serotonin is thought to play an inhibitory role." Ricuarte reasons that if MDMA depletes the serotonin system in the human brain as it does in the monkey and rat brain, the removal of serotonin's influence might account for its disinhibiting effects in people.

Perhaps the most pressing scientific issues about MDMA concern its mechanisms of action. For example, why do people quickly develop a tolerance to the desirable effects of MDMA but not to the undesirable effects? Is there a relationship between the first- and second-day effects of MDMA in people and the toxicity evident 2 weeks after drug administration to animals? Is the toxicity permanent or can neurons recover? Is MDMA or a metabolite responsible for the observed effects in animals and people? And do the (+) and (−) isomers of MDMA, both of which are present in most preparations of the drug, differ in their biological effects?

As yet, researchers can only speculate about most of the answers. "The initial 'high' with MDMA is probably due to serotonin release," says Peroutka. He proposes that MDMA stimulates the release of serotonin from neurons, particularly those in the dorsal raphe. (A neighboring group of nerve cells in the median raphe nucleus also produces serotonin but is curiously unaffected by MDMA toxicity.) Under normal conditions, this initial depletion of serotonin from dorsal raphe neurons would be accompanied by reuptake of the transmitter into the terminal endings of the nerve cells that released it. Perhaps MDMA somehow alters the uptake process and the nerve cells remain depleted of serotonin.

As a result of Stanford's experience with MDMA use among its undergraduates, the university is planning an information program for its students. Because MDMA causes such specific neurological damage, researchers may use the drug as a tool with which to probe the function of serotonin in the brain, which is still not well understood. At this point, however, it does not seem likely that any clinical testing of the drug will be pursued. ■ DEBORAH M. BARNES

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Heart of Darkness

There is increasing evidence that the familiar Andromeda galaxy harbors an ultramassive black hole at its center—a behemoth more than ten times as big as the million-solar-mass hole thought to lurk in our own galactic core. A somewhat smaller hole also seems to reside within the tiny elliptical galaxy M32, which appears in the photograph here just below Andromeda's central bulge.

"Including our own galaxy that's three for three," says University of Michigan astronomer Douglas O. Richstone, who reviewed the evidence at the recent meeting of the American Astronomical Society in Austin, Texas. "So if you're an optimist, then you can believe that there is at least one black hole per galaxy." Furthermore, he says, if quasars and the highly active Seyfert galaxies really are powered by matter falling into ultramassive black holes, as theory suggests, "then maybe every galaxy was once a quasar or a Seyfert."

In essence, says Richstone, the argument is that the innermost stars in M31 and M32 are moving too fast to be gravitationally bound. So some huge, unseen mass at the center must be holding them in. This is not a new argument, of course. But recently a night of exceptionally good observing conditions gave Alan Dressler of the Mount Wilson and Las Campanas Observatories a chance to obtain some exceptionally high-quality data. By comparing those data with computer simulations, Richstone was then able to rule out alternative explanations and to obtain approximate masses for the black holes: 50 million solar masses for Andromeda and 5 million solar masses for M32. The Andromeda black hole is big enough that the galaxy may well have spent its adolescence as a Seyfert galaxy, he says. Conceivably it could have even been a modest-sized quasar. ■ M. MITCHELL WALDROP

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