

Health & safety

BPA biomarker

Anthony King

Babies born to mothers exposed to high levels of bisphenol A show changes in their DNA, a new study shows. These DNA changes can also be detected in blood and could act as an early warning siren for psychiatric or behavioral problems, US researchers conclude.

The researchers found that the cord blood from babies born in New York, who were exposed to high levels of bisphenol A (BPA) while in the womb, showed so-called epigenetic changes to the BDNF (brain-derived neurotrophic factor) gene, involving DNA methylation (*Proc. Nat. Acad. Sciences*, doi: 10.1073/pnas.1408355111).

This in turn hampered the production of BDNF growth factor protein. BDNF growth factor has been dubbed a brain fertiliser and is known to promote the survival of neurons as well as brain neuroplasticity, important in learning and memory.

High BPA exposure among mums was associated with disturbed emotional regulation and increased aggressive behaviour in boys, as well as reduced aggression and lower anxiety scores in girls. The finding adds to a body of evidence linking bisphenol A, widely found in plastic packaging, to human health problems.

BDNF 'has been thought to be important in the risk of depression and other psychiatric problems later in life. So we looked at whether prenatal bisphenol A in our animal model was predicting epigenetic changes in that gene and it was,' explains senior author Frances Champagne at Columbia University.

'We showed that males had a behavioral change, did poorly in learning and memory tasks and had brain changes in the form of reduced expression of this brain derived neurotrophic factor gene. This might account for the way their brain and behaviour was altered.'

The researchers hope that their finding may prove useful as a blood biomarker for flagging early in life when something has gone awry. 'We could see it in the blood at an earlier stage of development and predict who will be at risk later on in life,' Champagne explains. This would be an initial step, with the hope that future strategies could be found to prevent or even reverse the epigenetic impacts. BDNF expression and DNA methylation are already known to be altered in several psychiatric disorders that are associated with early-life adversity, including depression, schizophrenia, bipolar disorder and autism.

'BDNF is involved in plasticity and adaptation and early life adversity would have effects on brain and body development and function via suppression of BDNF expression,' says Bruce McEwan, a neuroendocrinology researcher at Rockefeller University in the US. However, he says it is hard to say whether a biomarker would be clinically useful with regard to specific disorders, 'in part because there is often co-morbidity of many disorders, like diabetes and depression'.

Psychopathologist Georgina Hosang at Goldsmiths, University of London, UK, says: 'The strength to this study is the complementary use of animal data and information from human studies. The authors were able to show that their initial findings from the animal studies can be translated and applied to humans.'

Paul Hodges
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A great unwinding

In March (*C&I*, 2014, 3, 11), I suggested that China's economy was close to a turning point.

Since then President Xi Jinping has confirmed in several major speeches that the country has moved into a 'new normal'. Growth rates are set to be half of those seen during the boom years. And the policy focus for the next 10 years is no longer on creating a 'wealth effect' via a property boom in the cities. Instead, the target is to improve living standards in the rural areas – where disposable incomes average just \$1250/year.

This has enormous implications for anyone doing business with China, and for all those areas that have been boosted by China's demand. Oil prices are already collapsing, as are prices for most major commodities, whilst the US\$ is rising versus both the euro and the yen. Suddenly, it seems that Western central banks are bit-players in the drama. It is China's new direction that is now starting to drive developments in the global economy.

Analysis of China's latest trade data for PVC and purified terephthalic acid (PTA) highlights the criticality of the changes now under way. PVC is one of the world's major plastics, widely used by the construction industry in drainage pipes and windows. As recently as 2009, when its stimulus programme began, China was the world's largest importer, with net imports of 1.5m t – mainly from Asia and the US.

But since then it has vastly expanded its own production, by more than 70%. As a result of this, and the housing market slowdown, it has now become a significant net exporter. Even more remarkable is

'[China's] policy focus for the next 10 years is no longer on creating a "wealth effect" via a property boom'

that the US is the major loser, despite its cost advantage from shale gas developments. Not only have China's imports from the US fallen by a third versus 2012 levels, but China has been gaining export volume at US expense in India, SE Asia and Russia.

It also seems highly unlikely that China will change course. Most of its PVC production is coal-based, and it is strategically important for the country to maximise use of this resource, given its energy deficit. PVC production also maintains employment in the coal regions – which is critical for social stability.

Developments in PTA, the raw material for polyester, confirm the major changes now under way. China imported 6.5m t of PTA as recently as 2011. But its imports halved in 2013, and seem set to do the same in 2014. It is also now exporting PTA for the first time in history, as major new capacity comes online. Current trends thus suggest China could be a net exporter of PTA by the end of 2015.

Companies and investors have so far chosen to ignore these developments. But the recent collapse of oil prices, and the rise of the US\$, means they are being forced to take notice. A 'Great Unwinding' of policymaker stimulus now appears to be under way, led by China. We have a rocky road ahead. ●