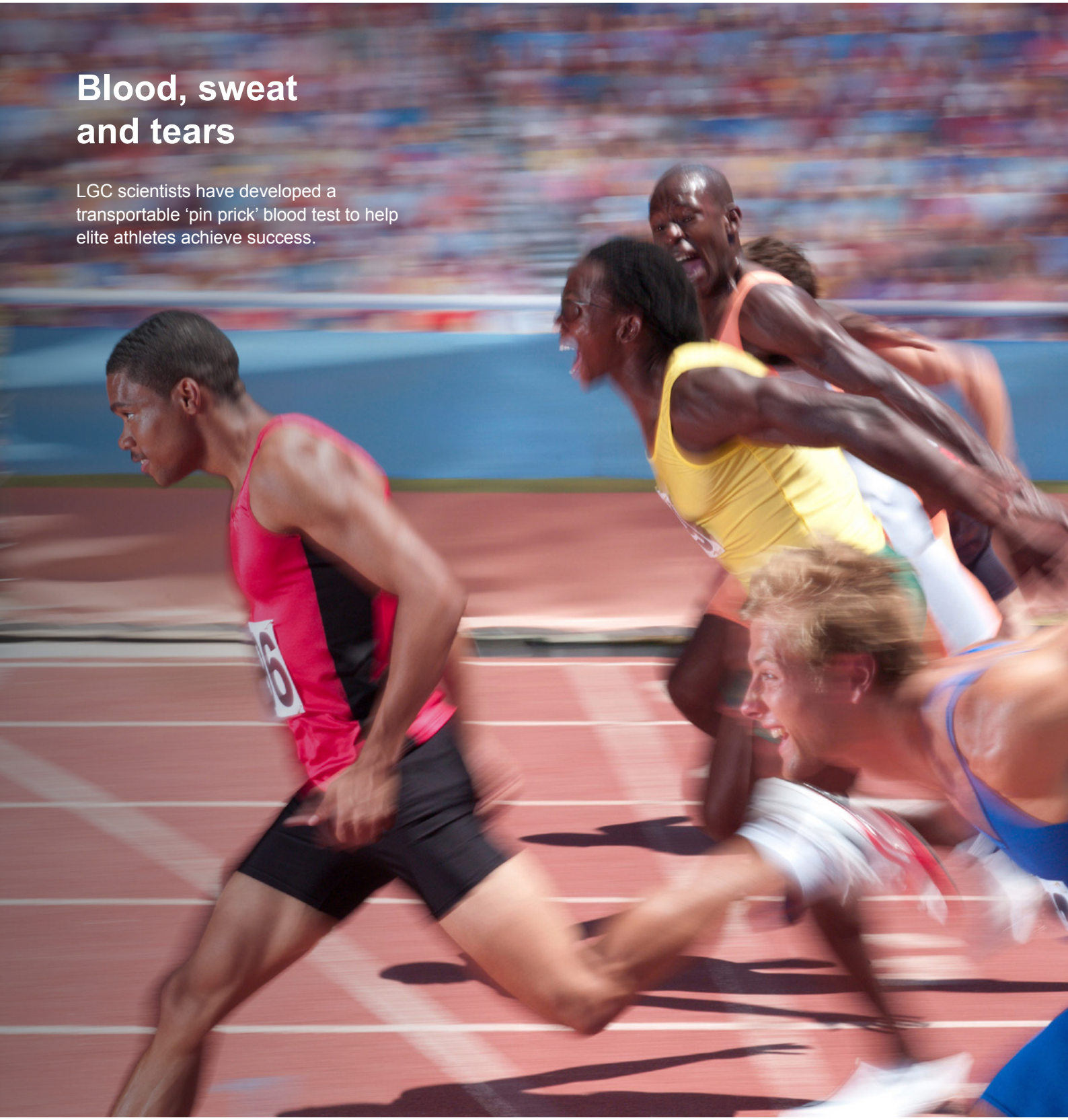
Blood, sweat and tears

LGC scientists have developed a transportable ‘pin prick’ blood test to help elite athletes achieve success.



Department for Business Innovation & Skills

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The requirement

In the highly competitive field of elite sport, athletes and their coaches are increasingly turning to science to help them assess physiological status and wellbeing in an attempt to optimise any competitive advantage. Stress biomarkers, such as cortisol, are often used to monitor the effectiveness of an athlete's training regime. Raised levels of cortisol are known to decrease muscle growth hormones and suppress immune function. A coach will be keen not to over train an athlete, as chronic elevated cortisol level causes the body to enter a state of constant muscle breakdown, with increasing risk of injury and susceptibility to viruses. However, levels of cortisol change quickly following exercise and so need to be monitored trackside to see if an athlete needs to be rested or whether they can train further and harder the next day.

While blood-based testing is more invasive than saliva testing, the latter is affected by dehydration or illness and after intensive training athletes can often not provide saliva samples. Saliva based testing may also be impaired by contaminating food, drink, bleeding gums and mucous from colds. Existing assays for total cortisol within serum are all laboratory-based, and the detection of the biologically active 'free' cortisol (that is not bound to other serum proteins) requires extensive and laborious sample processing prior to analysis. This means the results are not available to coaches and their athletes where and when they need them.

The solution

Researchers at LGC have developed new assays for detecting both free and total cortisol within human serum using a transportable platform technology. The instrument is a plate-based reader with a cooled charge-coupled device (CCD) camera that captures the light emitted by chemiluminescence. The light emitted correlates with the concentration of the cortisol in the test sample. LGC scientists have successfully eliminated the sample processing step for the detection of free cortisol and reduced the analyte incubation step to 15 minutes without affecting the assay recovery or reproducibility.

In collaboration with the English Institute of Sport, the cortisol assays were evaluated using blood samples from athletes (pre- and post-training) at Loughborough University via a pin prick to the finger.

Impact

Success in all sports is dependent on a consistently high performing athlete, with an individualised training plan set by his or her coach which is monitored and reviewed regularly.

Brian Cunniffe, Performance Lead at the English Institute of Sport, said:

> *"As the world of sports science changes rapidly, so does expectation from coaches and athletes in understand the training process in greater detail, more reliably and rapidly. Traditionally, most hormonal samples are collected either through venepuncture (blood) or saliva. Samples are then taken back to a laboratory, frozen and analysed a few weeks later. This can represent a cumbersome and inefficient process if we are to provide coaches and athletes with up to date information that informs the training process in the 'here and now' rather than the past."*

The novel assays developed at LGC provide real time data for cortisol levels in the field, negating the need to transit samples to laboratories and work is ongoing to further miniaturise the platform to provide even greater portability. Our blood-based tests uniquely guarantee measurements of both free and total cortisol in the same sample, providing athletes with further information: the percentage of biologically active cortisol. This may in the future provide more robust results for athletes on which to base their training decisions and help increase the return on investment on the hundreds of millions of pounds spent on UK elite athletes.

In addition to providing potential savings for elite athlete training programmes, innovative breakthroughs such as this novel free serum cortisol assay could provide financial benefits to the UK economy. Elite success boosts the 'feel-good' factor amongst the UK public and are known to result in increased uptake in sports activities, saving the health service between £1,750 and £6,900 per person.

Furthermore, this assay has the potential to provide additional future benefits in other areas, such as diagnosing and monitoring illnesses where stress is a surrogate marker of health status, improving quality of life and contributing further to the UK economy.

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