identified by Lanz *et al.* recognizes intracellular targets — EBNA1 is a transcription factor, and the intracellular portion of GlialCAM contains the antibody-binding region.

As was impressively corroborated by an epidemiological study[3] reported this year, infection by Epstein–Barr virus is tightly associated with the development of MS, and, indeed, such infection can be considered as a risk factor[11]. Should we now see MS as an autoantibody-driven autoimmune disease with EBNA1/GlialCAM antibody crossreactivity as a general mechanism triggering the disease? A definitive answer to this question would be premature at present.

Instead, we need to await the outcome of studies that examine more people, from a diverse range of ethnicities. Regarding the highlighted crossreactive antibodies, critics might point to the relatively small numbers of individuals studied, which could mean that this result is not applicable to a wide population of people with MS. Also worth mentioning is that the individuals studied were selected on the basis of the high numbers of immune cells found in their CSF, and this might have introduced a bias towards people with a particular subset of MS.

There is generally scant direct evidence of autoantibodies causing tissue destruction in MS. For many people with the disease, treatment to deplete B cells is highly effective, although it seems to have almost no effect on CSF OCBs or peripheral blood immunoglobulin[12]. However, there are subgroups of people with MS who have antibodies that bind to decaying brain cells, and who respond to the elimination of plasma (auto-)antibodies by a method known as plasmapheresis[13]. Even if the crossreactive antibodies identified by Lanz and colleagues are not a universal marker of MS, they might turn out to be useful as markers of a particular subtype of MS.

Despite these limitations, the new study provides a concrete, striking example of how a B cell that initially provides a defensive function by recognizing a viral antigen might acquire potentially dangerous self-reactivity. Beyond MS, this mechanism might be relevant to other viruses and autoimmune diseases. Will the present work pave the way to antiviral vaccination approaches as a means of protecting against MS? This would be the sort of advance hoped for by numerous people who either have the disease or are at high risk of developing it. The jury is out.

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Photonics

Light measures up on a chip the size of a fingertip

H. Y. Fu & Qian Li

An optical device enables high-speed, high-resolution distance measurements to be made over a large field of view. Clever switching gives the integrated design a tiny footprint and keeps its power consumption low. **See p.253**

Our eyes use 3D information to sense our surroundings, but few imaging systems are capable of emulating this feat. Light detection and ranging (lidar) systems are an exception: they use 3D imaging to measure targets over long distances with high precision, and for this reason, they have been widely applied in technologies ranging from autonomous driving to complex cartography[1]. The next challenges for lidar methods are miniaturization and integration into a single chip. But these advances can come at the cost of a limited field of view and low resolution. On page 253, Zhang *et al.*[2] report an integrated lidar system that offers an exceptional field of view and high resolution in a compact, low-power device.

Light waves have a similar role in lidar to that of radio waves in radar: a lidar sensor sends out and receives information encoded in light pulses, and the system uses this information to make a map of its surroundings. To capture 3D information in this map, a laser beam must be steered around the space, and this is typically achieved using mechanical beam scanners with moving parts. However, these methods can be unstable, slow, bulky and expensive. Over the past decade, mechanical beam scanners have begun to be replaced by non-mechanical scanners with fast steering speeds and improved stability[3,4]. The optical-phased array and the focal-plane switch array are two such devices.

An optical-phased array works by controlling the optical properties of the light waves emitted by antennas in an array — specifically, their relative phase, which is the degree to which the waves are in step with each other. To achieve high performance, the antennas must be large, and closely spaced on a single chip. However, controlling the phase of a large number of elements is challenging when they are tightly packed, and the power consumption is high, which makes integration difficult. This means that 2D optical-phased arrays are limited to a 46° field of view in one direction and 36° in the other[5], although some 2D optical-phased arrays with high resolution and large fields of view have also been demonstrated[6].

By contrast, a focal-plane switch array maps each angle in the field of view to a pixel in the focal plane of a lens, which then performs imaging like a camera. Instead of controlling the phase of each pixel, a focal-plane switch array uses switches to turn each pixel on and off. The optical antenna corresponding to each pixel is independent of the other antennas, making it possible to integrate a large array on a single chip. Nevertheless, focal-plane switch arrays can still require high power consumption and a large footprint because of the size of the switches and the energy needed to tune them[7].

For all of these reasons, integrating a large-scale focal-plane switch array into a single chip is a challenging task, yet Zhang *et al.* succeeded in fitting an antenna array corresponding to 128 × 128 pixels on a chip the size of a fingertip, just 10 × 11 millimetres. With a large-aperture lens, this means that their device can aim a laser beam in 16,384 distinct directions in a field of view of 70° by switching the beam to different antennas.

The team's chip achieves this remarkable performance with the help of microelectromechanical silicon photonic switches that control the optical antennas. The elaborate design of these switches is key,

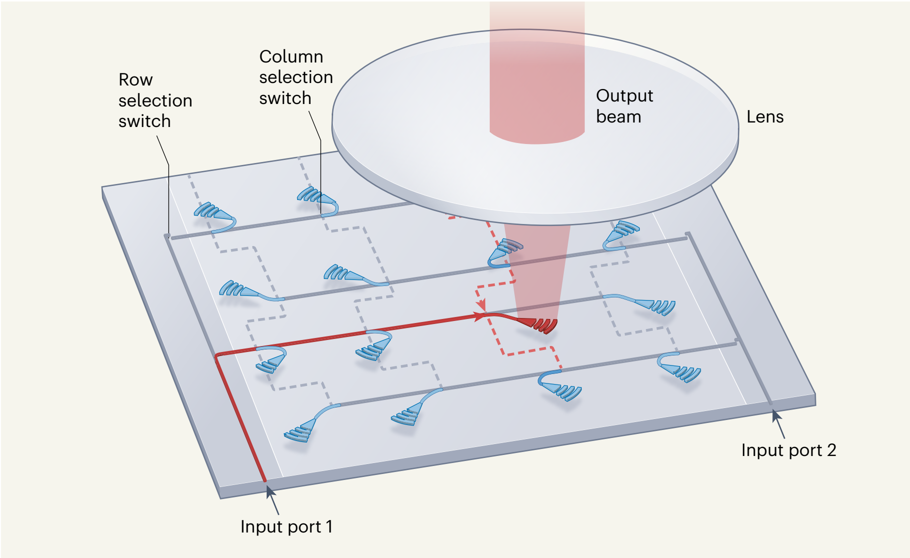

Figure 1 | An integrated lidar system. Zhang *et al.*[2] designed a light detection and ranging (lidar) system that can measure distances with high resolution and has a wide field of view, while maintaining a small footprint and low power consumption. The system comprises a 128 × 128 array of optical antennas (a representative 4 × 4 array is shown here) into which light (red arrows) is routed from one of two input ports along selected rows and columns by means of micro-electromechanical switches. Antennas in the same column are connected electrically (dashed lines), reducing the number of switches required. The lens (not to scale) converts the light emitted by the antenna into a laser beam that can point in 16,384 distinct directions, enabling distance measurements across a field of view of 70°. (Adapted from Fig. 1 of ref. 2.)

because it enables a microsecond response time. The chip also benefits from an innovative system of waveguides, which limits the number of switches required. Each column of the array is connected electrically through one of these waveguides, so a given antenna can be turned on by selecting the appropriate row and column switches, without the need for a separate switch at each antenna (Fig. 1). Light is routed to the chosen antenna from one of two input ports and then emitted at an angle that is uniquely prescribed to that antenna. When the switches are turned off, there is almost zero loss; this limits power consumption, even in large-scale arrays.

The performance of Zhang and colleagues' lidar system is very promising, especially with so many pixels and such a wide field of view. High-resolution 3D images can easily be captured by combining the device with a light source that transmits continuous power at a frequency that can be modulated. The device can detect distances with a resolution of 1.7 centimetres, which matches well with the frequency range of the laser that the authors used. This indicates the feasibility of the lidar system for practical applications. And by selecting lenses with different focal lengths, the field of view and lateral resolution (a measure of the ability to distinguish between two adjacent points in the field of view) could potentially be adapted to different scenes, demonstrating the flexibility of the approach.

However, the measured lateral resolution is only 0.13°, which is relatively low. This will restrict its applicability for long-distance detection, a shortcoming of many systems that incorporate a focal-plane switch array. The resolution could be improved by increasing the chip size or shrinking the footprint of each pixel, which would require further optimization of the switch design.

Nevertheless, Zhang and co-workers' device could provide a breakthrough in integrated lidar systems. As processing technologies mature, further miniaturization and improvements in performance will make focal-plane switch arrays a promising technology for applications including megapixel 3D lidar and optical communications.

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Psychology

A feeling of familiarity can deter crime

Elicia John & Shawn D. Bushway

A combination of Internet-based and field experiments suggests that being given personal information about a stranger leads people to believe that they themselves are known to that person — and to change their behaviour accordingly. **See p.297**

Community policing is often held up as an instrumental part of reforms to make policing less harmful, particularly in low-income communities that have high rates of violence. But building collaborative relationships between communities and police is hard. On page 297, Shah and LaForest[1] describe a large field experiment revealing that giving residents cards and letters with basic information about local police officers can prevent crime. Combining these results with those from Internet-based experiments, the authors attribute the observed reduction in crime to perceived 'information symmetry'.

Known strangers are individuals whom we've never met but still know something about, such as celebrities. We tend to assume, erroneously, that known strangers know as much about us as we do about them. This tendency to see information symmetry when there is none is referred to as a social heuristic — a shortcut in our mental processing.

Shah and LaForest used a series of Internet-based conceptual experiments to evaluate how this heuristic manifests in judgements about known strangers. The authors