

## Brain's choices rely on chemistry for currency

12/23/2002

By [TOM SIEGFRIED](#) / The Dallas Morning News

It's no mystery why economics is called the dismal science.

With most sciences, experts make pretty accurate predictions. Mix two known chemicals, and a chemist can tell you ahead of time what you'll get. Ask an astronomer when the next solar eclipse will be, and you'll get the day, time and best viewing locations, even if it won't occur for years.

But mix people with money, and you generally get madness. And no economist really has any idea when you'll see the next total eclipse of the stock market.

Still, economists produce endless prognostications of how people will spend or invest, how they'll weigh risks and costs to maximize their returns. Supposedly, those economists will tell you, people choose economic actions based on rational assessments of self-interest. Whereas in fact, all noneconomists (and even many economists) know that people often have no idea what their self-interest is, and even if they do, still waste money in all sorts of silly ways.

So maybe economists should seek some help from scientists who study how people decide what to do. Economics needs neuroscience. It's the brain, after all, that dictates how its owner behaves. And practitioners of a fuzzy new field called neural economics have begun to link the brain's inner workings to the economic decisions that drive the economy.

Understanding economics, then, really means understanding how people make decisions of any sort. Mexican food tonight, or Italian? Go to work today, or stay home? Cable modem or DSL? *Sopranos* or *Sunday Night Football*?

Such decisions aren't always deliberated consciously. All creatures must continually make snap judgments to choose from many competing possible actions, note neuroscientists P. Read Montague and Gregory Berns: "Do I chase this new prey or do I continue nibbling on my last kill? . . . Do I run from the possible predator that I see in the bushes or the one that I hear? Do I chase that potential mate or do I wait around for something better?"

But there's no simple way for an animal to compare its needs for food, safety and sex. Brains must add up all the considerations and compute a course of action to enhance the odds of survival, using some value scale for comparing different choices. In other words, not only do people have money on the brain, the neural equivalent of money operates within the brain.

Just as money replaced the barter system – providing a common currency for comparing various goods and services – nerve cell circuitry evolved to translate diverse choices into the common currency of brain chemistry, theorize Drs. Montague (of Baylor College of Medicine) and Berns (of Emory University in Atlanta).

In fact, experiments on animals and brain scans of humans reveal just the sort of nerve cell activity that such a theory suggests, the scientists write in a recent issue of the journal *Neuron*.

A circuit of activity linking two parts of the brain – one at the front, behind the forehead and another deep in the brain's middle – helps govern choicemaking by producing more or less of the chemical dopamine, various findings indicate. Presumably the brain predicts rewards for future choices using the dopamine system as a currency for comparison.

Dopamine is widely known as a pleasure molecule, linked to behavior that produces pleasant feelings. But it's not merely pleasure that drives dopamine production. Actually, the brain's dopamine currency seems tuned to the *expectation* of pleasure (or reward of some sort).

Some of the dopamine cells are programmed to monitor the difference between expected and actual reward. If a choice produces precisely the predicted reward, the dopamine nerve cells maintain a constant level of activity. But if the pleasure exceeds expectations, the cells squirt out dopamine like crazy. (They cut back if the reward is disappointing.) This reward monitoring system also considers timing – if dinner is delayed, dopamine is diminished. In any case, the brain chooses actions based on the expectation of reward, and the monitoring system corrects the behavior when the anticipated rewards aren't realized.

Neural economics is just in its infancy, but it has already provided some insights. For one thing, brains are not all alike, so economic behavior can differ from person to person.

Drs. Montague and Berns report on an experiment where people choose A or B on a screen and then watch as their "reward" rises or falls. The computer adjusts the rewards as the game goes on, based on the player's choices. At first, choosing A pays more, but choosing A too often will make B a better bet.

Some players notice the drop in reward from A quickly and switch to B. But others stick with A, gambling that it will return to its previous rate of payoff. Some brains, in other words, seem designed to take risks. And brain scans during other experiments show that risk takers exhibit higher activity in a small clump of nerve cells called the nucleus accumbens.

"Neuroimaging results in humans may well forge a connection between neural responses and direct measures of economic behavior," Drs. Montague and Berns write.

So someday, perhaps, people will want to see an MRI of their banker's brain before depositing their money.

---

Online at: <http://www.dallasnews.com/health/columnists/tsiegfried/stories/122302dnlivtomcol.13a56.html>