

Background

The NIHR BioResource (<https://bioresource.nihr.ac.uk/>) is at the heart of efforts to improve healthcare and the long-term prevention and treatment of disease. We achieve this by engaging with **participants**, and collaborating with leading research groups in academia, NHS and industry to rapidly translate findings in the laboratory into benefits for the clinic.

We also grant access to **samples, data and resources** to tackle healthcare challenges. The BioResource has a decade of experience and a large team in Recruitment & Recall, Sample Management, Ethics & Governance and Informatics.

To **engage with the public**, we have an active website, circulate newsletters, attend festivals/fairs, invite lay members to join committees, and hold virtual events.



The BioResource recruits at a **national** scale to 9 **programmes** covering common diseases, rare diseases, healthy population and COVID-19. There are 13 NIHR BioResource centres around England.



Participants consent to the NIHR BioResource via a programme (**Stage 1**) either electronically (tablet, website) or using a paper form.



Personal details are kept separate from research data. Consent includes access to medical or other health-related records.



Samples (blood or saliva) are collected allowing DNA, serum and plasma to be banked and accessed on demand.



DNA is **genotyped** using the UK Biobank v2.1 Axiom Array, and if required, we perform whole genome or whole exome sequencing (WGS/WES).



Depending on the programme, demographic, health & lifestyle (H&S) and clinical **data** is collected to get **phenotypes**.



Volunteers may be invited to **Stage 2** studies (up to 4 times/year face to face and 4 requests/year for online surveys) based on their **genotypes** or **phenotypes**.



Researchers can request to use samples in our biobank, data we have collected or recall participants via a **Stage 2** study.

Stage 1 Biobanking

Participants per programme	DNA extracted from 2 sources		Banked aliquots for further use		Genetic data			Phenotype data	
	Blood	Saliva	Serum	Plasma	Array	WGS	WES	H&L	Clinical
~ Count (Aug 2021)									
COV 7,600	✓		✓	✓	✓			✓	✓
CYP 9		✓						✓	
GEN 40,000	✓	✓few	✓	✓	✓			✓	
IBD 34,000	✓		✓	✓	✓16.5K	✓2K	✓12K	✓	✓
IMID 700	✓		✓	✓				✓	✓
MH 31,000		✓			✓			✓	✓
NAFLD 250	✓		✓	✓				✓	✓
RDC 15,000	✓	✓few	✓	✓	✓	✓8K	✓	✓	✓
STR 52,000	✓		✓	✓	✓			✓	

COV - cutting edge research looking at COVID-19

CYP - recruiting under 25s to the new (Aug 2021) Young People's BioResource

GEN - participants recruited from the general population

IBD - national platform looking at Inflammatory Bowel Disease

IMID - helping research into Immune-Mediated Inflammatory Disease

MH - improving our understanding of different Mental Health illnesses

NAFLD - a partnership to research Non-Alcoholic Fatty Liver Disease

RDC - aiming to identify genetic causes of Rare Diseases

STR - working with NHS Blood and Transplant to recruit donors to STRIDES

Stage 2 Sample Use

Year	Shipments to researchers			Number of aliquots shipped		
	DNA	Serum	Plasma	DNA	Serum	Plasma
2018	11	4	1	2660	1030	673
2019	17	1	1	21929	1264	1179
2020	3	11		4763	10017	
2021	2	13	3	5698	944	860

Samples are stored at a central biorepository (National Biosample Centre) for future use. The BioResource can help researchers choose samples or data of interest based on genotype and/or phenotype either by participant recall or the provision of data and/or samples. Applications are reviewed by the NIHR BioResource Steering Committee.

Work so far has led to:

- > 790,000 stored aliquots
- > 60,000 detailed full blood counts for blood donor studies such as STRIDES
- > 128 Stage 2 studies (including 11 shipments related to COVID-19)
- 234 publications to date since 2009 (<https://bioresource.nihr.ac.uk/publications/>)

Case studies

We responded quickly to help with the COVID-19 pandemic. Within a month of the first national lockdown, working closely with the Cambridge Institute of Therapeutic Immunology & Infectious Disease, samples taken from patients at screening pods and healthcare worker serology screenings (~6000) were stored. The COVID BioResource has expanded to support Stage 2 studies including vaccination (healthy and disease groups) and long COVID clinics. By rapidly providing banked serum or plasma samples to collaborators, key findings were expedited and published:

- 3% of asymptomatic HCWs tested positive for SARS-CoV-2 (Rivett et al., eLIFE, 2020).
- Understanding the immune responses following vaccination in elderly participants and younger healthcare workers (Collier et al., Nature, 2021).
- Looking at detailed immune phenotyping at multiple time points up to 90 days from symptom onset in patients with progressive COVID-19 compared to those with mild disease (Bergamaschi et al., Immunity, 2021).

The BioResource has been pivotal in recruiting patients, and in some cases their relatives, with a Rare Disease. We work in more than 50 disease areas, including in immunity, neuroscience, haematology, rheumatology, and cardiovascular disease.

- Contributions have been made to the 100,000 Genomes Project, led by Genomics England in partnership with the NHS, to reach the goal of sequencing 100,000 whole genomes from NHS patients.
- Sequencing samples of rare disease patients has led to recognition of patients' individual genomic variant information in clinical decision-making and a genetic diagnosis to 1,138 patients (Turro et al., Nature, 2020).
- Banked samples (2000 plasma aliquots) provided to a Stage 2 study for von Willebrand factor (VWF) level analysis and comparison to genetic data, this is the most common inherited bleeding disorder in the UK.
- Recently, the BioResource team has expanded to include the Rare Disease RNA Phenotyping project to drive forward knowledge at a cellular level.