The Science of Opioid Addiction

First published 2007

Opioids such as Vicodin and OxyContin are medications often prescribed because of their pain-relieving properties. Used as prescribed by a doctor, these drugs can safely change the way a person experiences pain. Opioids work by attaching to specific proteins called opioid *receptors* that are found in the brain, spinal cord, and gastrointestinal tract. Opioids relieve pain by triggering excess flow of certain neurotransmitters such as *dopamine*. Yet, when opioids are abused, serious health risks, including overdose and death, can occur.

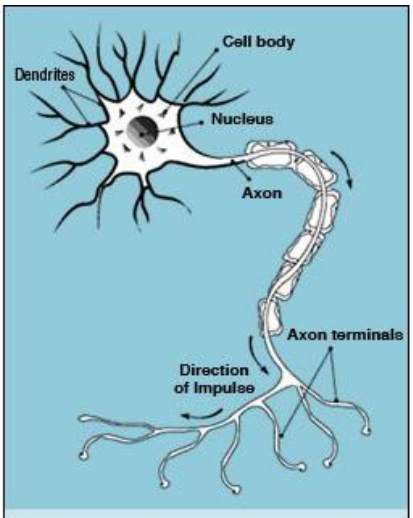

Figure 1. Neurons: Building Blocks of the Brain
The brain is made up of billions of nerve cells, also known as **neurons**. Neurons communicate with other neurons through a process known as neurotransmission.

To understand opioid abuse, it's helpful to understand some fundamentals of how brain cells interact with each other. First, the brain is made up of billions of nerve cells, also known as**neurons** (Figure 1). Typically, a neuron contains three important parts: a central **cell body** that directs all activities of the neuron; **dendrites**, short fibers that receive messages from other neurons and relay them to the cell body; and an**axon**, a long single fiber that transmits messages from the cell body to the dendrites of other neurons or to body tissues, such as muscles.

The communication of a message from the axon of one nerve cell to the dendrites of another is known as **neurotransmission** (Figure 2). Communication between nerve cells occurs mainly through the release of chemical messengers into the space between an axon and a dendrite; this space is called a **synapse**. Molecules called **neurotransmitters** are released from the axon of one neuron to molecules called **receptors** in the dendrites of another neuron.

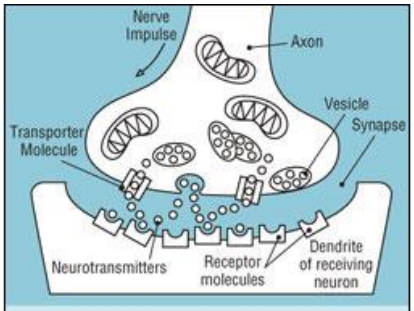

Figure 2. Neurotransmission: How Neurons Communicate with Each Other
The communication of a message from one nerve cell to another is known as **neurotransmission**. Opioids relieve pain by triggering excess flow of certain neurotransmitters such as dopamine. When opioids are not used exactly as prescribed, serious health risks and even death can occur.

Opioids, as stated above, trigger excess flow of the neurotransmitter dopamine, which leads to the relief of pain. When used as directed by a physician, opioids are designed to deliver pain relief little by little, over a 12-hour period. However, when abused, such as by crushing or chewing the pills, taking them with alcohol, or using them without a physician's prescription, opioids can flood the brain with dopamine—and the risk of overdose becomes very great.

Abuse of an opioid can produce drowsiness, cause constipation, and, depending upon the amount taken, depress breathing. Taking a large single dose can cause severe respiratory depression or death. Long-term use also can lead to *physical dependence*: The body adapts to the presence of the substance, and withdrawal symptoms occur if use is reduced abruptly. Long-term use can also result in *tolerance*, which means that higher doses of a medication must be taken to obtain the same initial effects.

Note that physical dependence is not the same as addiction—physical dependence can occur even with appropriate long-term use of opioids and other medications. *Drug addiction* is defined as compulsive, often uncontrollable drug use in spite of negative consequences, and is the result of changes in brain function.

Learn more about the science of drug addiction.

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Sources

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