Test strip able to identify blood type in less than a minute

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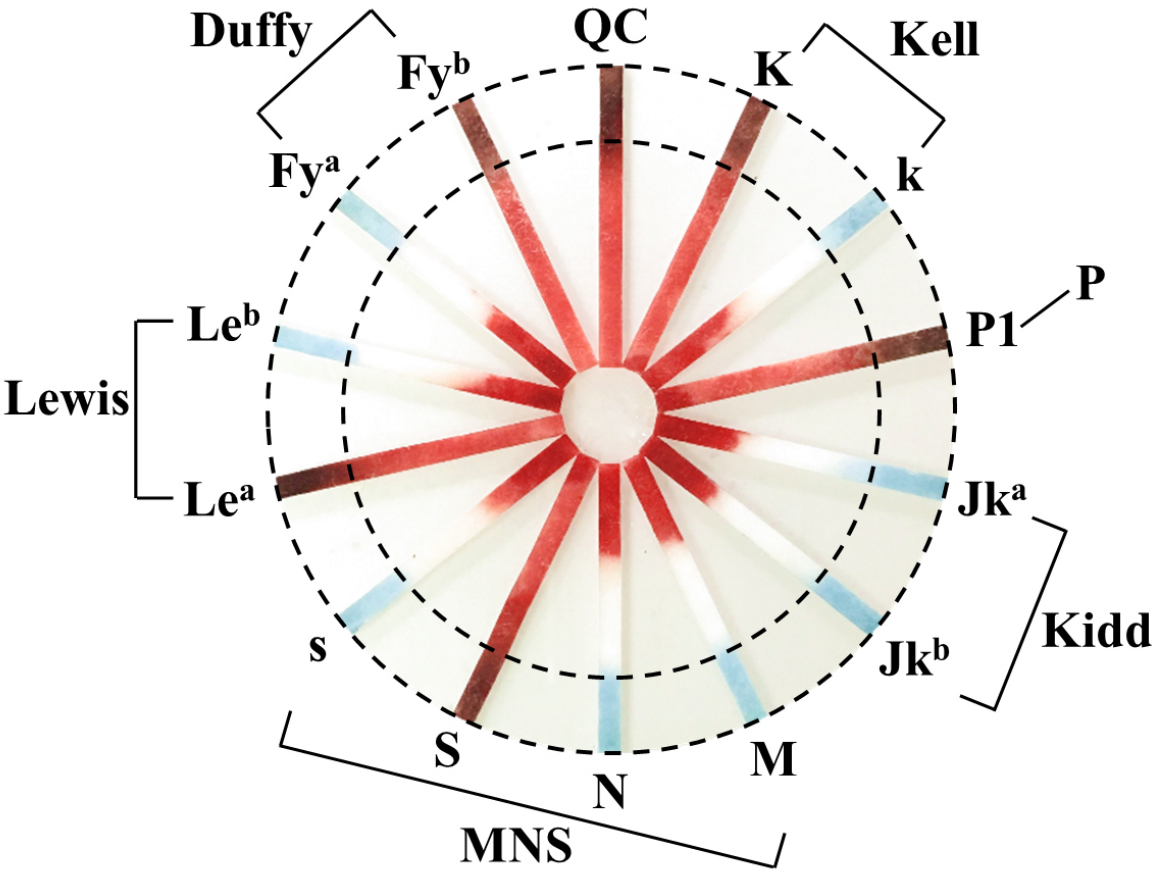

Image of a new paper blood test that detects common ABO groups as well as rarer variants such as Duffy and Kell. Credit: H. Zhang et al., Science Translational Medicine (2017)

(Medical Xpress)—A team of researchers at Third Military Medical University in China has developed a test strip that can be used to identify a person's blood type in less than a minute. In their paper published in the journal *Science Translational Medicine*, the team describes how the test strips work, how accurate they are and likely uses for them once they pass more stringent testing.

The current method for determining blood type involves taking a blood sample to a lab where a trained technician uses a centrifuge to separate and test the different blood parts—the entire process can take anywhere from 30 minutes to a few hours depending on circumstances. In this new effort, the researchers have created a paper-based test strip that can be used to do the same thing in under a minute by people with just a few minutes' training—and it is almost as accurate.

The paper strips developed by the team have small bits of antibodies and dyes that change colors (to teal or brown) when a drop of blood is applied. The colors change due to interactions between antigens in the blood sample and antibodies on the test strip. The strips are embedded in a plastic case with access windows, and in practice, the resulting product can be used much like common pregnancy tests.

Human blood comes mainly as type A, B, AB, or O. Type is determined by the antigens present on the surface of the red blood cell—type A blood has A antigens, B has B antigens, AB has both and O has neither of them. A different type of antigen determines whether the blood is positive or negative. The test strip relies on the fact that antibodies attack foreign antigens. If a person has blood with A antigens, for example, and is given blood with B antigens, antibodies in the blood will attack them, putting the person at risk of death. This is why emergency rooms typically use type O blood—it has no antigens to attack.

The researchers tested the test strip on 3550 blood samples and found it

was accurate 99.99 percent of the time and took on average just 30 seconds to give results. The researchers believe their test strips could prove most useful in a war zone or in countries with limited healthcare facilities. More testing will have to be done, but the team believes their strip will be on the market within the next couple of years.

More information: Hong Zhang et al. A dye-assisted paper-based point-of-care assay for fast and reliable blood grouping, *Science Translational Medicine* (2017). DOI: 10.1126/scitranslmed.aaf9209

Abstract

Fast and simultaneous forward and reverse blood grouping has long remained elusive. Forward blood grouping detects antigens on red blood cells, whereas reverse grouping identifies specific antibodies present in plasma. We developed a paper-based assay using immobilized antibodies and bromocresol green dye for rapid and reliable blood grouping, where dye-assisted color changes corresponding to distinct blood components provide a visual readout. ABO antigens and five major Rhesus antigens could be detected within 30 s, and simultaneous forward and reverse ABO blood grouping using small volumes (100 μl) of whole blood was achieved within 2 min through on-chip plasma separation without centrifugation. A machine-learning method was developed to classify the spectral plots corresponding to dye-based color changes, which enabled reproducible automatic grouping. Using optimized operating parameters, the dye-assisted paper assay exhibited comparable accuracy and reproducibility to the classical gel-card assays in grouping 3550 human blood samples. When translated to the assembly line and low-cost manufacturing, the proposed approach may be developed into a cost-effective and robust universal blood-grouping platform.