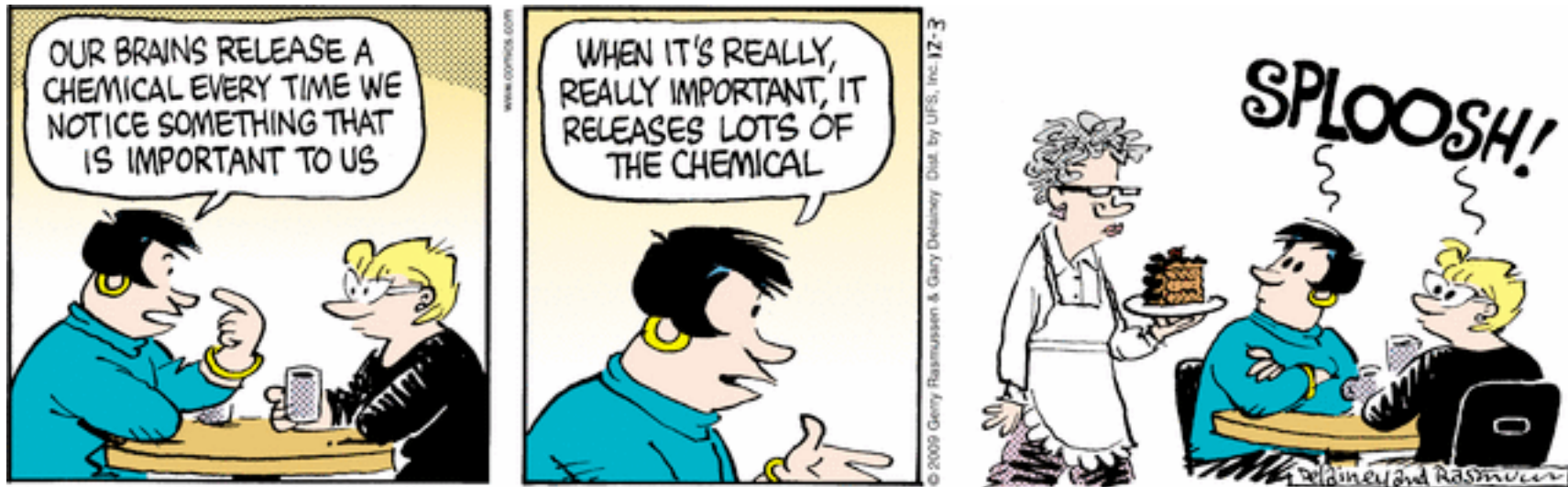


# Brain Chemicals in Action



Wikipedia, in massive understatement, informs us that “Brains can be extremely complex. The cerebral cortex of the human brain contains roughly 15–33 billion neurons depending on gender and age, linked with up to 10,000 synaptic connections each. Each cubic millimeter of cerebral cortex contains roughly one billion synapses.”

These neurons are activated and influenced by a variety of chemical neurotransmitters. Here are some of the biggies:

- **Blood.** Listed here to emphasize that it does not influence the brain. In fact, bad things happen if blood crosses the blood-brain barrier and starts contaminating the working environment.
- **Glutamate.** Excites neurons (stimulates electrical activity).
- **Gamma-aminobutyric acid (GABA).** Inhibits excitation.
- **Serotonin.** Regulates mood, appetite, sleep, muscle contraction, and some cognitive functions including memory and learning. The primary target of antidepressant drugs and many dietary aids, it comes from a small brainstem area called the Raphe nuclei.
- **Epinephrine.** Better known as adrenaline, it's what sets your heart a-pumpin', your

blood vessels to contracting, and your eyes and throat to open wide in the fight-or-flight response to startling stimuli. It's produced by the adrenal glands.

- **Norepinephrine.** Involved in arousal, it comes from a small area, near the Raphe nuclei, called the locus ceruleus.
- **Histamine.** The chemical that antihistamines suppress, promoting sedation, it comes from a tiny part of the hypothalamus called the tuberomammillary nucleus. In the brain it regulates sleep and wakefulness. Elsewhere in the body it's involved in the inflammatory or allergic response, including vasodilation, bronchoconstriction, bronchial smooth muscle contraction, and pain and itching due to insect stings.
- **Acetylcholine.** The 1st neurotransmitter identified, it's produced by the vagus nerve. It modulates plasticity, arousal, reward, alertness of sensory perceptions, memory fixation, and the ability to sustain attention.
- **Dopamine.** It has many brain functions, including important roles in behavior and cognition, voluntary movement, motivation and reward, sleep, mood, attention, and learning. Its predecessor, L-DOPA, can cross the blood-brain barrier.