how they respond to hormones or drugs, says Steve Chang, a psychologist at Yale University in New Haven, Connecticut. The neurohormone oxytocin, in particular, has been touted as a potential treatment for autism, because it seems to aid the formation of social bonds. For example, men playing the prisoner's dilemma are more likely to cooperate if they have breathed in oxytocin¹.

Chang and Platt have monitored the brains of monkeys playing a different game, in which they can choose to reward other monkeys without any sacrifice. Receiving a reward causes one set of neurons to fire, they found²; watching another monkey receive a reward triggers a different set. As in the prisoner's dilemma, the monkeys wanted to reward another monkey only if it was physically present, and were unlikely to reward a computer. Chang is now studying how oxytocin, which has been shown to increase monkeys' willingness to reward³, affects neural circuitry.

Besides drugs and neurohormones, electrical stimulation can also alter the brain. Platt's lab is trying to map neural circuits, and show how they respond to electromagnetic stimulation. Previous work has shown⁴ that stimulating certain parts of the brain can increase people's ability to perform empathetic tasks, such as assessing what someone else knows or likes.

But Platt says that scientists are just beginning to understand how such methods work. He adds that watching the response of neural circuits in monkeys is a good way to work out how much stimulation or hormone should be applied, and where. "If you were a parent and considering oxytocin or brain stimulation for your child, you would want to know the answers to all those questions," he says. ■

1. Rilling, J. K. *et al. Psychoneuroendocrinology* **37**, 447–461 (2012).
2. Chang, S. W. C., Gariépy, J.-F. & Platt, M. L. *Nature Neurosci.* **16**, 243–250 (2013).
3. Chang, S. W. C., Barter, J. W., Ebitz, R. B., Watson, K. K. & Platt, M. L. *Proc. Natl Acad. Sci. USA* **109**, 959–964 (2012).
4. Santiesteban, I., Banissy, M. J., Catmur, C. & Bird, G. *Curr. Biol.* **22**, 2274–2277 (2012).

3 Rewards delivered

The proposed Giant Magellan Telescope in Chile is seeking to secure funding for its construction phase.

ASTRONOMY

São Paulo poised to join megatelescope

Brazilian state mulls support for Giant Magellan Telescope.

BY ELIZABETH GIBNEY

Astronomers in Brazil's richest state are pushing for a stake in the Giant Magellan Telescope (GMT), one of three planned megatelescopes. The São Paulo Research Foundation (FAPESP) is evaluating a proposal that would see it invest US\$40 million in the 25-metre facility, to be built at the Carnegie Institution for Science's Las Campanas Observatory in Chile.

If Brazil finalizes joining the European Southern Observatory (ESO) as planned under a separate proposal, São Paulo state astronomers would have access to another megatelescope, the 39-metre European Extremely Large Telescope (E-ELT), which ESO also plans to build in Chile. Brazil's accession agreement to ESO, signed in 2010 by the then science minister Sergio Machado Rezende, would deliver €270 million (US\$371 million) to the organization over a decade — almost one-third of the E-ELT's cost. But Brazil's legislative committees are still hunting for funds and its Congress has not ratified the agreement (see *Nature* **501**, 13–14; 2013).

The strength of the astronomy department at the University of São Paulo alone helps to explain the state's move to join the GMT, says Gary Sanders, project manager of the Thirty Meter Telescope, the third megatelescope

in the pipeline, planned for Mauna Kea in Hawaii. "As an outsider, it does seem natural for me for the state of São Paulo to provide access to an extremely large telescope for that community," he says.

The GMT project is managed by a consortium of institutions in the United States, Australia and South Korea. The telescope will study the skies with about six times the collecting power of the largest existing observatories, probing deeply into how stars and galaxies formed in the early Universe. On 19 February, the GMT board announced that a major milestone had been cleared when a panel of experts approved its design. Now that the \$880-million telescope is technically ready for construction, it must secure its financial commitments. Cash is exactly what São Paulo could provide.

The state generates one-third of Brazil's gross domestic product, and more than half of its scientific output. São Paulo produces more scientific articles than any South American country, aside from Brazil as a whole. Funding for the GMT would bypass complicated federal mechanisms and come directly from FAPESP, which is supported by 1% of state taxes.

The proposal before FAPESP would secure a 4% stake in the GMT, guaranteeing São Paulo's researchers 4% of observation time each year, as well as representation on the consortium's decision-making board. This would be a ►

► huge advantage for astronomers in the state — particularly those at smaller institutions, says Cassio Leandro Barbosa, an astronomer at the University of Paraíba Valley in São Paulo state.

Wendy Freedman, chair of the GMT board and director of the Carnegie Observatories, thinks that São Paulo and the GMT are “a good match”. The decision to join will now come down to FAPESP’s review

“Our reputation would drop off a cliff.”

of a November 2013 workshop between Brazilian astronomers and the GMT leadership, along with an evaluation of benefits

for local industry, says Hernan Chaimovich, special aide to the scientific department at FAPESP. A decision is likely to be made by April, he says.

According to Chaimovich, FAPESP is also in discussions with the Brazilian Ministry of Science and Technology about a federal contribution to the GMT, which would grant telescope access to investigators outside the state of São Paulo. If the ministry does contribute, ESO advocates could have cause for concern, because that might undercut interest in using the E-ELT, a major driver for Brazil to ratify its ESO membership.

For ESO director-general Tim de Zeeuw, one proposal does not necessarily exclude the other. FAPESP’s bid to join the GMT “is independent of the ratification of Brazil to ESO and is very different”, he says. Both megatelescopes are a decade or so away from completion, but being part of the ESO gives Brazilian astronomers access to existing observatories in Chile, such as the Atacama Large Millimeter/submillimeter Array and the Very Large Telescope, he adds. “They are cutting-edge facilities available to the Brazilian community here and now.”

The ratification process formally began in February last year, but has stalled in Congress. De Zeeuw expects Brazil to confirm the agreement in the first half of 2014, but those familiar with the Brazilian system are less willing to make firm predictions in an election year. Beatriz Barbuy, head of the Astronomical Society of Brazil’s ESO committee, is hopeful that the process will wrap up this year. “We will see,” she says. “The next step is to find the budget.”

Further delays could hurt both ESO and Brazil. Under present rules, major construction contracts for the E-ELT cannot be awarded until Brazil’s funds are secure. The country’s growing standing in international science would also take a nose dive, says Barbosa, just as it seeks to join other global organizations, such as CERN, Europe’s particle-physics laboratory near Geneva, Switzerland. “Our reputation would drop off a cliff,” he says. ■

Albert Einstein at Mount Wilson Observatory in 1931, with Edwin Hubble (centre) and Walter Adams.

COSMOLOGY

Einstein’s lost theory uncovered

Physicist explored the idea of a steady-state Universe in 1931.

BY DAVIDE CASTELVECCHI

A manuscript that lay unnoticed by scientists for decades has revealed that Albert Einstein once dabbled with an alternative to what we now know as the Big Bang, proposing instead that the Universe expanded steadily and eternally. The recently uncovered work, written in 1931, is reminiscent of a theory championed by British astrophysicist Fred Hoyle nearly 20 years later. Einstein soon abandoned the idea, but the manuscript reveals his continued hesitance to accept that the Universe was created during a single explosive event.

Evidence for the Big Bang first emerged in the 1920s, when US astronomer Edwin Hubble and others discovered that distant galaxies are moving away and that space itself is expanding. This seemed to imply that, in the past, the contents of the observable Universe had been a very dense and hot ‘primordial broth’.

But, from the late 1940s, Hoyle argued that space could be expanding eternally and keeping a roughly constant density. It could do this by continually adding new matter, with elementary particles spontaneously popping up from

space, Hoyle said. Particles would then coalesce to form galaxies and stars, and these would appear at just the right rate to take up the extra room created by the expansion of space. Hoyle’s Universe was always infinite, so its size did not change as it expanded. It was in a ‘steady state’.

The newly uncovered document shows that Einstein had described essentially the same idea much earlier. “For the density to remain constant new particles of matter must be continually formed,” he writes. The manuscript is thought to have been produced during a trip to California in 1931 — in part because it was written on American note paper.

It had been stored in plain sight at the Albert Einstein Archives in Jerusalem — and is freely available to view on its website — but had been mistakenly classified as a first draft of another Einstein paper. Cormac O’Raifeartaigh, a physicist at the Waterford Institute of Technology in Ireland, says that he “almost fell out of his chair” when he realized what the manuscript was about. He and his collaborators have posted their findings, together with an English translation of Einstein’s original German manuscript, on the arXiv preprint server (C. O’Raifeartaigh *et al.* Preprint at <http://arxiv.org/abs/1402.0132>;