

# Mexico must do more

Mexico is a country rich with natural resources and an educated workforce. Yet its scientific output remains below its potential. In this focus issue we try to highlight some of Mexico's structural problems.

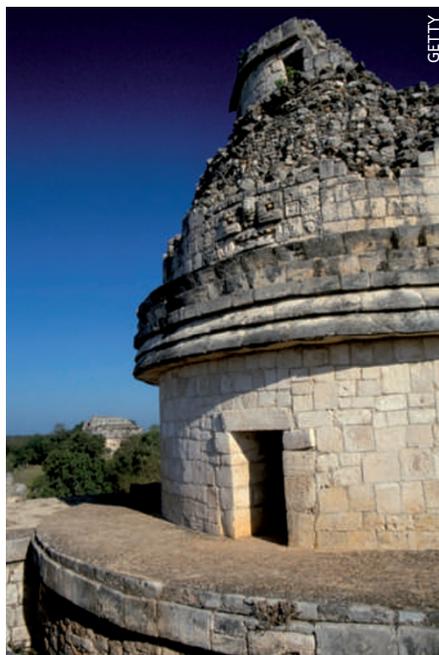
Two hundred years ago this September, Mexico gained political independence. With a population of about 100 million, Mexico is the largest Spanish-speaking country in the world and the second most-populous country in Latin America after Brazil<sup>1</sup>. Mexico boasts an abundance of natural resources, all of which are important to its economy, with oil being the main one<sup>2</sup>. All these factors make the country one of Latin America's key economies, well-supported by its membership in NAFTA, the North American Free Trade Agreement between the US, Canada and Mexico. At the same time, Mexico's 2008 investment in research and technological development (R&D) is only 0.37% of its gross domestic product (GDP), the lowest amongst 40 developed nations tracked by the Organization for Economic Cooperation and Development<sup>3</sup>.

There is no doubt that Mexico has improved access to education and literacy over the past few decades. A 2007 World Bank report<sup>4</sup> that shows 97% enrolment at the primary level is a good indicator that more children are completing primary education. However, at higher education levels the situation is very different with only 26.3% gross enrolment for the tertiary level.

Despite such encouraging statistics in primary education, Mexico's scientific and technological output clearly lags behind its potential. In his Commentary on page 781 of this issue<sup>5</sup>, Arturo Menchaca Rocha, President of the Mexican Academy of Sciences, notes that only 0.7% of publications indexed by ISI Web of Knowledge are from Mexico, despite the country's 1.6% share of global population.

A key concern is of course the severe underfunding of science and technology in relation to the country's GDP. Brazil spends three times more on its research infrastructure — with considerable success — and Japan's R&D spending as a fraction of GDP is almost ten times higher. It is for this reason that Juan Ramón de la Fuente Ramírez, President of the International Association of Universities, a former Mexican Minister of Health and former Rector of the Universidad Nacional Autónoma de México (UNAM) in his interview with *Nature Materials* asks for a national long-term strategy that ensures continuity and progress in Mexican science<sup>6</sup>.

Increasing research funding is of course no panacea. Even at the present level of funding



The ancient Mayan observatory *El Caracol* in Yucatán is a testament to the long scientific tradition in this region.

inefficiencies exist, and there are significant asymmetries between institutions or even states in Mexico. UNAM's 2009 federal government funding stood at an impressive 1.6 billion US dollars<sup>7</sup>, which is larger than the budget of some states in Mexico<sup>8</sup>. Of course, UNAM is an enormous institution with more than 300,000 registered students. However, other publicly funded universities around the country do not have access to similar resources even though these institutions make important contributions to the research output of the country. In a situation where increased R&D funding seems inevitable, increases in budget could be used to even imbalances in funding as an efficient way of enhancing the country's research output.

Similarly, a dedicated funding of centres of excellence could attract Mexican researchers from abroad to return to their country. Mexico's National Science and Technology Council (CONACYT), for example, funds 27 research centres with a budget of about US\$450 million. Germany's Max-Planck Society in 2007 ran 80 institutes and research centres on a total budget of 1.433 billion

Euros. Even though Max-Planck Institutes tend to be smaller than CONACYT centres, at present exchange rates their funding per institute on average is almost 40% higher.

At the same time, the individual achievements of Mexican scientists are increasingly visible. The recent creation of *Redalyc*<sup>9</sup>, an open access journal repository for Latin America has improved the impact that local research has at a global level, and according to UNESCO is an important contribution to improving access to scientific knowledge<sup>10</sup>.

An important issue raised by both Menchaca Rocha and de la Fuente Ramírez is technology transfer. Mexico's industry needs to advance its innovative capacity and expand its capability for innovation. Fewer than two researchers per thousand work in industry<sup>11</sup> and the business sector plays a much smaller role in the innovation process than the higher education sector. As a consequence, Mexico has an enormous dependence on foreign technology, and a very low rate of patents registered to Mexican nationals. During the 1990s the main objective in science and technology in Mexico was heavily concentrated on increasing the scientific research capacity of the country, and technological development was somewhat set aside.

Two hundred years ago Mexico achieved political independence. During the past century, the country has seen the creation of its higher-education institutions. For its next few decades, it is now time for Mexico to build on these achievements and to create a strong science and technology base for the benefit and prosperity of its people. □

## References

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