Success from the biological standpoint

We Want Pleasure

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Dr. Ewelina Knapska, head of the Laboratory of Emotions Neurobiology at the Nencki Institute, tells us about why our brains strive for success and how humans differ from animals in this regard

Academia: Is success a sociological-psychological phenomenon, or does it also have neurobiological underpinnings?

Ewelina Knapska: *The drive for success is to a certain extent based on the reward system. Attaining certain objectives gives us pleasure. Under laboratory conditions, animals seek reward in the form of sugar water or attractive food. In people, goals and the motivation to achieve them are very complex. The reward system nevertheless operates in both cases.*

What is the reward system?

A group of structures in the brain. Its bounds are not strictly fixed because more and more structures are turning out to be linked into it, with their neurons also participating in controlling positive reactions or the learning of positively-motivated reactions. Reactions to pleasant events to a large extent involve the secretion of dopamine in the brain, which is a crucial neurotransmitter in reward-related tasks.

Research on the reward system began with the work of James Olds and Peter Milner, who in 1953 came up with the idea of implanting rats with an electrode in the pleasure region of the brain. The animals could stimulate the region by pressing a lever in their cage. They discovered that such stimulation can be so enticing that the rats forgot about eating, drinking, and everything else – all they did was constantly press the lever, because it most evidently gave them pleasure.

On that basis, can we conclude that the drive for success is not exceptional in people, that it also occurs in mammals and other animals?

The drive to attain rewards definitely has an adaptive significance. The only question is how we define reward and success.

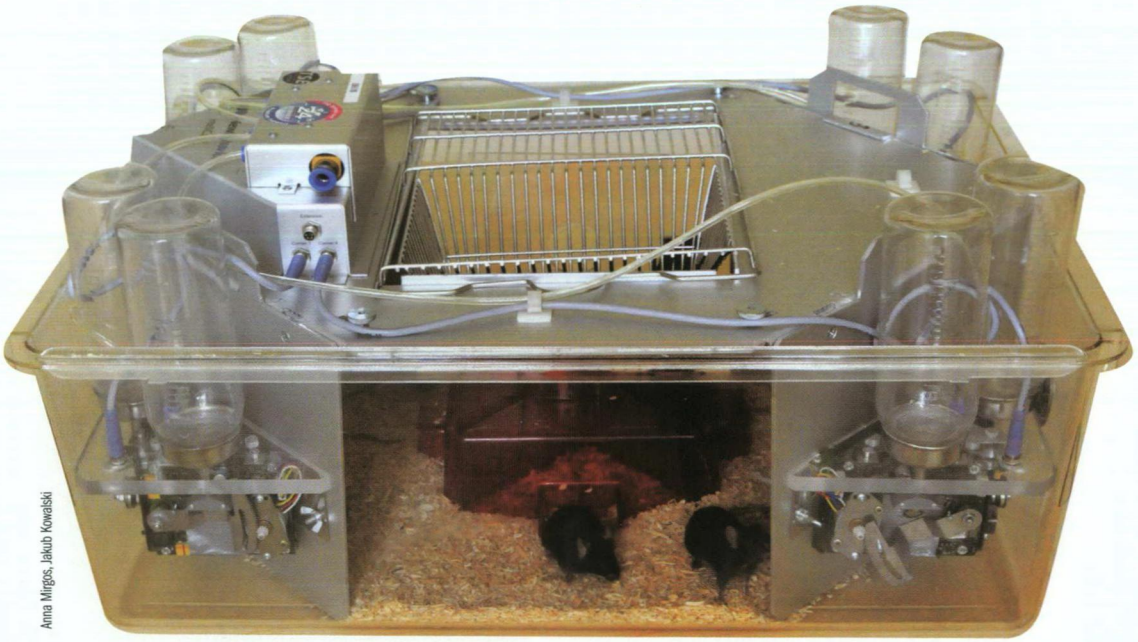
In my lab we work with animals, and assume a certain evolutionary continuity. A mouse or a rat may strive to obtain food or a sexual partner, whereas people have higher, more complicated objectives, such as social advancement. But the biological foundations and related brain mechanisms are to a certain extent the same in both cases.

For animals, does a reward always have to be of a material nature (such as tasty food), or are there observations that suggest that for certain species a "reward" can mean something more?

Yes, such as in the case of rodents, which are quite simple from the social standpoint when compared for instance to the primates. Classic studies showed that we can create what is known as second-order conditioning. Here we first need to cause an animal to associate the receipt of a material reward, such as food, with a certain stimulus, such as a sound. Later, in the next stage of conditioning, we use the sound to encourage the animal to perform a different task. The animal will turn out to eagerly press a lever just to hear the sound, even though it is no longer accompanied by any material reward in the form of food.

One can imagine this being developed into a long series of conditionings, although in rodents this cannot be continued indefinitely. Mice and rats will realize at a certain point that we are deceiving them somewhat, because they are not actually receiving any attractive reward. But generally, the more complex the organism, the easier it is to create multi-level conditioning, in other words we can learn successive reactions by linking them to something we learned previously and gave us pleasure. Then the stimulus that triggers pleasure does not have to be material.

Let's go back to people for a moment. Can we imagine that during the course of evolution the rewards were first quite straightforward



Anna Mirgos, Jakub Kowalski

An "intellicage" equipped with electronic devices that automatically keep track of animal behavior. It can be used to reward an animal with access to sugar water

as society developed, more abstract rewards appeared (for instance higher status within the group) but were still linked to simple, material ones? That could explain why success, which after all has a social context, gives us pleasure.

Things are of course quite complex. Achieving success in today's world also requires a few other predispositions. Most organisms, for example, feel a need to explore their environment, to seek out new stimuli. This enables them to know their environment better, and therefore to shape it. Such a drive is one of the traits that make up personalities, which greatly differ both among animals and among people.

Looking at people from the psychological standpoint (in this respect our knowledge about animals is significantly poorer), we can characterize these personality differences. Some people strive for success, for a successful career, whereas others feel less need in this regard. This is linked not only to their intellectual predispositions, but also their motivation to achieve success. We assume, however, that stimulation of the reward system is pleasant for everyone.

Dr. Ewelina Knapska studied biology and psychology at Warsaw University, and earned her PhD in neurobiology from the Nencki Institute of Experimental Biology, Polish Academy of Sciences. She spent two years as a post-doc at the University of Michigan, then received her DSc (*habilitation*) degree in 2013. She has won grants and stipends from the Foundation for Polish Science, the Polish Ministry of Science and Higher Education, and Academia Europaea. This year she won the Polish Prime Minister's Prize for her habilitation work. She studies the neurobiological foundations of emotions. In particular, she tries to describe the cellular mechanisms involved in social transmission of emotions, reward-motivated learning, and fear suppression in rodents, using both advanced molecular biology techniques and methods of non-invasive observation of animal behavior

So what happens if stimulation of the reward system stops working? Are there known illnesses related to disturbances of the reward system?

The main disturbance of the reward system, the easiest one to observe, is addiction. When addiction occurs, the reward system starts to react differently. This is due to physical changes that occur in the brain, the more addictive substances are taken. But certain individuals are more addiction-prone than others, and on this basis we can presume that there exist certain predispositions in this respect, which then interact with environmental factors. As a result, one person's whole nervous system may be more susceptible to addictive substances, another's less so. Of course these are changes of a pathological nature, because changes in the reward system leave us dependent on a particular substance, and that starts to complicate our life.

Can we try to explain in similar terms the strong drive for success seen in certain individuals? Perhaps their reward system functions differently than in most other people? Of course we are mixing biology and psychology here...

That is indeed a question near the borderline of psychology, but we can still answer it affirmatively. Although first we have to remember that due to upbringing or environmental pressure, certain people feel a greater need to achieve success than others. Apart from this, success is a cultural issue – there are a civilizations or cultures out there that did not develop the concept of success as we understand it. Yet they still function somehow, although they presumably have different value systems. A lot therefore depends on how we define success. ■

Inteview by **Agnieszka Kloch**