“UK Biobank – the biggest gift ever given to science, by any nation”

UK Biobank is the biggest gift ever given to health researchers by a single nation, pioneering Icelandic geneticist Dr Kári Stefánsson told our 2019 scientific conference.

As the project grows in detail every year, researchers praised the way in which the resource is being used, and looked to the future with anticipation and excitement.

Thanks to participants’ long-term support of UK Biobank the study has passed a range of important landmarks this past year:

- More than 12,000 health scientists from around the world are now registered to use the resource;
- More than 1,000 health studies have been approved;
- More than 900 projects have reported their findings in expert scientific journals such as The Lancet, Nature and the Journal of the American Medical Association;
- Hundreds of scientists have presented their findings at health conferences around the world.

None of this would have been possible without your support. Thank you!

Stop Press!

Research into illnesses like dementia, cancer and heart disease has received a huge boost with news of a ground-breaking initiative to sequence the whole genomes of all UK Biobank participants. The £200 million venture is funded by the government’s UK Research & Innovation (UKRI) Industrial Strategy Challenge Fund, Wellcome and industry (GlaxoSmithKline, AstraZeneca, Johnson & Johnson and Amgen). It covers the sequencing of 450,000 participants, after a vanguard study funded by the UK Medical Research Council (MRC), paid for the first 50,000 last year. Whole genome sequencing records all the genetic variations between individuals and will provide lots of new information on why some people get particular illness and others do not. UK Biobank genetic data are already transforming research, but this level of detail is a game-changer say researchers.
Genetics – the future is almost here

Imagine a future where treatments are tailored to individual patients. Side effects will be reduced or avoided as doctors establish how a patient will respond to therapy before it is given. And specific preventive advice can be targeted at those most in need.

Such is the hope for personalised medicine – and UK Biobank is at the heart of the genetics revolution to deliver it.

Genes are the instructions inside each cell which tell it how to behave. Understanding how they do this is a major goal for health research.

Huge reductions in the time and cost of analysing genes are opening up new areas of research in ways thought impossible when UK Biobank began recruitment in 2006.

UK Biobank has undertaken three types of genetic analysis:

Whole genome sequencing – a Vanguard study on 50,000 samples is now under way and, as described on our front page, approval has just been given to sequence all UK Biobank participants. The work is funded by government, charity and industry. Data will be released to the wider research community after a 9-month exclusivity period for the industry partners.

Exome sequencing looks at the active genes (about 2% of the whole genome) that produce proteins to build cells and control cell activity. Analysis of the first 50,000 was led by Regeneron and GSK (and after a 9-month exclusivity period, the data are now being used in more than 100 other studies). A new consortium led by Regeneron is now analysing the other 450,000 samples.

Genotyping provided a picture of the human genome at 800,000 points of special interest. In addition, 90 million other points were estimated, making UK Biobank even more useful for health research. These data are widely available and being used in lots of studies.

“Wisdom from crowds”

The prestigious science journal Nature featured UK Biobank on its front cover and provided detailed analysis of the resource inside. Here’s what it had to say about the need for studies like UK Biobank, to follow the health of lots of people over many years:

“Precision medicine aims to improve treatments for individuals, but to do so it needs information from crowds. Only by tracking the health of large numbers of people can the influence of genetics be teased out and incorporated into future tailored treatments. Scientists now report the success of such a project, UK Biobank [...] Many (other) studies have aggregated UK Biobank data with other data sets to enable studies on a much larger scale, some reaching more than 1 million individuals. That is the future of medicine: wisdom from crowds.”

You can find out more about the types of genetics work under way by visiting our website: www.ukbiobank.ac.uk
Can’t get a good night’s sleep? Blame your genes
Many thanks to the 100,000 participants who wore a UK Biobank activity monitor for a week several years ago. The information is helping with a wide range of studies. An international collaboration were interested in inactivity – when participants were resting – and linked it to genetics. They found 47 links between genes and the quality, quantity and timing of our sleep. The scientists were based in the UK, US, Netherlands, France and Switzerland.

Reducing dementia risk, even in people at high risk
People born with a higher genetic risk of dementia can counteract that risk by following a healthy lifestyle. So say Exeter-based scientists who examined data from 196,000 UK Biobank participants aged over 60 and identified 1,700 new cases of dementia. They categorised participants by diet, physical activity, smoking and alcohol consumption. Sticking to a healthy lifestyle was associated with a reduced dementia risk, regardless of genetic risk.

Getting to grips with asthma
When joining UK Biobank, you were asked whether you suffered from asthma, hay fever or eczema. Scientists have now used this information from 350,000 participants alongside genetic data to find 41 genes that have not previously been linked to these illnesses. A large number of the genes raised risk for all three diseases but some were more disease-specific. The work paves the way for better diagnosis and the development of new drugs to treat the disorders.

Mental health boost from UK Biobank
UK Biobank’s sheer size has allowed researchers to investigate mental health in new ways. Genetic analyses will help uncover some of the biological causes of the illness, while imaging of the brain will allow investigation of the structure of the brain. Work using UK Biobank data and other sources such as the Psychiatry Genomics Consortium, has led to the discovery of hundreds of genes linked to depression, which could lead to new treatments and help identify people most at risk.

Cambridge University scientists believe they have identified a link between heart disease and depression: inflammation – the body’s response to negative environmental factors, such as stress. The researchers used data from 370,000 UK Biobank participants and concluded: “It is possible that heart disease and depression share common underlying biological mechanisms which manifest as two different conditions in two different organs, the cardiovascular system and the brain”.

Wisdom from crowds
Getting to the heart of the matter

Pollution linked with serious changes in the heart
A team of London and Oxford scientists studied data from around 4,000 UK Biobank participants and found that people exposed to air pollution well within UK guidelines have changes in the structure of the heart, similar to those seen in the early stages of heart failure. The research was part-funded by the British Heart Foundation (BHF) and was published in the journal Circulation. UK Biobank imaging data were used to measure the size, weight and function of participants’ hearts. Even though most participants studied lived outside major UK cities, there was a clear association between those who lived near loud, busy roads, and were exposed to nitrogen dioxide (NO2) or small particles of air pollution (called PM2.5) and the development of larger right and left ventricles in the heart. The ventricles are important pumping chambers and, although these participants were healthy and had no symptoms, similar heart changes are seen in the early stages of heart failure. Higher exposures to the pollutants were linked to more significant changes in the structure of the heart.

Kolkata scientist is our 10,000th
A scientist from the Indian Statistical Institute in Kolkata has become UK Biobank’s 10,000th approved researcher. Mr Anabik Pal was drawn to the resource because of the wide range of heart imaging data available. His registration demonstrates the global reach of UK Biobank, with scientists from more than 70 different countries now registered.

• To encourage the pioneer researchers of the future, a reduced fee to use UK Biobank data may apply to student scientists.

Smoking, diabetes increase risk of heart attack more in women
Smoking, diabetes and high blood pressure increase the risk of a heart attack more in women than in men. The study of 472,000 UK Biobank participants found that female smokers had over three times the risk of a heart attack compared to women who had never smoked. For men who smoked compared with men who did not, the risk was only double. A higher risk was also found among women with high blood pressure, and type I and type II diabetes, but not with a high BMI.

Screening possibility for heart disease
Nationwide screening to identify people at higher risk of a heart attack might be possible thanks to research carried out using UK Biobank data. American scientists studied the changes in DNA that increase the risk of heart disease, breast cancer, bowel disease, Type 2 diabetes and abnormal heart rhythm. Despite not showing symptoms, they found that eight per cent of people were three times more likely to develop heart disease, based on their genetic make-up. It could pave the way for a screening programme to identify people at risk earlier, and provide guidance to reduce risk.
Health records help research

UK Biobank continues to follow your health through electronic record systems. This has helped in a number of studies. For instance, UK Biobank genetic and GP data have shown that:

- UK Biobank genetic and GP data have shown that Type 1 diabetes is much more common in adults than previously realised – and that too many adults are treated for the wrong type of diabetes;
- Haemochromatosis, a life-threatening disorder caused by too much iron in the blood, is also much more common than realised. Research shows that people could be spared a range of health problems later in life if the condition was caught earlier.

Diabetes damage to heart observed

MRI images from almost 4,000 UK Biobank participants have shown that diabetes causes subtle structural changes to the heart, say scientists. One of the earliest signs of heart disease in people with diabetes may be that all four chambers of the heart become smaller.

The research, funded by the British Heart Foundation, shows for the first time the extent to which diabetes affects the heart muscle. These early changes in the heart muscle could allow action to be taken before the damage leads to serious heart problems. Around 4.7 million people are living with diabetes in the UK. Adults with diabetes are up to three times more likely to develop heart and circulatory diseases.

Hearing loss drugs step closer after discovery of 44 genes linked to condition

We know that loss of hearing as we age can be a frustrating and isolating health problem. It affects a third of people by the age of 65 and has recently been identified as a risk factor for dementia.

Now scientists, with the help of information from 250,000 UK Biobank participants, have identified a large number of genes that may be involved. The study has provided information on the 'genetic landscape' of age-related hearing impairment (ARHI) and may open up avenues for treatment.
Healthy brains...

MRI scans of the brains of almost 10,000 UK Biobank participants have shown that factors that influence the health of our blood vessels, such as smoking, high blood pressure, obesity and diabetes, are linked to less healthy brains. The strongest links were in areas of the brain known to be responsible for our more complex thinking skills, and which deteriorate during the development of Alzheimer’s disease and dementia. With the exception of high cholesterol, all of the other vascular risk factors were linked to greater brain shrinkage, less grey matter (tissue found mainly on the surface of the brain) and less healthy white matter (tissue in deeper parts of the brain). The findings show the potential of making lifestyle changes to improve brain and cognitive ageing.

... and good news on diabetes too

Swedish imaging experts have developed new techniques to analyse body fat that might help predict an individual’s risk of heart disease and diabetes. AMRA used data from 10,000 UK Biobank scans to study abdominal fat and fat around the organs. “Our research shows that a simple MRI tells you much more about what’s going on inside the body and what disease propensities may be lurking,” said one of the researchers.

We are currently almost halfway to our goal of imaging 100,000 participants. Do look out for your invitation to take part coming in the post.

Thank you to all our participants for making the UK Biobank resource possible. You can find out much more about our successes on our website.

www.ukbiobank.ac.uk

More information: www.ukbiobank.ac.uk or join more than 10,000 other supporters by following us on Twitter @uk_bibank

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