Science Writing Competition 2015 – Winning entry

Below is the winning entry in the '21 and over' category for the 2015 international Science Writing Competition organised by the University of the West of England's Science Communication Unit and BBC Focus magazine.

Winner: 21 and over

The Spectrum in Your Pocket
Emily Coyte, aged 24

Sometimes it feels like the Internet has the answer to everything. At our fingertips we have the ability to expand our knowledge or test someone's dubious "Did you know…" statement like never before.

Our online searches have their limits, though. If we have questions about the physical things in front of us, Google can't always help us. Is this cup of water safe to drink? Would irises fare well in this part of my garden? How much fat is really in this steak? Search engines cannot access these objects, so its answers are limited to averages and tendencies. To get real answers, we must tap into the chemical makeup of our world.

The technology to do this does exist but it's currently relegated to immovably clunky pieces of lab kit. They're called near-infrared (NIR) spectrometers and have been used by scientists for decades. Analysing distant galaxies, living brains and familiar artworks are all jobs safely and effectively assigned to the spectrometer.

If we could take spectrometers into our own hands, this fairly old technology could truly transform our future. This has happened before: consider the computer. When the first hulking calculators started appearing in the homes and then the pockets of the public, they became true game-changers for everyone. The story of spectrometers could take a similar turn.

Visible light contains a range, or spectrum of wavelengths that give us the familiar rainbow of colours. NIR light also comes as a spectrum - we just can't see it. The wavelengths of NIR are special because they are just right for energising the bonds that hold atoms in molecules together. It's also perfectly safe compared to the more destructive X-rays or ultraviolet radiation.

NIR spectrometers work by shining a spectrum of infrared light onto objects and analysing the light that bounces back. Say you want to scan an apple. Each substance within the fruit, be it water, sugar or fibre will respond to the NIR light in a unique way. The bonds within them will be energised, jiggling around at specific wavelengths only. The spectrometer can compile these into chemical fingerprints to identify exactly what's inside your particular apple, and how much.

If your smartphone held a personal spectrometer within it, you could delve into the chemistry of almost anything. If your houseplant was looking worse for wear, rather than typing in "symptoms", you could scan it and get instant feedback about its needs. Perhaps you want to test two glasses of wine to assess which is sweeter, just scan them and see. More seriously, if you ordered some pharmaceuticals online and want to confirm their identity, you could scan them too.

Progress towards portability is already underway. The Infrascanner 2000 is a handheld medical device which uses NIRS technology to non-invasively test for head trauma. Weighing 400 grams and producing results within minutes, kit like this is designed to help paramedics make first-aid decisions. This is still specialised equipment, but it shows that miniaturisation is possible.

The first pocket NIR scanner available to the public may well come from start-ups like Consumer Physics. Their main pitch is Scio, a finger-sized spectrometer with smartphone app connectivity. In June 2014 Scio's highly successful Kickstarter campaign raised over ten times its original $200,000 (£130,000) target. With this, they plan to convert their current working prototypes into real products anyone can use, with a wide range of smartphone apps to go with it.

Whether or not Scio is the device that makes it first, the scanners will probably follow cameras and satnavs in their migration into our smartphones. In the beginning they may not be particularly sensitive, and functions may be limited at first. But that would just be the start. As more people scan more objects, databases will grow and new applications will be discovered. The true transformative potential of this technology will reveal itself.

With these scanners in our pocket, we will see the world very differently. Our newfound ability to grasp the world at a molecular level will reveal questions we never even thought to ask, just waiting to be answered.