

# Is Epstein-Barr Virus (EBV) the cause of multiple sclerosis? A preliminary study

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		<input type="checkbox"/> Protocol
<b>Registration date</b> 21/07/2022	<b>Overall study status</b> Ongoing	<input type="checkbox"/> Statistical analysis plan
		<input type="checkbox"/> Results
<b>Last Edited</b> 18/12/2023	<b>Condition category</b> Nervous System Diseases	<input type="checkbox"/> Individual participant data
		<input type="checkbox"/> Record updated in last year

## Plain English Summary

### Background and study aims

Multiple sclerosis (MS) is an autoimmune disorder affecting the central nervous system. Data supports Epstein Barr Virus (EBV) as being necessary, but not sufficient, for someone to develop MS. The memory B-cell population is a subset of immune cells that has been suggested to be the cell population driving MS. The memory B cell population, which contains the subset of cells that are latently infected with EBV, is critical in the development of MS and is likely to be the main target of licensed MS treatments. The aim of this study is to see if people with MS have evidence of ongoing EBV replication compared to healthy volunteers, and whether or not MS treatments impact EBV replication.

### Who can participate?

People with MS and healthy volunteers aged 18 years or above.

### What does the study involve?

Participants will be asked to provide up to three extra blood and saliva samples. They will be asked to complete a questionnaire regarding their demographics, medical history, current medications and natural history of MS. No personal identifiers will be collected as part of the questionnaire.

### What are the possible benefits and risks of participating?

Blood tests are a safe procedure but there can be complications, such as bruising at the site of puncture and excessive bleeding. The researchers will minimise the risk of complications by having trained personnel perform the blood extraction in accordance with infection control guidelines. They are not aware of any risk linked to taking saliva samples. There is no immediate benefit to participants, but it is hoped that the findings from this study will help with the development of new MS treatments in the future.

### Where is the study run from?

Queen Mary University of London and Barts NHS Trust (UK)

### When is the study starting and how long is it expected to run for?

October 2021 to February 2026

Who is funding the study?  
Horne Family Foundation (UK)

Who is the main contact?

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**Additional identifiers****EudraCT/CTIS number**

Nil known

**IRAS number**

313742

**ClinicalTrials.gov number**

Nil known

## Secondary identifying numbers

IRAS 313742

# Study information

## Scientific Title

EBV and Memory B-cells study in patients with multiple sclerosis

## Acronym

EBV-Mems

## Study hypothesis

Multiple sclerosis (MS) is an autoimmune disorder affecting the central nervous system. Epidemiological data support Epstein Barr Virus (EBV) as being necessary, but not sufficient, for someone to develop MS. The memory B-cell population is a subset of immune cells that has been suggested to be the pathogenic cell population driving MS. The memory B cell population, which contains the subset of cells that are latently infected with EBV, is critical in the pathogenesis of MS and likely to be the main therapeutic target of licensed MS disease-modifying therapies. We propose testing this hypothesis, using a range of technologies, to see if people with MS (pwMS), compared to normal controls, have evidence of ongoing EBV replication and whether or not MS disease-modifying therapies impact EBV replication.

## Ethics approval required

Ethics approval required

## Ethics approval(s)

Approved 22/11/2022, West of Scotland REC 5 (Research Ethics, Clinical Research and Development, Dykebar Hospital, Grahamston Road, Paisley, PA2 7DE, United Kingdom; +44 (0) 141 314 0214; WoSREC5@ggc.scot.nhs.uk), ref: 22/WS/0150

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## Study design

Single-centre longitudinal biomarker and laboratory study

## Primary study design

Observational

## Secondary study design

Longitudinal biomarker and laboratory study

## Study setting(s)

Hospital, Laboratory

## Study type(s)

Other

## Participant information sheet

Not available in web format, please use the contact details to request a participant information sheet

## **Condition**

Multiple sclerosis

## **Interventions**

This longitudinal study, with the option to retest study subjects, will examine peripheral blood and saliva samples of people with Multiple Sclerosis (pwMS) and normal control subjects. EBV viral loads and EBV genome sequencing from spontaneously derived lymphoblastoid cell lines (LCLs) will be compared. Participants will also be asked to consent if they are prepared to return for repeated sampling (both blood and saliva) for the study over a period of 3 years. This will be a maximum of three time points at least 12 months apart (12, 24 and 36 months). We only anticipate recalling subjects who produce spontaneous LCLs, 12-24 months later, to ascertain whether the ability of their cells to spontaneously form LCLs is a stable phenomenon and to reassess the stability of the EBV genome and B-cell and T-cell repertoire between two different time points. Number of participants: up to 200 people with MS (pwMS) and up to 400 healthy subjects, with the aim of generating 100 LCLs from study subjects with MS and 30 LCLs from healthy subjects.

Comparisons of EBV viral loads will be done using a two-sided unpaired T-test if the data follows a normally distributed. The normality of the distribution will be measured using the Kolmogorov-Smirnov test. If the data is shown to be nonparametric standard transformation methods will be applied to the data. If transformation methods are unsuccessful the groups will be compared using Wilcoxon rank-sum test depending on the distribution.

## **Intervention Type**

Other

## **Primary outcome measure**

EBV viral loads in cell-free plasma, peripheral blood mononuclear cells, B-cells, memory B-cells and saliva measured using a standard EBV-specific RT-qPCR assay at time zero, 12 and 24 months

## **Secondary outcome measures**

1. EBV genome analysis and B cell repertoire analysis using DNA extraction, library construction, targeted enrichment and sequencing at time zero, at 12 months and at 24 months?
2. Proportion of subjects with MS who generate LCLs compared to healthy control subjects measured using LCLs ex vivo in cell culture lines numbers  
Time points are not relevant as this is a cross-sectional biomarker study with the option of calling back the LCL+ve subjects to assess how reproducible the findings are.
3. Relative number of EBV-associated LCLs generated by pwMS on each DMT measured using LCLs ex vivo in cell culture lines numbers.  
Time points are not relevant as this is a cross-sectional biomarker study with the option of calling back the LCL+ve subjects to assess how reproducible the findings are.
4. Mutations, deletions and insertions in the EBV genomes from pwMS LCLs and normal controls, measured using principal component analysis as described by Palser and colleagues (Palser et al. 2015).  
Time points are not relevant as this is a cross-sectional biomarker study with the option of calling back the LCL+ve subjects to assess how reproducible the findings are.
5. Proportion of subjects with MS who have type 2 EBV genome compared to healthy control subjects measured using principal component analysis as described by Palser and colleagues

(Palser et al. 2015)

Time points are not relevant as this is a cross-sectional biomarker study with the option of calling back the LCL+ve subjects to assess how reproducible the findings are.

6. The relative number of genetic polymorphisms in the B-cell repertoire (IgG sequences) of pwMS on each DMT measured using [method] Antibody genes will be sequencing by high-throughput Illumina Miseq sequencing (using 300bp paired-end reads).

Time points are not relevant as this is a cross-sectional biomarker study with the option of calling back the LCL+ve subjects to assess how reproducible the findings are.

7. EBV-specific T-cell response measured using EBV-specific tetramers after antigen-specific stimulation with intracellular cytokine staining, elispot gamma-interferon production analysis and proliferative responses in subjects that produce spontaneous LCLs compared to subjects who do not, at time zero, at 12 months and at 24 months

### **Overall study start date**

01/10/2021

### **Overall study end date**

01/02/2026

## **Eligibility**

### **Participant inclusion criteria**

People with MS (pwMS):

1. Diagnosis of Multiple Sclerosis according to the McDonald criteria (Thompson et al. 2018)
2. Age above 18 years
3. Informed consent

Normal controls (healthy volunteers):

1. Age above 18 years
2. Informed consent
3. Absent of a pre-existing autoimmune disease, for example, type diabetes mellitus, autoimmune thyroid disease, inflammatory bowel disease, psoriasis, etc

### **Participant type(s)**

Mixed

### **Age group**

Adult

### **Lower age limit**

18 Years

### **Sex**

Both

### **Target number of participants**

Up to 200 people with MS (pwMS) and up to 400 healthy subjects, with the aim of generating 100 LCLs from study subjects with MS and 30 LCLs from healthy subjects.

### **Participant exclusion criteria**

People with MS and healthy subjects:

1. Other pre-existing autoimmune diseases, for example, type I diabetes mellitus, autoimmune thyroid disease, inflammatory bowel disease, psoriasis, etc
2. Unable to comply with study requirements
3. Unable to give informed consent to participate

**Recruitment start date**

01/09/2022

**Recruitment end date**

01/08/2025

## Locations

**Countries of recruitment**

England

United Kingdom

**Study participating centre**

**The Royal London Hospital Laboratory**

The Royal London Hospital

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London

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## Sponsor information

**Organisation**

Queen Mary University of London

**Sponsor details**

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**Sponsor type**

University/education

**Website**

<http://www.jrmo.org.uk/>

**ROR**

<https://ror.org/026zzn846>

## Funder(s)

**Funder type**

Charity

**Funder Name**

Horne Family Foundation

## Results and Publications

**Publication and dissemination plan**

The results of the study will be disseminated by:

1. Publication in peer-reviewed scientific journals
2. Internal report
3. Conference presentation
4. Participants will be asked whether they would like to receive a copy of the publication
5. A live presentation will be made at the Barts MS research open day

**Intention to publish date**

01/08/2026

**Individual participant data (IPD) sharing plan**

The datasets generated and/or analysed during the current study during this study will be included in the subsequent results publication

**IPD sharing plan summary**

Published as a supplement to the results publication

**Study outputs**

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">HRA research summary</a>			28/06/2023	No	No