

Pleasure – Pain Shift



Pain circuits
activate in order to
move toward
homeostasis or
balance



Then the balance is more on the "pain" side which is where we want more to feel "normal" again.

Anna Lembke, 2021,
https://www.youtube.com/watch?v=5Pu82wZRZwo&ab_channel=AndreaSamadi

Pleasure and pain out of balance

This is a dopamine-deficit state, where we are walking around unhappy.

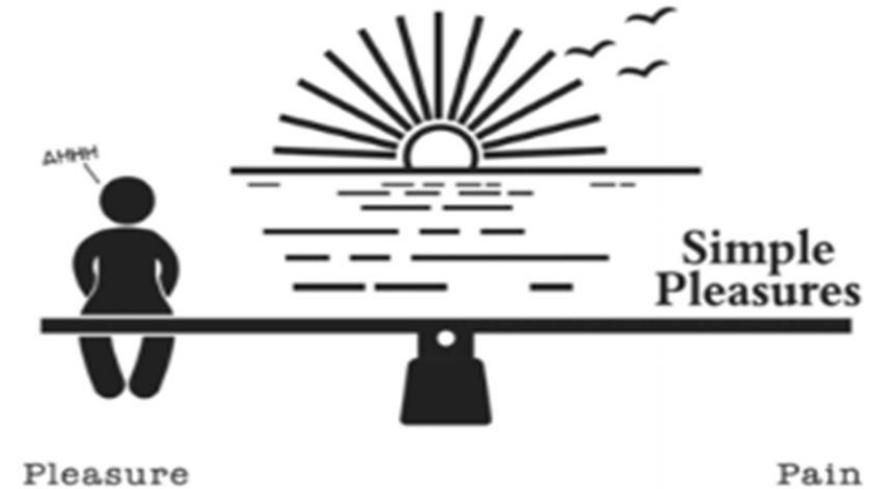
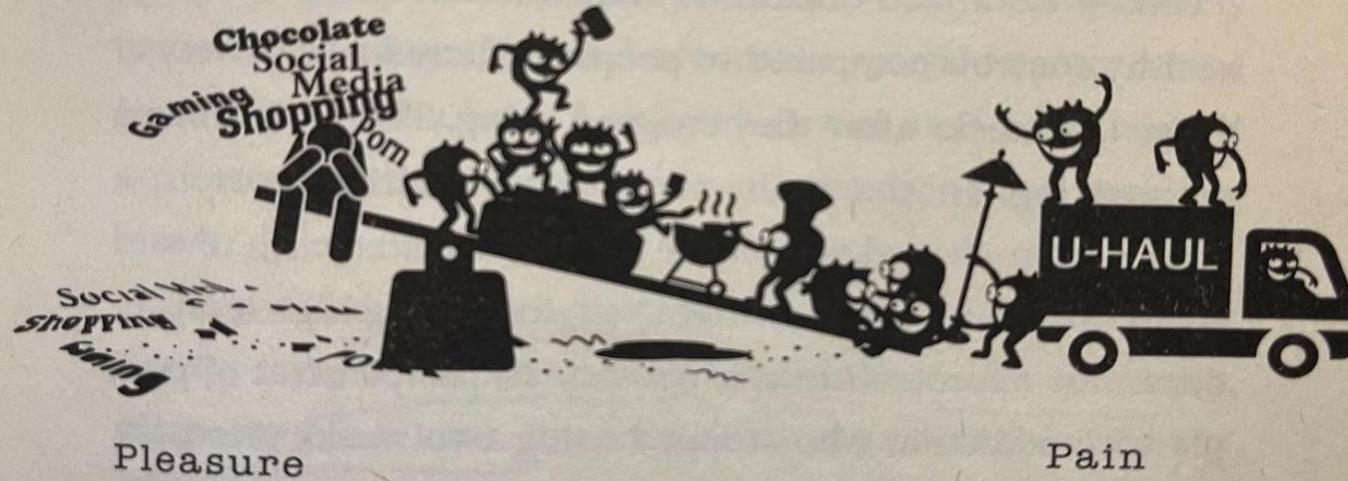


Dopamine Nation "It's harder for us to experience pleasure and more likely we will experience pain."

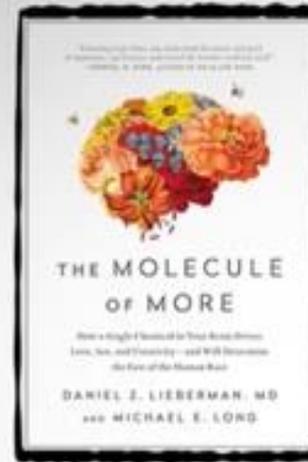
Anna Lembke (2021)

https://www.youtube.com/watch?v=5Pu82wZRZwo&ab_chann el=AndreaSamadi

Dr. Lembke recommends a 30-day dopamine fast in order to rebalance the dopaminergic circuits in the brain.



The following slides are taken largely from Dr. Lieberman's excellent book, *The Molecule of More*



INSIGHTS FROM
DANIEL LIEBERMAN
AND
MICHAEL LONG'S

THE MOLECULE OF MORE

BROUGHT TO YOU BY **INSTAREAD**

The Molecule of More

Click here to listen to Dr. Lieberman:

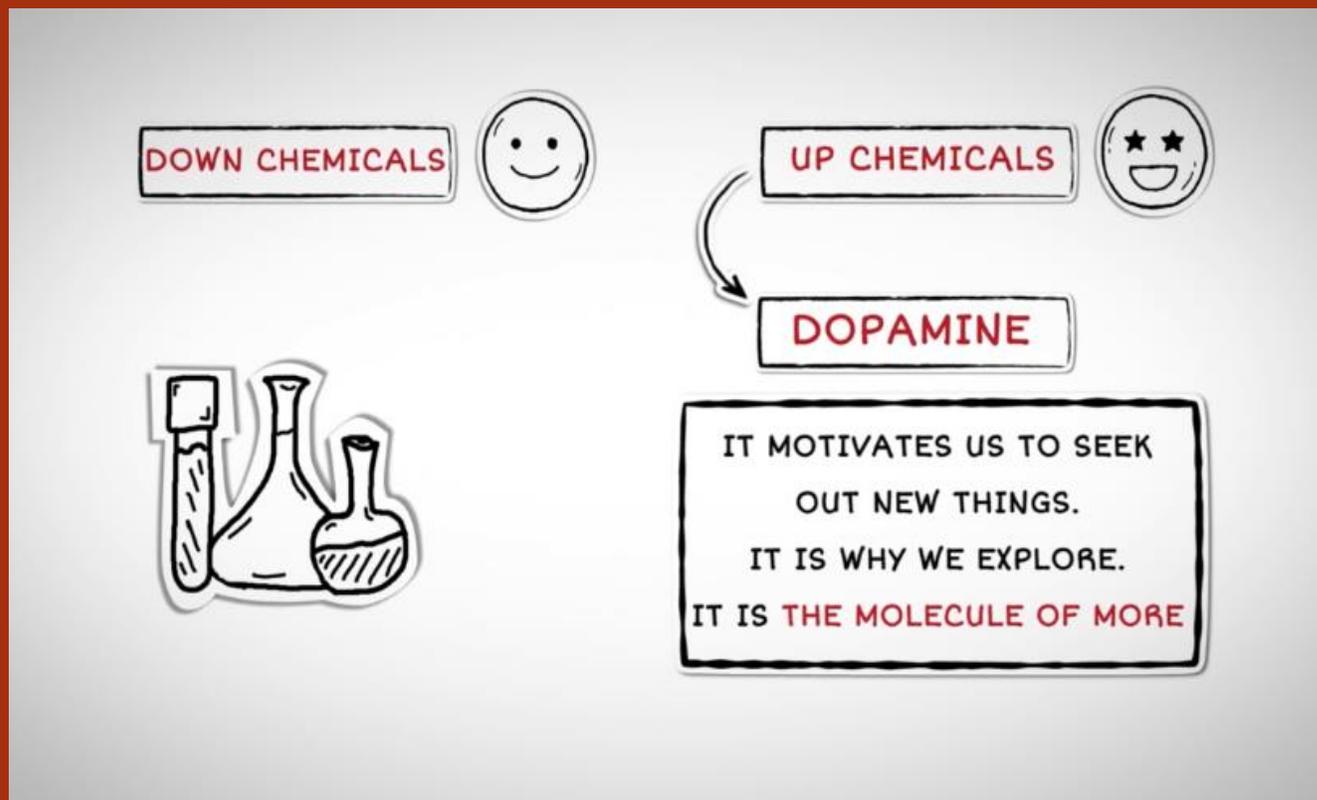
https://www.youtube.com/watch?v=TjKCzYYkKN4&ab_channel=Valuetainment

Click here to listen to animated video on Molecule of More:

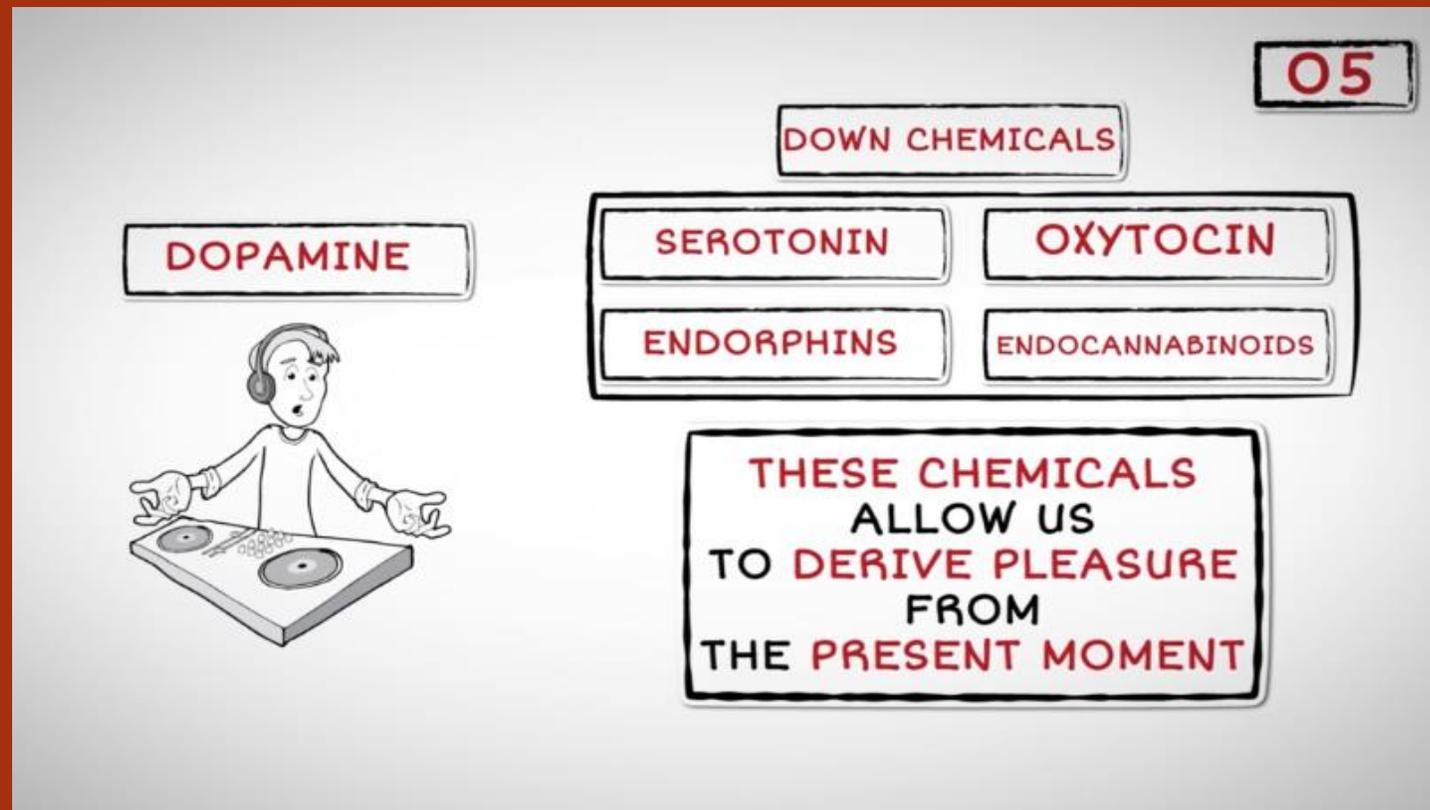
https://www.youtube.com/watch?v=sPpY_nePtV8&ab_channel=Instaread

The brain has **up** chemicals and **down** chemicals

The up chemical dopamine drives us to seek **new things**



The Down
Chemicals –
designed for
the **here and
now**

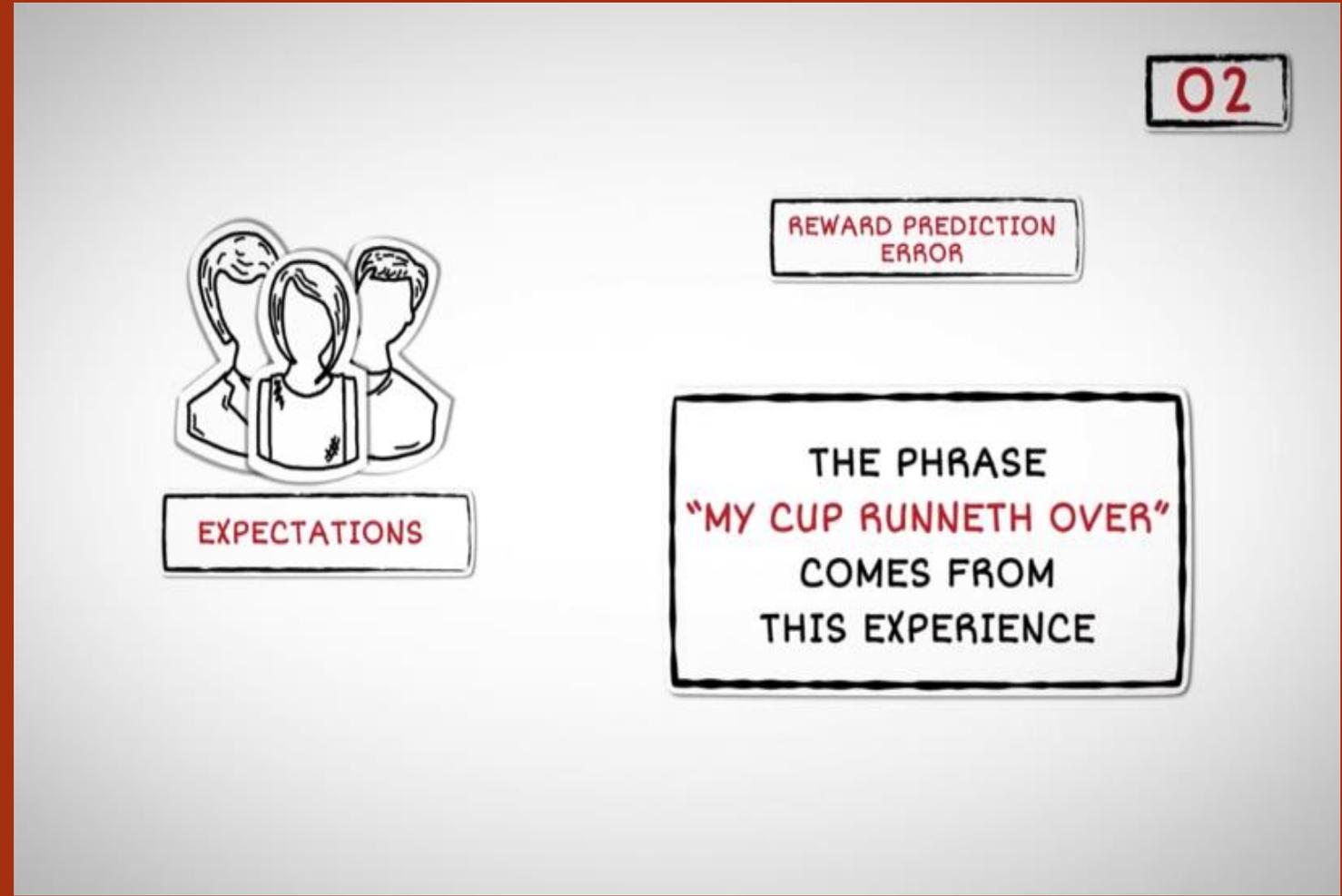


Dopamine is future-oriented and less conscious in process



Reward Prediction Error

When the **expected** becomes **unexpected** which increases dopamine dramatically and compels us to continue seeking the **new thing**. This can become addicting.



Reward Prediction Error

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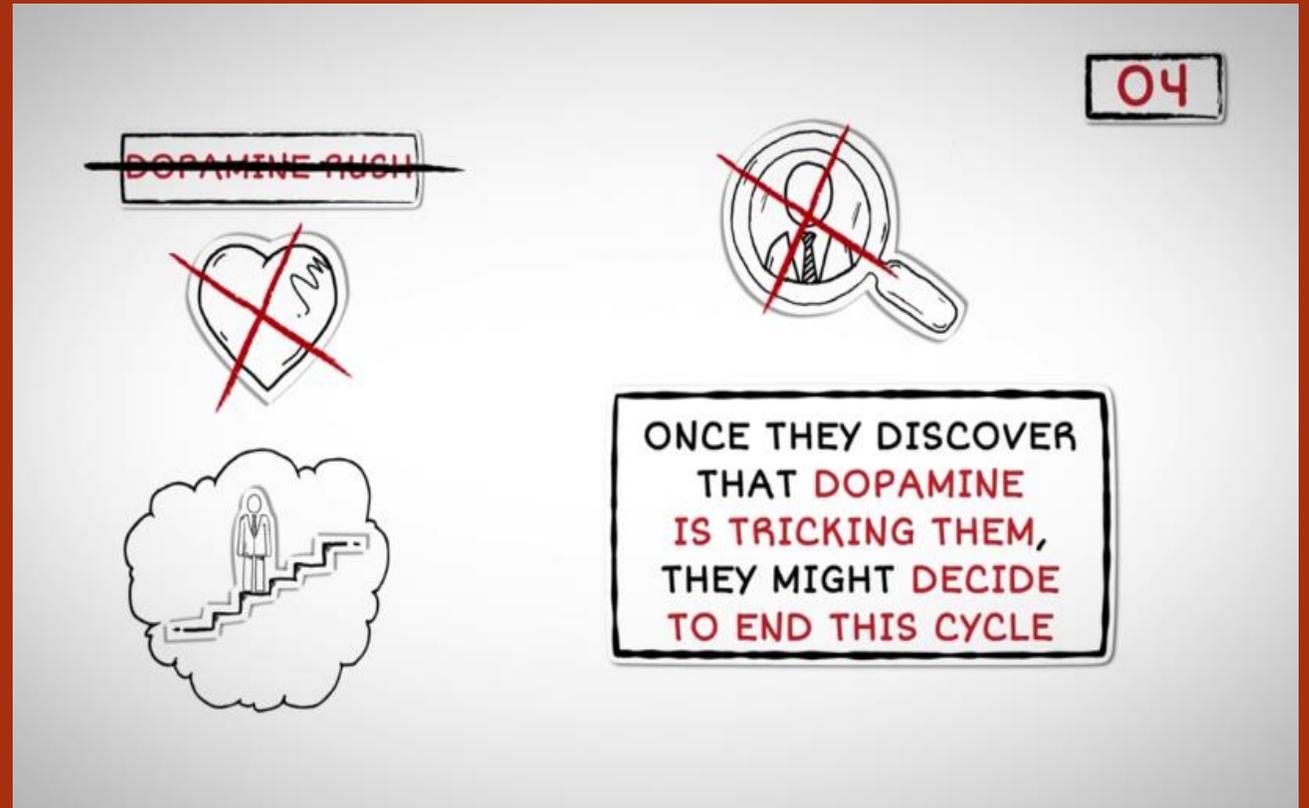
Dopamine drops
when the
unexpected
becomes
expected.



REACTION TO
PROMISING
SURPRISES AND
UNEXPECTED EVENTS

WHAT WAS ONCE
UNEXPECTED
BECOMES EXPECTED
AND EXPERIENCING A
DOPAMINE RUSH
BECOMES LESS LIKELY

We can then possibly decide to end the cycle.



Here & Now Circuits

allow us to back off the future pursuit and enjoy the present and all that it offers – relationships, peace, connection

AGENTIC RELATIONSHIP

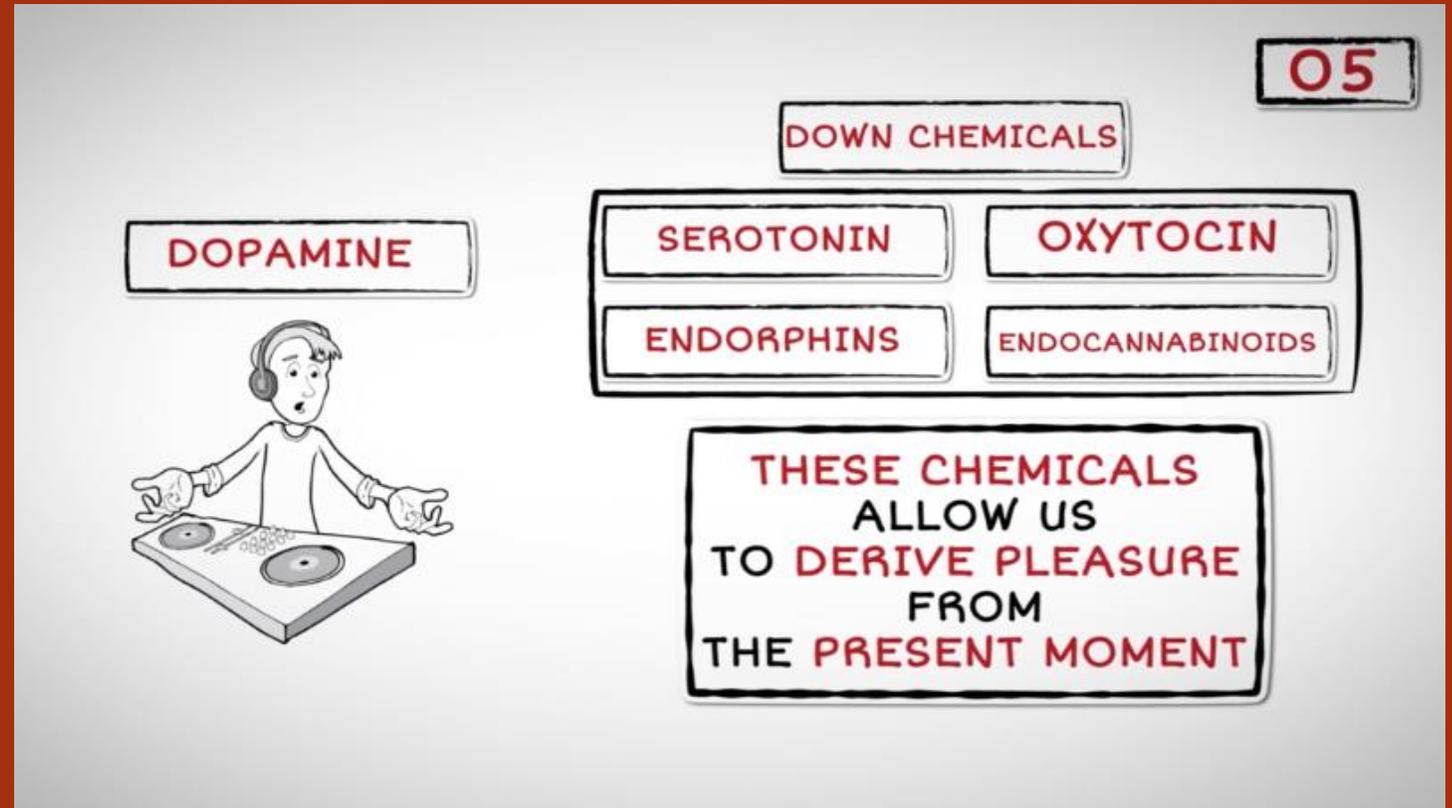


AFFILIATIVE RELATIONSHIP



IT IS POWERED BY
OXYTOCIN AND
ENDORPHINS

If we end the **dopamine rush**, we are able to enter into the **here and now zone** driven by the down chemicals.



Being able to shift from **future craving** (dopamine) to the **present** (here and now chemicals) is essential to mental health

09

~~THE FUTURE IS A FANTASY~~

THE PRESENT IS REAL

DOPAMINE MAKES US CONSTANTLY WANT THINGS, WHEREAS THE HERE-AND-NOW NEUROTRANSMITTERS, THE DOWN CHEMICALS, ALLOW US TO APPRECIATE THEM

Dopamine fixes us
on a **future target**
and can be a good
thing **if balanced**



**THE MORE DOPAMINE YOU HAVE,
THE MORE YOU ARE MOTIVATED
TO WORK HARD FOR YOUR
GOALS REGARDLESS
OF HOW TOUGH IT GETS**

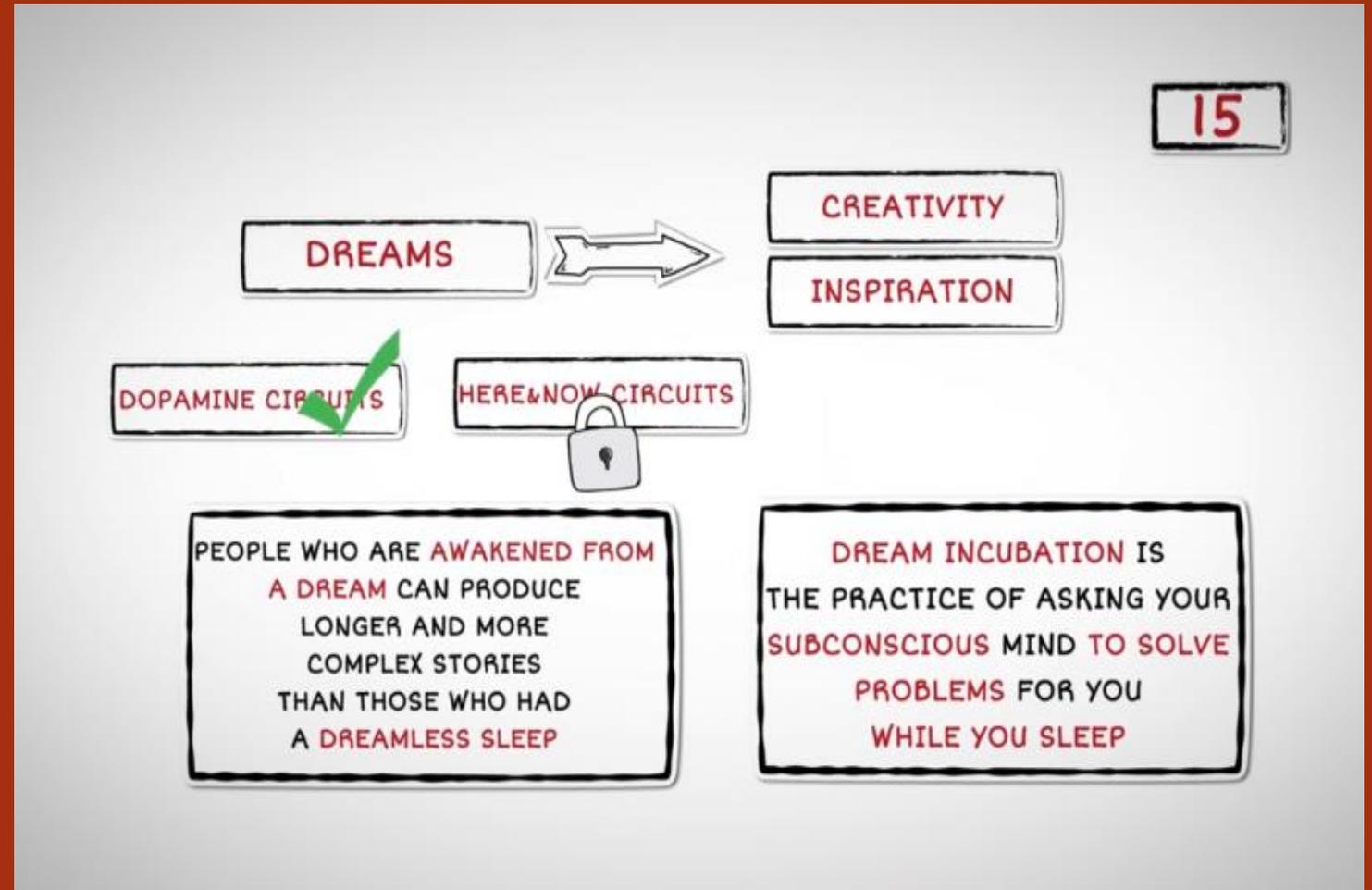
Dopamine used well: Fix on the target and ignore the distractions

CHARLES DARWIN

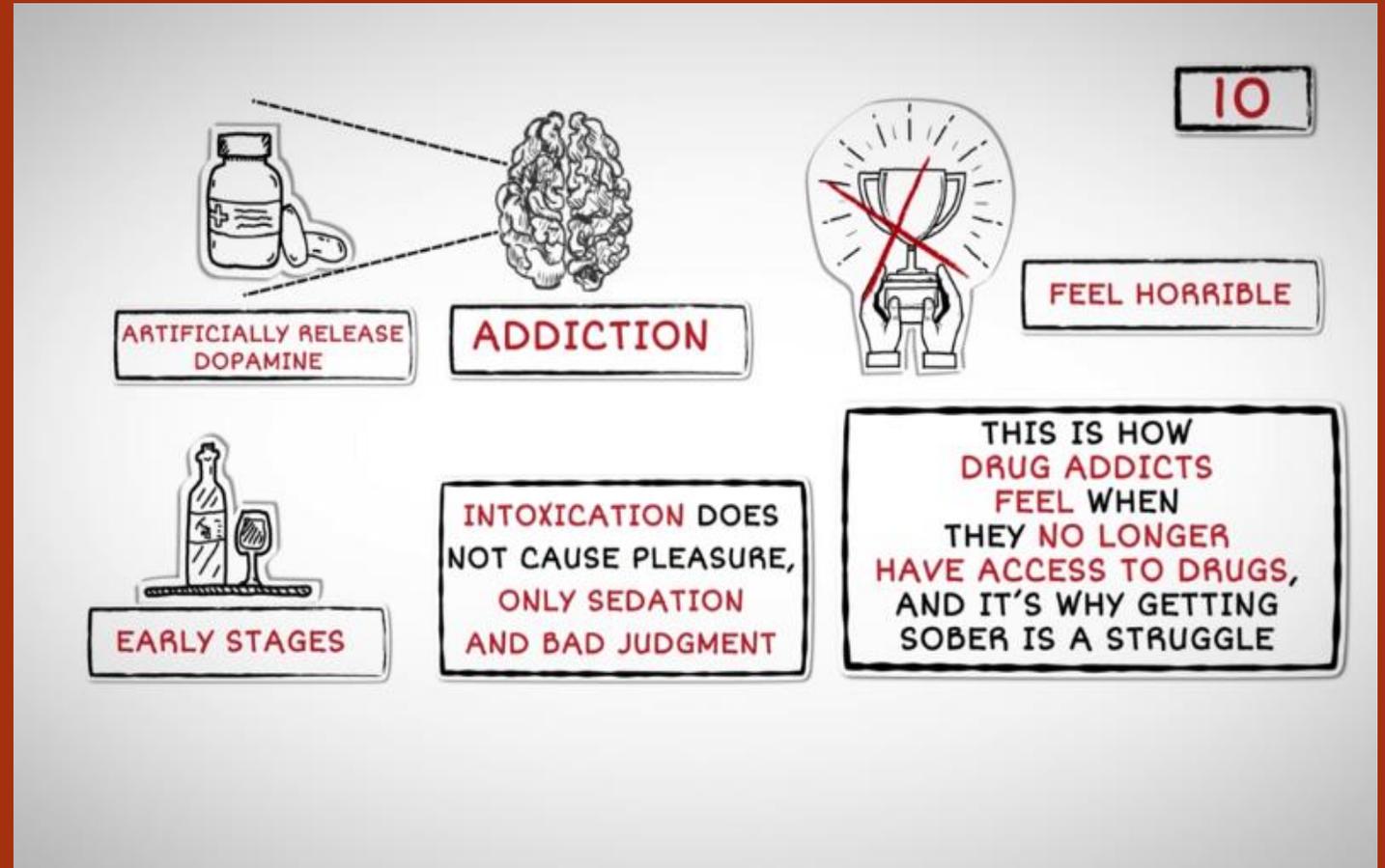
ONLY THE STRONGEST AND MOST ADAPTABLE ORGANISMS SURVIVE LONG ENOUGH TO REPRODUCE. OFTEN, IT IS THOSE WITH HIGH DOPAMINE WHO FIND IT EASIEST TO ADAPT



Dopamine used
well:
Creativity and
Inspiration

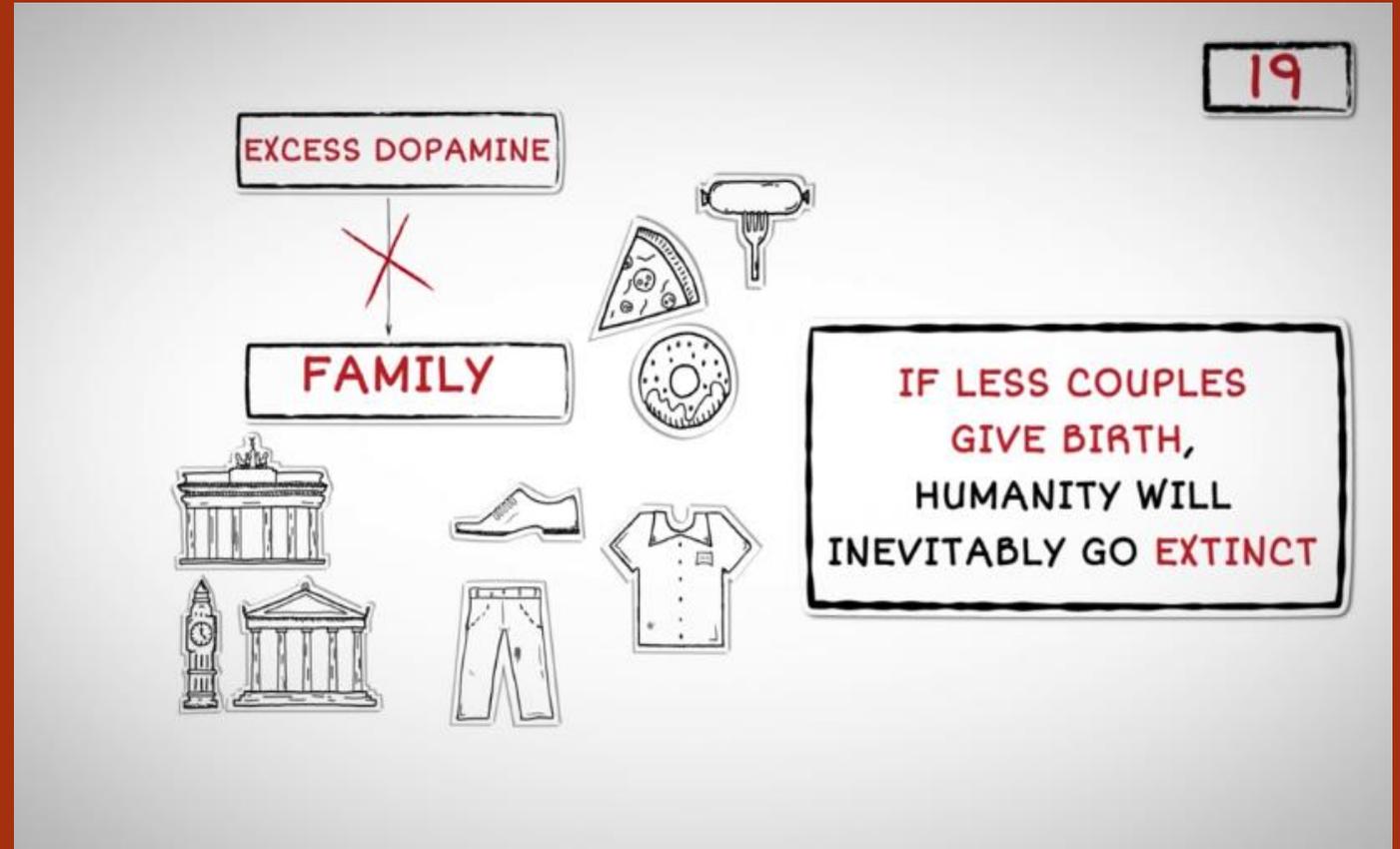


Dopamine when used poorly can lead to **escalation** and then ultimately **addiction**



Too much dopamine and too little Here & Now Chemicals are **anti-family/procreation.**

You get the goal but arrive there **alone!**



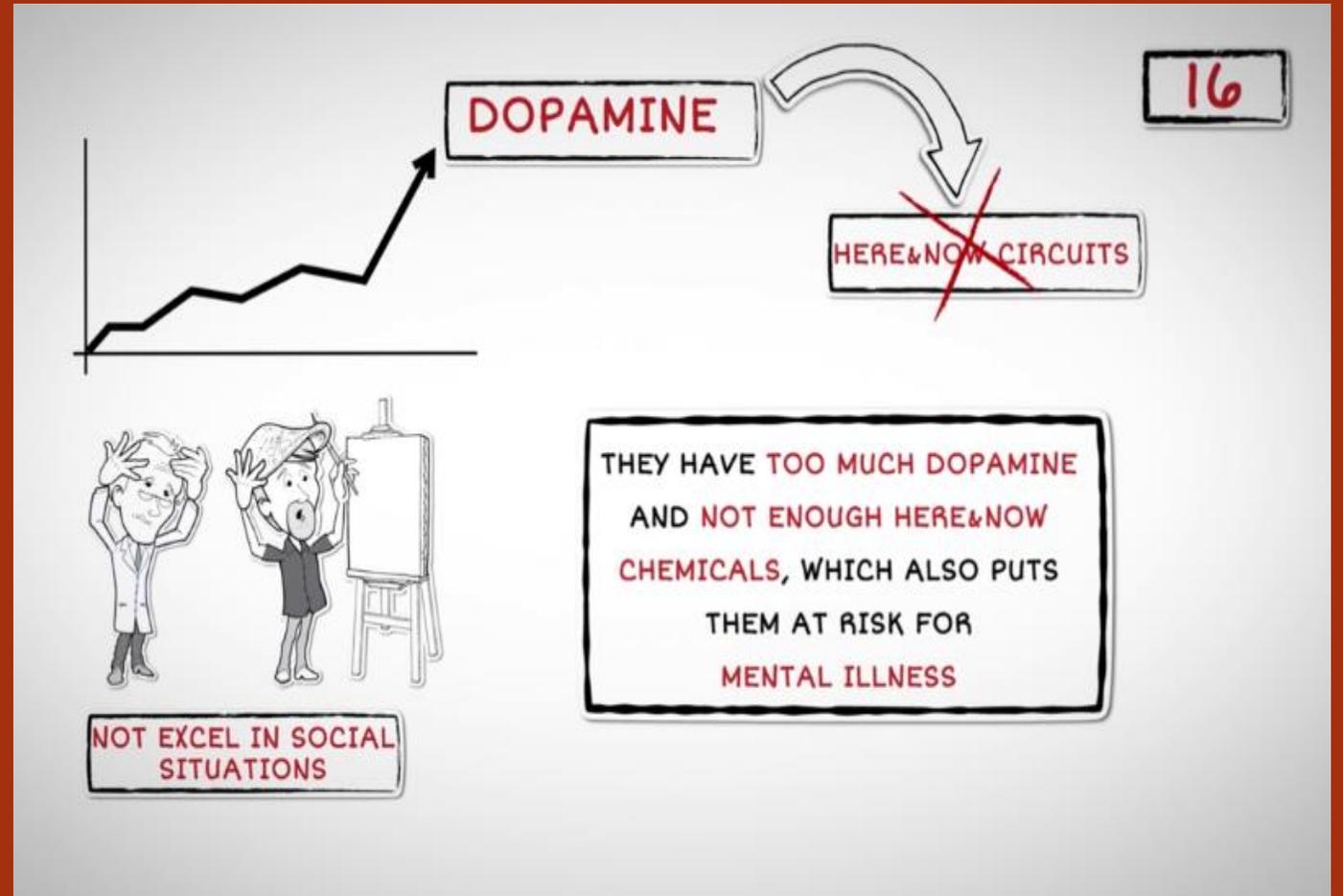
Dopaminergic **Desire** and **Control** Circuits



There are two main dopaminergic circuits:

- ▶ **The dopamine desire circuit** (meso-limbic circuit) moves us toward more **immediate future targets**.
- ▶ **The dopamine control circuit** (meso-cortical-limbic) allows us to use the prefrontal cortex to apply the **brakes** if needed and evaluate the **cost-benefit** of moving toward the desired reward.

Excess Dopaminergic
Circuits and too little
Here & Now Circuits
cause problems for
us **emotionally**



When dopamine and here and now chemicals are **in balance**, our lives will be balanced, and we can enjoy **peace**

THE ONLY WAY TO **SAVE OURSELVES**
IS TO **OVERCOME OUR OBSESSION**
WITH **EXCESS** AND **LEARN TO**
BE GRATEFUL FOR WHAT WE HAVE



In conclusion

So, let's choose to balance this amazing dopamine resource so we can "live long and prosper."

