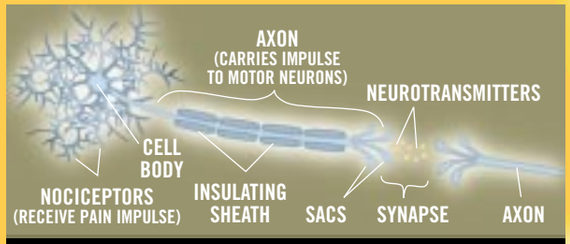
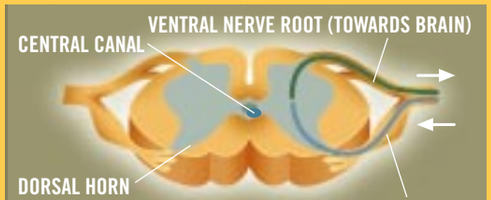
Pain's pathway and the drugs that block it

Defining Pain

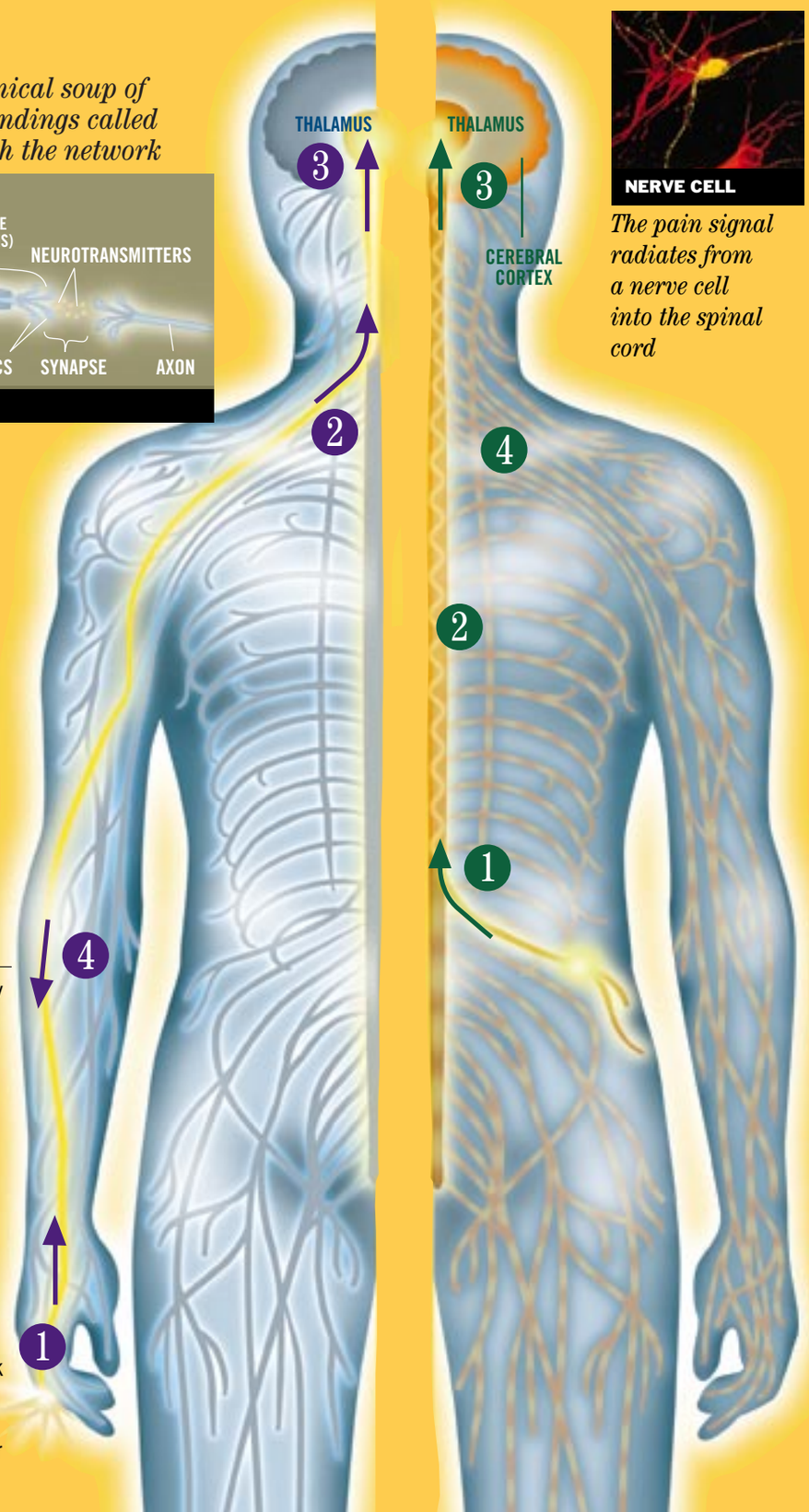
The pain sensation originates as a chemical soup of signals emitted by pain-sensing nerve endings called nociceptors. These signals travel through the network of peripheral nerves that run throughout the body to the central nervous system, the brain, and spinal cord. There they gather in the dorsal horn, a site in the spinal cord that acts as a clearinghouse for pain messages. The signals are transmitted into the brain's thalamus, which sorts them and passes them on to the cerebral cortex, where the pain is actually "felt."



NOCICEPTORS



DORSAL HORN



NERVE CELL

The pain signal radiates from a nerve cell into the spinal cord

ACUTE PAIN

Sharp, immediate pain comes from an injury to tissue but can also be triggered by bodily malfunction or severe illness.

1. Nociceptors in the peripheral nerves sense the injury and in response, release chemical messengers.
2. The messengers travel through superfast nerve conduits to the spinal cord, where...
3. ... they are passed directly to the thalamus and into the cerebral cortex.
4. The brain precisely identifies the site of the injury and sends a message back down the spinal column telling the muscles to contract and block the pain. The process can take place in the instant that your finger touches a hot stove and pulls away.

PAIN SNIPERS

The newest analgesics are far more specific than aspirin or narcotics, taking aim only at certain pain-causing cellular mechanisms.

ACTIQ **Anesta**

A crystallized narcotic on a stick, approved in November, that offers quick relief for breakthrough cancer pain.

CELEBREX, VIOXX **Monsanto, Merck**

Arthritis treatments just reaching the market that block pain and inflammation without the stomach-damaging effects of aspirin-like drugs.

NEURONTIN **Warner-Lambert**

An epilepsy drug in clinical trials for chronic neuropathic pain. It targets a neurotransmitter that controls both pain and nerve excitability.

ZICONOTIDE **Neurex**

Based on the venom of a sea snail, it blocks pain signals from entering the spinal cord. Neurex will file for FDA approval this year.

MORPHIDEX **Algos Pharmaceutical**

By blocking secondary pain sensors, the drug allows morphine to be twice as effective without increasing side effects. Algos filed for FDA approval in August.

ABT-594 **Abbott Laboratories**

Based on a toxin in the skin of a rainforest frog, it prevents the central nervous system from processing pain signals. In early human trials.

CHRONIC PAIN

Persistent, debilitating pain, such as that from a bad back or diseases of the nerves themselves, takes a more circuitous route.

1. Pain signals enter the dorsal horn of the spinal cord...
2. ... and transfer back and forth between interconnected nerves that modulate the pain message as it travels up the spinal cord...
3. ...to the cerebral cortex, which assesses the damage and adjusts emotions and other bodily functions, such as breathing.
4. This slower pathway creates duller, more persistent pain. If the pain persists, the entire nervous system may be reprogrammed to create a lower threshold for pain.

PHOTOGRAPHS BY (NERVE CELL) PATRICK MANTYH; (SNAIL) NORBERT WU/PETER ARNOLD; (FROG) MARION BACON/ANIMALS ANIMALS