

## **BGI Genomics: a study and analysis of the company's work in the UK**

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**Note from UK-China Transparency:** this report was authored by the two journalists above and shared with UKCT in early 2024. All of the Freedom of Information requests that it is based on were already available [online](#) but UKCT decided to re-publish them in the UKCT [digital library](#). They have been uploaded there into a folder called 'BGI Group'.

UKCT made minor changes to the original report to reflect information received in response to FOI requests from public bodies since the authors originally produced the report – and inserted notes where appropriate. UKCT also removed the names of a few people with a loose connection to BGI who were mentioned in the original report. The opinions expressed in this study are not necessarily those of UKCT.

BGI Group's full statement in response to this report can be found [here](#).

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### **Introduction**

BGI Genomics is a Chinese genome sequencing company founded in 1999 by geneticist and businessman Wang Jian at the Beijing Genomics Institute (now the BGI Group). It has since grown into a global business, collaborating on research projects around the world with academic and medical institutions.

However, in 2021, Reuters [reported that](#) NIFTY (Non-Invasive Fetal Trisomy), a neonatal genetic testing kit produced by BGI, was harvesting the genetic data of millions of women around the world, while in March 2023, Conservative MP George Freeman said that the company had repeatedly [attempted to hack](#) into Genomics England to gain access to the NHS genetic database of UK citizens. Freeman later corrected himself, stating that there was “no evidence” for this claim.

The Evening Standard [has reported](#) that “BGI Group, which runs the state-owned national gene bank, is believed to have significant and long-standing ties to the Chinese Communist Party and the country's military.”

Despite government knowledge of this, BGI Genomics [was awarded](#) a £10.8 million contract to undertake genomic testing of Covid samples during the pandemic. BGI was also listed as an approved supplier on three framework agreements for diagnostic equipment, research and development, and clinical laboratory diagnostic testing, though there were no further contracts awarded to BGI under the terms of the framework agreements.

The UK government is increasingly concerned with China's attempts to gain access to Intellectual Property (IP) held in the UK, with Parliament's Intelligence and Security Committee (ISC) recently publishing a report saying China had managed to "successfully penetrate every sector of the UK's economy", and that the UK was of "significant interest to China when it comes to espionage and interference".

Reuters' [investigation](#) into BGI says that "U.S. government advisors warned in March that a vast bank of genomic data that the company, BGI Group, is amassing and analysing with artificial intelligence could give China a path to economic and military advantage. As science pinpoints new links between genes and human traits, access to the biggest, most diverse set of human genomes is a strategic edge."

The US government believes that the capturing of large quantities of genetic data could help China to dominate the pharmaceuticals industry.

This research aims to identify the extent of BGI Genomics' (and any subsidiaries or linked companies such as MGI) work in the UK, and to understand how seriously to take the threat posed to the UK's valuable genetic data.

### **Methodology**

The authors of this report primarily used the Freedom of Information (FoI) Act to find out which public bodies had worked with BGI Genomics, what projects they had worked on, and whether they were still working with BGI.

We used the website WhatDoTheyKnow.com to send FoI requests, primarily to universities, but also to some NHS trusts and police forces, asking for the details of any contracts or joint projects conducted with BGI or MGI.

We collated the responses and then talked to experts in the field to understand whether the work being undertaken by BGI Genomics could have given them access to any valuable data which could be copied and accessed by Chinese government bodies.

We have attempted to situate the findings about BGI's academic partnerships in the larger context of genomic advances and their complexity, and in an understanding of the political sensitivities around Chinese companies and how their business practices could be instrumentalised by the Chinese surveillance state.

### **Findings**

Certain work undertaken by BGI Genomics in the UK had already been reported on before this research.

BGI Genomics' main address in the UK is on the technology campus of **Queen Mary University of London (QMUL)**, where the London Genome Centre is based. QMUL's press office told us that "I can confirm that they rent commercial space as you have noted but nothing beyond that. I.e. no funded or collaborative research projects." The university and BGI have however held at least one [joint networking event](#) together.

In a [parliamentary question](#) about BGI's work on the QMUL campus, Foreign Office minister Anne-Marie Trevelyan said that businesses should comply with UK laws and that "the Government is undertaking a full programme of work to assess how we can minimise the risks from biological data to protect our burgeoning bioeconomy".

In an additional statement, A QMUL spokesperson said: "All Queen Mary University of London's agreements are constructed in full alignment with UK government legislation and

subject to rigorous procedures regarding security, ethics, intellectual property protection and other relevant policies.”

**The University of Oxford** has been reported to have undertaken joint research projects with BGI. They told us that “There are no current agreements with BGI Genomics but six completed ones”. These are as follows:

	<b>Project Description</b>	<b>Completed Date</b>
1	MTA Recipient Beijing Genomics Institute BGI - The aim of this study is to interrogate the impact of typhoid toxin on the human blood transcriptome using RNAseq to analyse samples from volunteers challenged with Salmonella Typhi with or without a toxin gene.	08/11/2017
2	Redefining glomerular histology with spatial transcriptomics	28/10/2019
3	Confidentiality agreement - Relating to collaboration with China Kadoorie Biobank	20/01/2020
4	Confidentiality agreement - To facilitate discussion of BGI/MGI’s spatial transcriptomics technology.	19/06/2020
5	China Kadoorie Biobank - mDNA collaboration with BGI Research - Projects aimed at generating genomic resources from the China Kadoorie Biobank, improving understanding of human origin and evolution and of genetic contributions to human disease, and contributing to precision medicine for Chinese populations.	04/01/2021
6	Data analysis of Stereo-seq results for mouse heart development	09/01/2023

The Chinese [government reprimanded](#) BGI Genomics in 2015 for undertaking a research project with Oxford that involved the genomic data of 140,000 female Chinese citizens. BGI said the research was conducted by a Chinese research and development team in China, and therefore did not risk any data going overseas. Technode reported that “The authority ordered BGI to stop the research, destroy the genetic materials and research data that are not transported overseas and suspend all Chinese human genetic research that involves a foreign partner.”

The Evening Standard has reported that **Exeter University** “has a running contract with a BGI subsidiary involving data sharing”. In a response to our FoI request, Exeter clarified that “The University of Exeter has previously had one contract with BGI Genomics for ‘The provision of a human whole genome sequencing service’ – whereby, anonymised data samples were issued to the supplier for sequencing services. This contract was awarded 16/02/2018 and expired 15/02/2022. While this contract is not ongoing, some low-value, ad-hoc orders have been placed with BGI up-to Dec 2022 in order to complete research associated with the original contract.”

**The University of Bath** [told us](#) that “The University’s Research Innovation Services also holds information on a research project which is supported by BGI Shenzhen as follows: [Polygamy and Purifying Selection in Birds and Dense Sampling of Bird Diversity Increases Power of Comparative Genomics](#). Current PhD research about sequencing which is focused on ecological and evolutionary questions and analysis of the genomes of Arctic shorebirds

has all sequencing and bioinformatics expenses paid for by BGI Shenzhen in regard to this project.”

**The University of Brighton** told us that they “had one contract with BGI Genomics. The contract period is 5.11.19 to 30.11.23. The contract was for equipment hire, training and consumables.” We asked for further details about the nature of the contract, to which Brighton told us that “the contract related to the loan of a MGI G400 sequencer together with purchase of associated reagents and sequencing sets, with training provided to staff/ researcher.”

A spokesperson from Brighton University told us that: “The University of Brighton does not have any contracts in place with BGI Genomics. The contract referenced in our FOI request was put in place by a member of academic staff in our School of Sport and Health Sciences in relation to research on doping testing among elite athletes. The contract was terminated early, and the equipment returned in January 2022... Brighton Integrative Genomics (BIG) Unit does not have, and has never had, any association with BGI Genomics... Brighton Integrative Genomics (BIG) Unit does not outsource sequencing activities. It has its own sequencing equipment, with sequencing data stored securely in line with the university’s security and privacy policies... BIG (and the university’s genomics unit, as it was known pre-2022) has never had any interaction with BGI Genomics of any kind. Any suggestion otherwise would be untrue.”

**The University of Cambridge** initially said they had “two research collaboration agreements (both in medical/biosciences) with start dates of March and April 2023 respectively” with BGI Genomics. The university then clarified, saying “Upon further investigation, it appears that our original response to your request was inaccurate, for which we apologise. There are no current agreements with BGI: the two collaboration agreements previously referred to have not in fact been undertaken.” Asked why these research projects had not gone ahead, the [university said](#) in June 2023 “we can confirm that the agreements remain under review from an ethics perspective.”

**The University of Cardiff** revealed five contracts with BGI or subsidiaries. These contracts, with a number of BGI subsidiaries, were for projects to develop therapies for Rheumatoid Arthritis, sequencing of wildlife for conservation, and general genome sequencing. These are listed below:

External entity	Project Title and Description referred to in relevant legal agreement / contract	Date Signed	Further details
Complete Genomics Inc	MATURA (Maximising Therapeutic Utility in Rheumatoid Arthritis) Collaboration Agreement	04/12/2014	None recorded in central databases
BGI Tech Solutions (HongKong) Co Limited	BGI: Genome sequencing services (wildlife)	10/09/2013	Wildlife conservation genetics
Beijing Genome Institute Europe	Service Agreement: BGI HK	10/10/2011	None recorded in central databases

BGI Tech Solutions (HongKong) Co Limited	BGI: Genome sequencing services (wildlife)	14/10/2014	Wildlife conservation genetics
Beijing Genome Institute Europe	BGI: Genome Sequencing	19/04/2011	None recorded in central databases

**Liverpool School of Tropical Medicine** had one contract: “We have 1 contract for BGI Genomics from 31st January 2018 to 31 July 2018...The contract with BGI Genomics which ran from 31st January 2018 to 31 July 2018 was for cell sequencing.”

The authors of this report also found joint research projects between BGI and five other universities: the University of Liverpool, University of Manchester, the University of Bangor and the University of Birmingham, which set up a [joint research centre](#) with BGI on their campus in 2014.

In response to a follow up sent by the authors to the **University of Liverpool**, the university told us that “at the time of your previous FOI request, we did not have the partner name on our internal system – but it was on the externally held research application. We apologise for this omission. We can confirm that the University does not have any other joint research projects [with] BGI Genomics, or any other company which is part of the BGI Group.”

**The University of Birmingham** requested further information about the nature of our request and when this was provided, they refused to provide the information requested by claiming it would take too much time to provide, saying: “The information being requested is not held in a database that can be searched. Therefore, it would be necessary to interrogate background documents to determine whether these are relevant to this request. It has been estimated that this will take in excess of 18 hours in total.”

However, the university also added, “The University confirms that it holds some of the information you have requested, and that this could be extracted within 18 hours.” Birmingham suggested that we send another FoI request, but limit the scope to “a specific time period beginning no earlier than 2019, being the year in which the University changed its internal case reporting systems”.

Birmingham was the only university to outright refuse our FoI request, a strange lack of transparency given the fact that they published a notice about the setting up of a joint research centre with BGI on their own website in 2014.

The authors sent a request to the **University of Manchester** for further information about joint work, to which the university responded: “We can confirm this [i.e. the link provided] is the only research collaboration between the University and BGI that we can find on our records. This collaboration was awarded as an Innovation Fellowship fund by BBSRC, which supports the exchange of knowledge and skills between academic and industrial sectors.”

An [investigation by the Daily Mail](#) found that **Imperial College London and Edinburgh University** had also collaborated with BGI, who were the primary sponsors of a genomics conference in June of 2023 at Edinburgh. Imperial and Edinburgh both denied having worked with BGI in response to our FoI requests, though a news story from 2012 by

that “[Edinburgh] and BGI have agreed a memorandum of understanding to develop research with BGI which could lead to a new generation of personalised medical treatments.”

An investigation by [The Times](#) has also confirmed that the **University of Edinburgh** uses BGI for sequencing services, and that Edinburgh undertook a collaborative research project with BGI from 2019-21. In response to our FoI, Edinburgh confirmed that they had “a collaborative research project from ERO, and we also provided information about BGI’s sponsorship of [‘A Cell for All Seasons: Macrophages in Health and Disease’](#), a conference that took place in the University on 1 June 2023.

On 5 September 2023, Edinburgh provided [more information](#) about their work with BGI, namely that:

*“The University has recently been involved in commercial interactions with BGI Group’s subsidiaries, including BGI Genomics, BGI Research and MGI Tech. These companies develop, produce and supply reagents and instrumentations used for genomic studies.*

*“Between October and November 2022, researchers from different institutes and centres across have been beta-testing a new technology developed by BGI Research and commercialised by MGI Tech. To carry on this work, reagents were purchased from MGI Tech, and experiments were carried out under the supervision of BGI Research staff members. This was solely due to the technical complexities relative to the use of such technology, while no intellectual contribution towards University research was made by BGI/MGI representatives.*

*“Between 2022 and 2023, the University has been evaluating a contract to demo-test an instrument developed and manufactured by MGI Tech for a period of six months followed by an additional six months. The contract is currently being evaluated by ERO as a material transfer agreement (MTA); it does not involve any payment from the University towards the BGI Group and its subsidiaries including MGI Tech, nor any financial contribution from the BGI Group and its subsidiaries including MGI Tech towards the University. If the agreement is positively evaluated and accepted, the University will have to purchase NGS reagents from MGI Tech at standard prices to operate the instrument. However, this agreement does not involve any form of intellectual contribution towards University research by BGI/MGI representatives.*

*“In 2022/23, the University purchased goods and services from BGI Genomics and MGI Tech. Purchases were completed upon signature of single sales contracts. There was no intellectual contribution towards University research by BGI/MGI representatives.”*

Given that the university initially provided quite limited information about their work with BGI, this eventual admission of more work shows the value of persistence in following up with our FoI requests over a period of many months.

The authors also sent a request for further information to **Imperial College**, to which the university replied “We have no records of Imperial College ever having been a party to a contract with BGI, MGI or subsidiaries. BGI were not part of the legal agreement related to the International Phenome Centre Network and did not provide any funding towards the establishment of the National Phenome Centre, the funding received was from the [1]Medical

Research Council and the [2]National Institute for Health and Care Research as a single grant.”

**King’s College London** also had two studies with BGI, but told us that: “Our Research Management and Innovation Directorate have on record two studies in which an SLA was set up with a BGI subsidiary however, on both occasions no work was outsourced to BGI and the partnerships were not activated. For clarity, no income was received, no samples have been sent for analysis, no access to UK Biobank was involved and no transfers to China.”

When asked about the nature of the SLA agreements and whether ethical concerns had led to the cancellation of these contracts, King’s College refused to provide further details, citing that disclosing commercial information valuable to their competitors would be likely to prejudice the interest of the College in open competition. The authors asked for a review of this decision by the university, and were refused further information.

Lastly, the **University of Southampton** rejected the FoI request sent to them, saying that they do hold information relevant to the inquiry - suggesting they have had contracts with BGI - but refusing to publish details citing commercial confidentiality. The authors have asked for a review of this decision by the university. The authors of this report have since discovered [evidence of a joint research project](#) between Southampton’s faculty of medicine and BGI.

The authors of this report additionally sent freedom of information requests to NHS England, and 48 UK constabularies, none of which held any contracts with BGI.

We also asked [Rothamsted Research](#), one of the oldest agricultural research organisations in the world, about a publication showing they had had a visit from a BGI representative in 2018. A Rothamsted representative told us that “we have had no jointly funded projects with BGI. We did propose using them as sequencing partner on at least one proposal (which wasn’t funded) and for several papers on Brazilian and Chinese soil microbial communities.”

We have also submitted [an FoI](#) to the **UK Health and Security Agency**, asking for information about whether or not the Covid testing contract signed with BGI allowed the company to keep genetic samples after testing. The UKHSA has not responded to this FoI by the time of completion of this report, but should have responded by the end of September 2023, when the response will be visible at the FoI link above.

**NOTE FROM UK-CHINA TRANSPARENCY:** UKHSA has since responded and UKCT has [published](#) its response. Testing under the contract took place at BGI’s site at QMUL. 3,400 samples were processed. UKHSA stated that “BGI were contractually obligated to destroy all samples and delivery media within one week after tests results had been generated.” [The contract itself](#), which has been downloaded from a government database and uploaded to UKCT’s digital library, had a value of £10,800,000 – far more than the small number of samples would suggest. UKCT contacted the UK Health Security Agency to ask about this discrepancy and were told: “BGI was paid for the 3.4k samples tested, not the full £10.8m contract value ceiling. The total spent on the 3.4k samples is commercially sensitive. The contract between UKHSA and BGI expired at its agreed expiry date – it was not cancelled.”

To summarise our findings: of the academic institutions in the UK to have done joint work with BGI or its subsidiaries, seven (Brighton, Bath, Cardiff, QMUL, Edinburgh, Exeter, and Liverpool School of Tropical Medicine) have had contracts with BGI. An additional seven (Oxford, Southampton, Liverpool, Manchester, Imperial, Bangor, and Birmingham) have had joint research contracts with BGI, with Birmingham setting up a joint research centre with BGI. King's College London set up SLA agreements with BGI but no funding was exchanged. Cambridge had two research collaboration agreements with BGI, which were cancelled due to ethical concerns.

### **Analysis**

The authors of this report spoke to a number of experts in the field of genetics to discuss our findings, as well as politician Alistair Carmichael MP, who chairs the all-party parliamentary group on Uighurs, and speaks regularly on human rights in China.

We also spoke to Jens Carlsson, Associate Professor at University College Dublin School of Biology and Environmental Science, and Jeanette Carlsson, senior genetics lab technician at University College Dublin to discuss our findings. We also consulted with Glenn Bryan, a retired geneticist who previously worked at the James Hutton Institute in Dundee.

### **Technical and legal considerations**

Professor Yves Moreau, a professor of engineering at the university of Leuven, Belgium, was previously quoted in the [Evening Standard's investigation](#) into BGI Group. He talked to the authors about the technical aspects of genomic data, the context of BGI's work with UK universities, and how to mitigate the risk of valuable data being stolen or hacked.

Moreau believes that while the vacuuming up of data by states and companies is something to be concerned about, genomic data is "much more sensitive" because it is "potentially medically relevant". Although genomic data is not quite the same as medical data, according to Moreau it does have medical relevance.

When DNA is sequenced, a service provider sends samples to a lab for sequencing, which can either be of the whole genome, or the exome, which, Moreau explains, is "just 1% of the genome that is supposed to be most medically relevant and cheaper." What should happen is that the sample is processed in the lab owned by BGI or another sequencing provider, and the data returned securely to the customer. This data is usually held for 3-6 months before being destroyed.

For European or EU companies, there is a process for redress if the company behaves badly with the data they hold. But in China, says Moreau, where a government minister recently [went missing](#), and the former head of Interpol was disappeared before [being jailed](#) for taking bribes, a charge his wife said was "trumped up", the situation is "more complicated", says Moreau.

"For a Chinese company, the situation is much more complicated. Even if the intentions of the management are entirely honest, well... If you get put under pressure from Chinese authorities as a Chinese national or Chinese company, well, you just have to abide by whatever request is being made. And so if you look into for example, BGI or NIFTY, their



service for prenatal testing, they make a very strong claim that they will never ever share your data with authorities unless compelled to do so by law, which even a Western company would have to,” according to Moreau.

We know that the Chinese surveillance state is trying to get its hands on as much data as possible, which is why the sequencing of genomic data for BGI’s [NIFTY test](#) is concerning. Likewise the BGI Covid testing contract in the UK could have given BGI access to the genomic data of hundreds of thousands of people. However, it’s important to note that this kind of data, while potentially useful for some types of research, is not as useful as data that includes patients’ medical histories and records.

“There is a difference between just having access to the genetic data, which is valuable, and having access to the genetic data and relevant medical information at the same time, which is significantly more valuable. So if I get to pick a data set if I only have a data set of genomic information of individuals, but I know nothing about the condition they're suffering from, usually I'm kind of saying okay, good. I have data, but what exactly can I do? The true relevance only comes when I can also couple the medical information,” Moreau says.

Jens Carlsson says, however, that even if you don’t have medical information, “you can make a link between genetics or medical outcome and the population. For instance, Finnish people tend to be a very unique population genetically. So they're very easily identified, you can easily say that this genome comes from a Finnish person. And from that you can then do estimations of what is the disease picture of Finland. And how they would use that, I don’t know, maybe from a medical point of view, like what pharmaceuticals they should be focusing on what markets they should be focusing on.”

Carlsson adds that this data is only “anonymous to certain level. You can even pull up related individuals from that data and see if you have a mother and daughter or father in the genome database”.

Despite the data you can get from Covid tests being “less interesting” according to Moreau, this doesn’t mean that the Chinese surveillance state would be uninterested in it. The more banal motivation for contracts like the Covid testing services, from the point of view of BGI, is that “by doing business with people, you open the door to more business. And so even something that is less concerning can become more concerning if in the subsequent steps are suddenly not about COVID testing, it's about something else”.

Moreau says that “if you buy kits from BGI and you run your COVID tests yourself, there's no reason to be concerned. If you buy a machine from BGI and you run COVID test with their kit, there is a small concern that what if the machine collected some data, and then shipped it back. That would be really hard to do, because these machines are typically put inside a hospital IT infrastructure that is monitored, normally, with a decent firewall. Somebody would catch that at some point. Plus, the COVID tests themselves only provide information about the viral sequence; that is really not super interesting information. To get an interesting information, you would need to get other types of information like the sequence of an individual from that sample.”

Moreau mentioned the example of Hong Kong, where he said concern was warranted about the collection of DNA data on activists through COVID testing. However, for Moreau, “in a Western country, the risk linked with the COVID test will be very low. The only issue we're

considering is by starting to do large scale business with a company like BGI, what will be the next step?”

When it comes to BGI’s prenatal tests, Moreau says that some technical considerations are important, namely that: “when carried out as designed, they do not provide detailed or even clear information about the entire genome of the mother or the foetus.” However, given that BGI sends samples for testing in Hong Kong, the question for Moreau is whether a patient wants their DNA sample “to potentially end up somewhere in China, where it's really hard to control what happens with it?”

This economic ‘path dependency’ of relying on Chinese firms means that it is possible to become dependent on them, though geneticist Glenn Bryan says that a lot of researchers who used to use BGI for sequencing services have switched to other providers: “It has always been easy to use BGI for sequencing. email for a quote, package up DNA samples and mail them off to China, or more latterly the UK or European facilities. I worked at the James Hutton Institute in Dundee, a lot of people there and elsewhere have been using Novogene recently for sequencing projects; plants mainly in my experience.”

Moreau also says that BGI’s whole genome whole exome sequencing has been impacted by the negative press reports, and he has heard from colleagues who used to send samples to BGI for processing who no longer work with the company.

Likewise, Jens and Jeanette Carlsson said they had previously had contact with BGI through using the company to sequence samples of animal DNA. “Obviously, they may have the data, and they could do whatever they want with it. But that would probably be illegal, because there would be a contract breach if they did.” However, if they are co-funding research, the outputs may be owned by BGI.

Regarding the BGI Covid testing contract, Jens Carlsson says that testing a lot of samples for COVID would result in the company “sitting on a lot of COVID sequences, which gives them an advantage because seeing a new strain wouldn't be a problem for them. And then the question is, can they associate that with a different country or a different population or something?” He also points out that it is important to remember that “the possibility of saving genetic data without the client's knowledge is not unique to BGI but any sequence company in the work could in theory do that.”

One further consideration is that in the past year, progress in genomic research is allowing for a more detailed genetic picture to be seen from prenatal testing. Moreau says “we're kind of able to get some kind of blurry picture of the genome, imagine a very blurry picture of the face, where you could still kind of recognise who it is, if you have a reasonable idea. So you could for example, recognise the ethnicity from the result of something like that, but you could not know whether somebody has a mutation for breast cancer, for example. So I would upgrade my Risk Assessment from low to medium.”

The Reuters article about BGI’s NIFTY tests, while not being factually incorrect, “created a very dark picture, which I don't think was totally warranted. So it is true that that subsidiary is collecting a lot of samples from patients. Those samples are not the easiest to process,” according to Moreau.

## Political considerations

“It’s a hard and pretty uncomfortable truth that higher education in this country is dependent on Chinese money to keep functioning” says Alistair Carmichael. He believes that the misuse of data by companies such as [Cambridge Analytica](#) is indicative of the potential of data misuse, and that as a country we should be taking the protection of genomic data more seriously. He doesn’t want to remove Chinese business from Britain, but believes that the commercial relationship should be based on human rights and that the same rules should apply to all companies.

As the authors of this piece wrote in an article for *Byline Times*, “Since [huge cuts](#) to university funding from 2011 onwards, British universities have come to rely on money from research collaborations and foreign students, particularly from India and China, who pay higher fees than domestic students. It is these cuts, and the marketisation of higher education that has followed, which has made Britain vulnerable to economic attacks, and dependent on foreign money.”

A lack of public funding for UK universities means that they feel required to enter into commercial partnerships with companies who may have links to human rights violations, including arms companies such as BAE Systems, and companies like BGI with links to the military establishment of other states.

Moreau says that while there is collaboration between BGI and the Chinese military, the PLA, “it didn’t strike me as a very intense and structured programme.” Xinjiang public security has released statements about collaborating with BGI, and it is public knowledge that BGI helped set up a DNA database in Xinjiang. However, Moreau says that BGI or MGI, its subsidiary, are not major, top players in this area. “The top would start with Thermo Fisher, Promega, and then a couple of Chinese companies.”

One of the authors of this research has [previously reported on](#) Thermo Fisher’s involvement in providing equipment used in the forced genomic surveillance of minority groups in China.

**UKCT note: in its [response](#) to the publication of this report, BGI Group stated that “BGI Group did not assist in establishing a DNA database in Xinjiang with Xinjiang Public Security. BGI Group does not engage in unethical practices and does not provide technology for the surveillance of minorities. BGI Group does not condone and would never be involved in any human-rights abuses.”**

**As no source for the claim about BGI’s involvement in Xinjiang was included in the original report, and because this is an important point of contention, UKCT has investigated it. There is indeed publicly available [evidence](#) that BGI Group works in Xinjiang and that this work relates to the public security apparatus. One of the strongest pieces of evidence is an account of a signing ceremony published in 2016 by a branch of the government of Xinjiang. According to this account, the ceremony marked the signing of a deal whereby BGI Group would establish a major presence in Xinjiang and work with the government on health, medicine and agriculture but also, critically, on building a “Xinjiang gene bank” (“新疆基因库”) and on “innovative technology for the justice system” (“司法创新技术”). Present were Wang Jian 汪建, who is BGI’s chairman, but also senior officials from Xinjiang and from the China National GeneBank. The account of the ceremony has since been removed from the**

Internet by the Xinjiang government, however, an [archived version](#) of it has been saved in the Internet Archive.

Confronted with the above paragraph, BGI Group told UKCT: “BGI Group would like to clarify that the signing ceremony was for a strategic agreement framework, which did not stipulate any concrete projects. The projects on "innovative technology for the justice system" and the “Xinjiang gene bank" do not exist, as they never commenced in the first place.”

### **The Genomics England hack claim**

On March 8, 2023, George Freeman MP [stated during a parliamentary debate](#) on genomics and national security that:

“BGI is clearly one of those danger points in the ecosystem. I share with the House the fact that, in 2014, I was wheeled out to give a speech on the occasion of the visit of President Xi to the Guildhall. When President Xi and then Prime Minister Cameron were wheeled in, I was speaking to around 1,000 Chinese delegates about Genomics England. I had been prepared to pay tribute to the work of BGI when my officials pointed out that at that point Genomics England was suffering several hack attacks from BGI each week. [\[Official Report, 9 March 2023, Vol. 729, c. 2MC.\]](#) That was a wake-up call for all of us.”

There is an [official correction](#) to this statement in Hansard, stating that there is no evidence of what Freeman stated.

George Freeman > Share

I had been prepared to pay tribute to the work of BGI when my officials pointed out that at that point Genomics England was suffering several hack attacks from BGI each week.

*[Official Report, 8 March 2023, Vol. 729, c. 120WH.]*

*Letter of correction from the Minister of State, Department for Science, Innovation and Technology, the hon. Member for Mid Norfolk (George Freeman):*

An error has been identified in my response to the debate.

The correct response should have been:

George Freeman > Share

There is no evidence of attempted hacking of Genomics England in 2014 from BGI.

Carmichael believes that the government were quite angry with Freeman for stating this: “I can only imagine what happened thereafter, I'm pretty certain that BGI were on to the department saying, what the hell have you said here? And he issued a clarification, which was on the narrowest of distinctions, meaningless really, and he said that you couldn't say that they'd hacked Genomics England, because none of the attempts at hacking were successful.”

On the claim made by George Freeman MP that BGI had attempted to hack into Genomics England, Moreau says that “I think that it should be revisited very carefully. If you read the [Guardian piece](#), it starts with this claim. And then somewhere down the article, it's also stated that the office could not confirm it. So I find that statement difficult to believe.”

The authors of this report approached George Freeman MP for an interview but received no reply. Moreau says he finds it more likely that Chinese hackers linked to the security state could have attempted to hack Genomics England, but the idea that it was BGI specifically who attempted the hack Genomics England “would imply that BGI has some kind of in house team of hackers that they can direct against certain targets. And that we can't totally exclude it, but that seems far fetched to me. So it would require, you know, a pretty high burden of proof, you'd have to be really sure.”

As mentioned previously, BGI was fined by Chinese authorities for exporting genomic samples out of China. Moreau sees this as evidence that the company is not synonymous with the Chinese state.

“Chinese authorities definitely view genomic data as a strategic resource. And so they want to leverage at the minimum, the national genomic diversity as an asset like oil, at that level that is really quite clear from the legislation and from their actions,” says Moreau.

Jens Carlsson says that “Looking at the Chinese and their technology, where they've been going lately, I think you're looking at the pharmaceutical industry - definitely interested in this. The other aspects, probably human identification, like from remains, human remains like saliva, thumb prints, etc. If you look at the identification, using cameras, the AI they're working on, it's getting quite complex. So adding another layer to that for identifying humans to get their identity, I think.”

Jeanette Carlsson adds that “just for research, people are going full genome sequencing, that's the trend now. Full genome, everything to create biobanks everywhere.”

However, in leveraging genomic data, it should be remembered that “the genomic information of an individual is not a resource to be controlled by authorities, my genome does not belong to them. So it's a balance to be found, obviously there is an element of common good that can only be leveraged if the data is made available, to borrow research in appropriate ways. We have to be careful not to transform that data into some kind of asset that gets traded, because ultimately, it's information about people, and not resources of the authority.”

Looking at the lists of research agreements and studies conducted by BGI with UK Universities, Moreau says that they look like “run of the mill research questions. I mean, of course, you can always interpret things to say do we really want to be working on salmonella with the Chinese, but this is really what people do in biomedical research, it's really quite typical.”

The concern for Moreau is not these research collaborations, most of which are publicly available for anyone to benefit from and would not be of any use to Chinese authorities on their own. He says instead that “for me the actual risk is the idea that many researchers, many hospitals [are] sending year after year tens of thousands of samples to BGI in Copenhagen or

in California with the risk that at some point that data can divert, and I think that is really the concern.”

Moreau says the management of BGI has been “quite independent”, and that CEO Wang Jian has been seen as “a bit of a maverick, and has not always spoken super highly of the Chinese authorities. And I also hold it from people who have close contact with them, they don't really see him as a goon of the Communist Party that would be there with horrible intentions.”

Despite this impression of independence, Moreau says, “if you get put under pressure, then you do what you're being told. That's all there is to it.” The risk is that if genomic researchers keep working with BGI, and they accumulate “10s of millions of samples, and eventually a copy of much of that ends up in China. I think that that is for me, the actual risk.”

One way to mitigate this risk, Moreau says, is “don't do a whole whole genome analysis of patients or whole exome analysis, which is data that is really quite significant.”

BGI says that it simply processes samples, sends them back, and then destroys the data after a while, without ever seeing the relevant medical information that would make the data useful. Moreau says this is a correct argument that holds for low volumes of data, but when we are talking about data on millions of people, it's a different proposition.

“So then suddenly, we're talking about a couple of hundreds of millions of genomes, and good share of that would have been done by BGI, 20-50% of that, but we know somebody's talking on the scale of a couple of decades, about 10s of millions or even 100 million people that would have gone through BGI hub, that is certainly a very substantial asset. And so how do we ensure that nothing wrong happens with that? Of course, by simply keeping the spotlight on BGI we may be able to prevent the worst of it,” Moreau says.

## **Conclusion**

Jens Carlsson says that advances in genomics are a “double edged sword. It could be used in the wrong hands to do really bad stuff... the more data you have, the more you have to mine and the better information you can get out of it. And the more precise you can be. Now do I see a danger? I don't know. That's more of a philosophical question than a scientific question, I believe.”

The human genome project cost about \$5 billion dollars and took 13 years, Carlsson says, but “we can now do that in 48 hours for 900 euros.” This opens up the possibility of research that could lead to significant healthcare improvements, but also creates lots of data that must be safeguarded.

Understanding the threats to these data, and how to prevent hostile actors getting access to sensitive data, will be a question for policymakers, cybersecurity experts and scientific ethicists for the foreseeable future.

The geneticists we talked to did not feel that the contracts and research work done by BGI in the UK were problematic on their own. However, relying on the company for genetic sequencing, whether by researchers, users of the NIFTY test, or the government's award of a

COVID testing contract, could create a long-term threat of large amounts of data being held by the company becoming accessible to Chinese authorities, especially if held in Hong Kong.

For Carmichael, “this is not just about genomics, but this is about the position of academia in this country, of higher education in general and the way that it relates to China.” Some universities are “wilfully blind” to how the relationship between Chinese companies and the Chinese Communist Party works. National Security Law in China requires any Chinese consulate to open the books for any security interest that the government thinks is necessary or expedient for them to do. Carmichael says that we should not be naive about the issues this creates for entrusting Chinese companies with sensitive data.

Carmichael adds that the goal is not to isolate China or to kick Chinese businesses out of the UK. “I don't want to kick Chinese business out of Britain, I think that there are a lot of really good influences that we can share and develop together, especially in a field like this. But it has to be done on the basis of concern and respect for human rights.”

Companies in the field of genomics need to develop best practices in dealing with large quantities of DNA data. Biobanks with hundreds of thousands of genomes must be kept secure from hacking, and medical data and genomic data on patients should be kept separately and securely.

The UK has its own genomics industry which has also benefited from contracts for sequencing services during the pandemic, and this industry should be encouraged and developed further by government. There is no reason why researchers at UK universities should not go on working with BGI on joint research which can benefit the wider academic community, but universities should in general be wary of relying too heavily on Chinese funding.

As the pandemic and Ukraine war have shown, a global pandemic or political crisis can have huge effects on supply chains and material costs. Learning to be politically and technologically resilient to these kinds of shocks involves onshoring supply chains for sensitive types of production, which also includes the production of valuable genomic data on populations.

The potential benefits and dangers of advances in genomics are slowly coming into focus. Ensuring the former while mitigating the latter involves political choices, as well as developing ethical and technical standards in the handling of genomic information. The amount of genetic data that exists is only going to keep growing, and so the problem of keeping that data safe will continue to concern officials for years to come.