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# The Animal Origins of Dopamine, Serotonin, Oxytocin and Endorphin, and Implications for Human Wellbeing

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## Abstract

*The brain chemicals that make us feel good are inherited from earlier animals. They reward an animal with a good feeling when it sees a way to promote its survival. The function of dopamine, serotonin, oxytocin and endorphin in animals illuminates the feelings they produce in humans. Our reward chemicals evolved to do a job, not to flow all the time for no reason. Each spurt is soon metabolized and an organism has to do more to get more. Realistic expectations can improve self-acceptance and wellbeing. A more complete explanation is in my book, Habits of a Happy Brain: Retrain your brain to boost your serotonin, dopamine, dxytocin and endorphin levels.*

*Natural selection built a brain that rewards you with a good feeling when you do something good for your survival. The good feelings of dopamine, serotonin, oxytocin and endorphin turn on when that promotes survival action. This is may not seem true in daily life because the mammal brain defines survival in a quirky way. It cares about the survival of your genes, and it relies on neural pathways built in youth. The motivations produced by our reward chemicals are hard to make sense of until you know how they work in animals. Here is a brief introduction to each chemical's job in the state of nature. The conclusion addresses the quirky neural pathways that stimulate them in modern life.*

## Dopamine

A hungry lion would starve to death if it ran after every gazelle it saw. It has to save its energy for a good opportunity in order to prevail. Dopamine is the brain's signal that a reward is expected. When a lion sees a gazelle it can catch, its dopamine surges, which releases its reserve tank of energy. Dopamine motivates an investment of energy in anticipation of a reward. A dopamine surge builds a pathway that turns on more of the good feelings in similar future circumstances.

Our ancestors had to forage to survive. They scanned constantly for opportunities to meet their needs. When they saw something promising, dopamine was released. The good feeling motivated approach, and each step triggered more if the reward appeared closer. A reward bigger than expected triggered even more. The dopamine paved neural pathways that helped them meet their needs in the future.

Dopamine creates the excitement you feel when you anticipate a reward. The good feeling motivates you to scan for opportunity and helps you invest the energy it takes to step toward it.

The foraging role of dopamine is widely overlooked in today's world, for many reasons. First, we are used to hearing about dopamine in the context of disease. Second, romanticized notions about joy and nature make it hard to acknowledge our natural urge to seek rewards. Finally, once basic needs are met, we seek rewards that do not seem to promote survival. We seek social rewards, with pathways built in youth. Serotonin and oxytocin create the good feeling of social rewards, but dopamine alerts you to opportunities and initiates action.

Once you get what you need, the dopamine stops and you have to do more to get more. Dopamine motivated survival action in a harsh world by making it feel good.

## Oxytocin

Oxytocin is the safe feeling of social support. A hungry gazelle longs for greener pastures, but if it strays too far from the herd, it is quickly eliminated from the gene pool. Natural selection built a brain that rewards a mammal with the good feeling of oxytocin when it finds safety in numbers. Even lions seek safety in numbers because hyenas steal their kill when they're isolated.

A mammal can lower its guard a bit in the safety of its group. Oxytocin produces this relaxed sense of safety. We humans call it "trust."

Oxytocin stimulates labor and lactation, so every mammal is born into a surge of oxytocin. Neurons connect when oxytocin flows, which wires a mammal to release it in similar future situations. This wires a young mammal to eventually transfer its attachment from its mother to its herd or pack or troop.

A herd only promotes survival if you run when your herd mates run. We humans hate the idea of being a herd follower, but a gazelle would not last long if it insisted on seeing the lion for itself. It survives by trusting the judgment of its herd mates. We have inherited a brain that feels safe when among those we trust. You may long to explore greener pasture, but when you are separated from the herd, your oxytocin falls and you feel as threatened as an isolated gazelle.

Touch stimulates oxytocin. Primates stimulate it by grooming each other's fur. But an individual close enough to touch you is close enough to bite you. The mammal brain is designed to make careful decisions about who to trust rather than just release it all the time.

Life in a herd is not all warm and fuzzy. There is plenty of conflict in a mammalian social group. Individuals disperse to reduce conflict when predator threat is low. But when predators lurk, mammals seek social trust in ways that fit their oxytocin past. Common enemies are the social glue of the mammal world.

Oxytocin is often romanticized as the "bonding chemical" or the "love hormone." We imagine animals sticking together in the "got your back" way that we long for. But a gazelle seeks a herd to save itself, even as it puts others at risk. Realistic expectations about oxytocin can help us enjoy the trust we have instead of judging it against an ideal that doesn't exist.

## Serotonin

When two monkeys see the same banana, one of them withdraws and the other goes for it. Animals avoid conflict by constantly comparing themselves to others, and restraining assertions near stronger individuals. When an individual see that it's in the position of weakness, cortisol is released, which motivates a retreat to avoid pain. When an individual sees itself in the position of strength, serotonin is released and it asserts itself. Serotonin is not aggression. It is the nice calm feeling of being in a position where you can safely meet your needs.

In the state of nature, some individuals make a lot of copies of their genes while others make none at all. We are descended from those who did what it took to keep their genes alive. Natural selection built a brain that rewards you with a good feeling when you assert and prevail. Serotonin is that feeling.

A mammal who asserted all the time would soon come to harm. The brain built by natural selection makes careful decisions about when to assert. Social comparison is effectively more primal than food for sex because it always comes first. You only get the serotonin when you come out on top in your own estimation. It would be nice to have this good feeling all the time, but your brain saves it for when it actually promotes survival.

Mammals avoid violence in an interesting way. When two individuals meet, the mammal who sees itself to be in the position of strength makes a dominance gesture that is understood by that species. The other individual can either respond with a submission gesture, or risk a conflict. Animals only fight when they expect to win. Most of the time, one individual submits. The dominant individual enjoys a moment of serotonin, which makes it feel calm rather than aggressive. It may even share resources and protect the weak. But it expects submission, and gets it, until one day it doesn't.

The serotonin facts of life make us uncomfortable. Ethologists described these dynamics decades ago, but the information has been ignored. Yet humans have lived alongside animals and observed their dominance struggles for millennia. The facts are easily available to anyone who wants to understand our natural impulses. The point is not that we should dominate others to feel good. The point is that we create social comparison in our own minds. We cause our own suffering when we believe we are weak, and we can relieve our suffering by changing that belief. Of course it is better not to compare yourself to others at all, but your mammal brain does it anyway. You will think it is imposed on you until you see how you are doing it yourself.

Female animals seek social advantage as urgently as males do, with behaviors effective for promoting a female's genes. Mammals invest most of their energy in the quest for serotonin as soon as they are safe from hunger and predation.

Neurons connect when serotonin flows, which wires a mammal to expect the good feeling in ways that worked before. The mammal brain generates social expectations from its own lived experience. It responds to those around it from moment to moment. It does not construct abstractions about the way things are. It doesn't have enough neurons to do that.

The big human cortex constructs generalizations about our social impulses. We have dozens of words to describe the mammalian urge for the one-up position, such as pride, ego, status, confidence, competitiveness, getting respect, attention or recognition, feeling special, important or appreciated. Harsh words come to mind when our rivals seek social advantage, but when we seek it ourselves, we feel like we are just trying to survive.

The natural urge for serotonin explains many of the frustrations of daily life. Small perceived slights often feel like survival threats because losing the one-up position is a survival threat in the state of nature. The mammal brain's quest for serotonin creates a sense of urgency about the minutiae of social interactions. Many people have the impression that others are on the serotonin fast track and they are somehow deprived. It helps to recognize that serotonin is a challenge for everyone. The monkey who is stronger in one moment endures more challenges. Usually it is on the "live fast and die young" track. No one has a royal road to serotonin.

## Endorphin

Physical pain triggers endorphin. It evolved to help an injured animal do what it takes to survive. A gazelle can run while a lion is hanging from its flesh because endorphin masks pain. A caveman with a broken leg could seek help thanks to endorphin. Our endogenous morphine masks pain with a euphoric feeling for a few minutes. After that, we are designed to feel pain because the information is essential to protect injuries.

We are not designed to inflict pain on ourselves to enjoy the endorphin. That would be a very bad survival strategy. Alas, people are tempted to chase it. Runner's high is a familiar example. Runners do not trigger endorphin every time they run. They only get it when they run to the point of pain. As the body habituates, it takes more and more pain. This strategy is tragically unsustainable. We did not evolve to seek endorphin. We are meant to seek dopamine, serotonin, and oxytocin, and save endorphin for emergencies.

Fortunately, you get a small bit of endorphin when you move your body in new ways. Laughing triggers a bit of endorphin as it jiggles your innards. Exercise triggers a bit of it too. We can be satisfied with small endorphin rewards instead of pursuing big highs with harmful consequences. And of course we need to exercise with or without the endorphin high.

## Individual Wellbeing

Our happy chemicals are not designed to surge all the time. They evolved to do a job. They dip after they spurt. Realistic expectations help a person build trust in their own wellbeing instead of feeling threatened by nature's ups and downs.

It helps to know why our happy chemicals dip. For example, an elephant on a long trek to a waterhole is motivated by dopamine, but once it has drunk its fill, the dopamine stops. The brain quickly habituates to the rewards it has, and it takes an unmet need to stimulate dopamine. If you were thirsty in a desert, your dopamine would surge at the sight of an oasis, but when you have unlimited running water, it does not make you happy. If you bite into the best brownie you've ever had, your dopamine surges, but the next time you have it, it's no longer the best you've ever had. Without new information, there's no new dopamine. You can end up disappointed a lot. Or you can make peace with your dopamine dips by understanding the survival value of habituation.

Oxytocin also dips after it spurts. A lost gazelle surges with oxytocin when it finds its way back to the troop. But the great feeling doesn't last. A gazelle would be in trouble if it expected that feeling all the time and left its herd in pursuit of it. We enjoy an oxytocin surge when we find a new source of acceptance and belonging; but once you have it, it is not meeting an unmet need. The surge ends. It's good be grateful for what you have, but it helps to know why your brain doesn't work that way. Instead of being irate about the lack of trust around you, you can learn to understand your own oxytocin dip.

Serotonin dips and surges as well. A monkey who rises in stature among its troop mates faces continual challenges. It is never just coasting on a river of effortless serotonin. When you find a new way to be special, you enjoy some serotonin, but you soon take that new position for granted. You think you will be happy every minute if you get that dream job, but when you succeed, your brain is surprisingly focused on the next way to promote your survival.

We define rewards with neural pathways built from experience. Whatever triggered your dopamine before built a pathway that tells you to expect more of the good feeling when you see something similar. Whatever triggered your serotonin before carved the pathways that shape your social comparisons today. Your past oxytocin paved a pathway that tells you who to trust today. The pathways you built before age eight and during puberty became the superhighways of your brain because myelin peaks in those years. Repetition builds pathways too, so whatever happened to you repeatedly and emotionally in youth built the myelinated pathways that guide you today.

No one has perfect pathways. No one has an effortless flow of reward chemicals. These good feelings evolved to do a job, not to make you feel good all the time. An elephant can find a waterhole in a drought because the joy of finding it in the last drought built such a big pathway. But the elephant does not expect to feel that joy every time it goes to the waterhole. A lion can catch prey that runs very fast because it got wired by the joy of prior successes. But a lion does not expect to feel that joy all the time. Nor does it tell itself that other lions are getting it all the time.

Humans have enough neurons to generate abstractions. We can imagine feelings we think we should have, and mourn their absence. When we do this, we can remind ourselves that our brain is inherited from survivors. This may sound obvious, but survival rates are low in the state of nature, yet your ancestors did what it took to keep their genes alive, going all the way back. It's a miracle when you think about it. Our brain evolved to promote survival, not to make you happy every minute. We can celebrate this brain we've inherited instead of making unrealistic demands on it.