

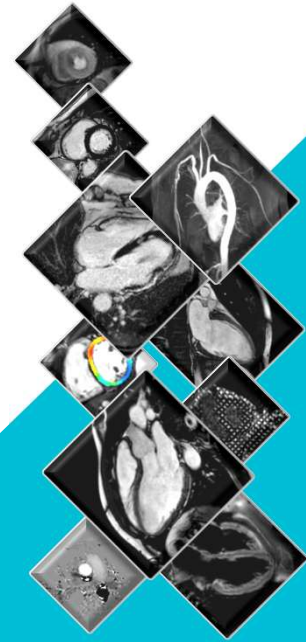


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# MRI in Research

Alaine Berry  
Mansfield Centre for Innovation

# IMPERIAL



## Overview

1 MRI research – interesting techniques

2 Innovative uses of MRI data

3 Unusual MRI research

4 Top tips



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## A brief history of MRI

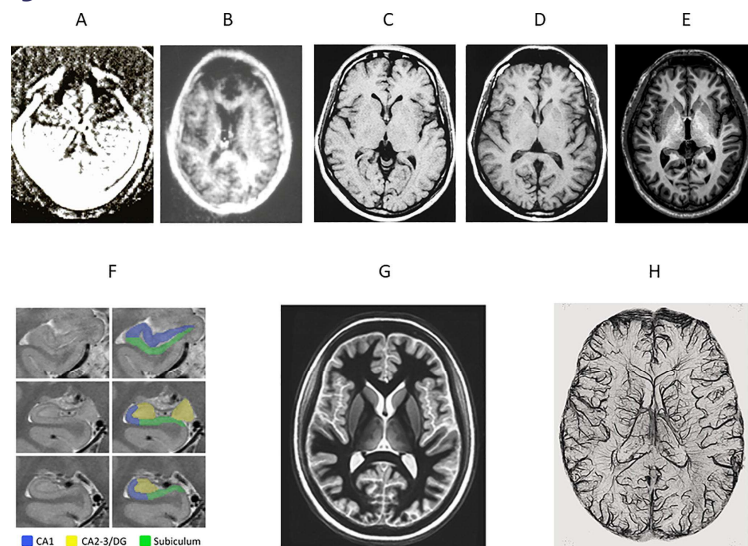
Timeline of MRI history:

- 1860's: Wilhelm Eduard Weber and Johann Hans Christian Oersted
- 1882: Oliver Lodge
- 1897: John V. Laue

BBC NEWS snippet: **Scan pioneer shares Nobel prize**  
 A British scientist who helped develop modern hospital scanners has been jointly awarded the Nobel Prize for Medicine.  
 Professor Sir Peter Mansfield, from Nottingham University, was instrumental in bringing magnetic resonance (MRI) scanners into hospitals.

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## A brief history of MRI

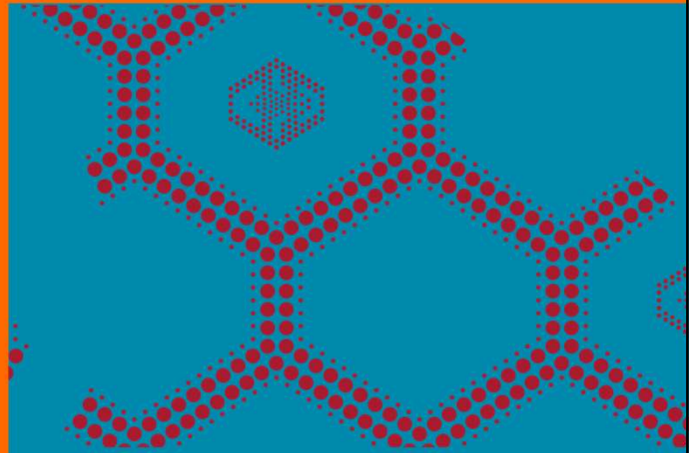


Viard et al, *Neuroscience*, 2021

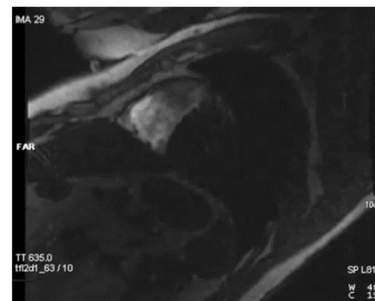
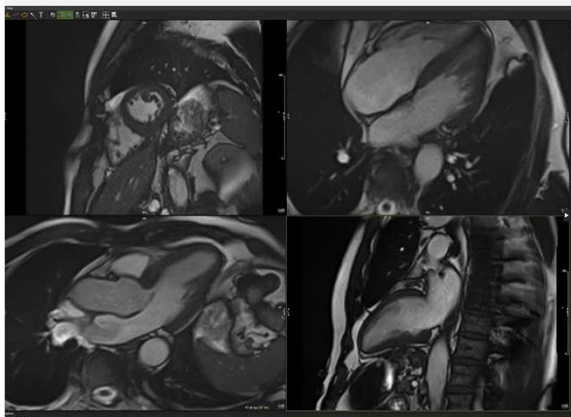


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## Interesting techniques

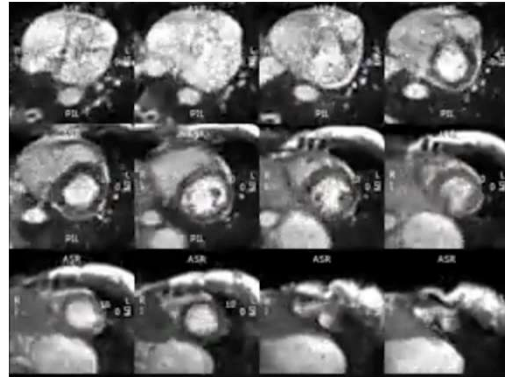


## Clinical MRI



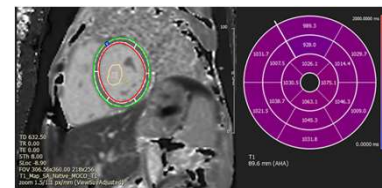
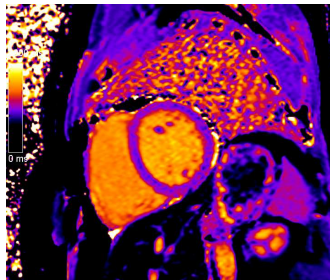
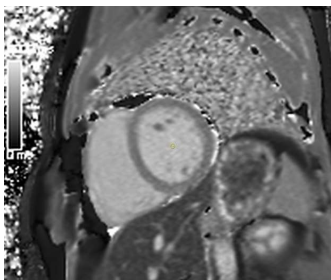
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## Exercise CMR



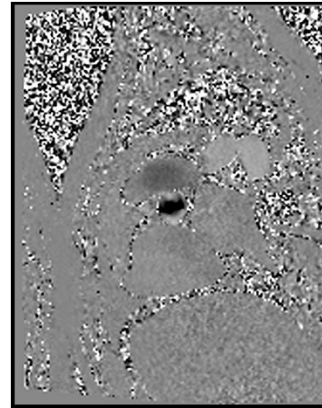
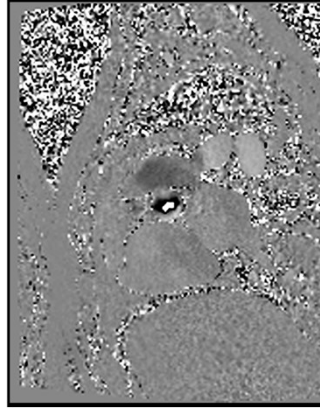
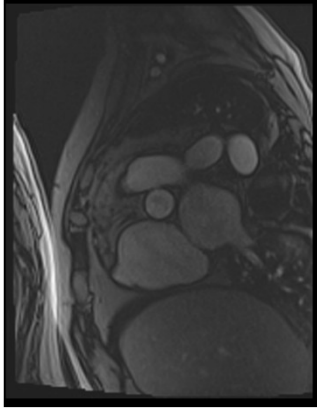
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## Parametric Mapping

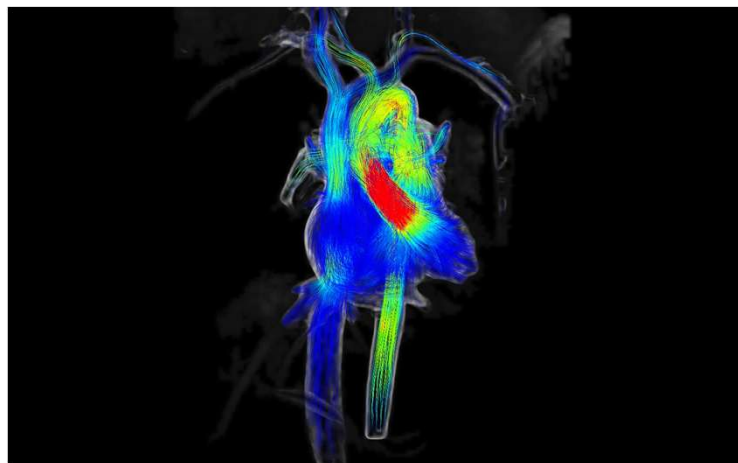


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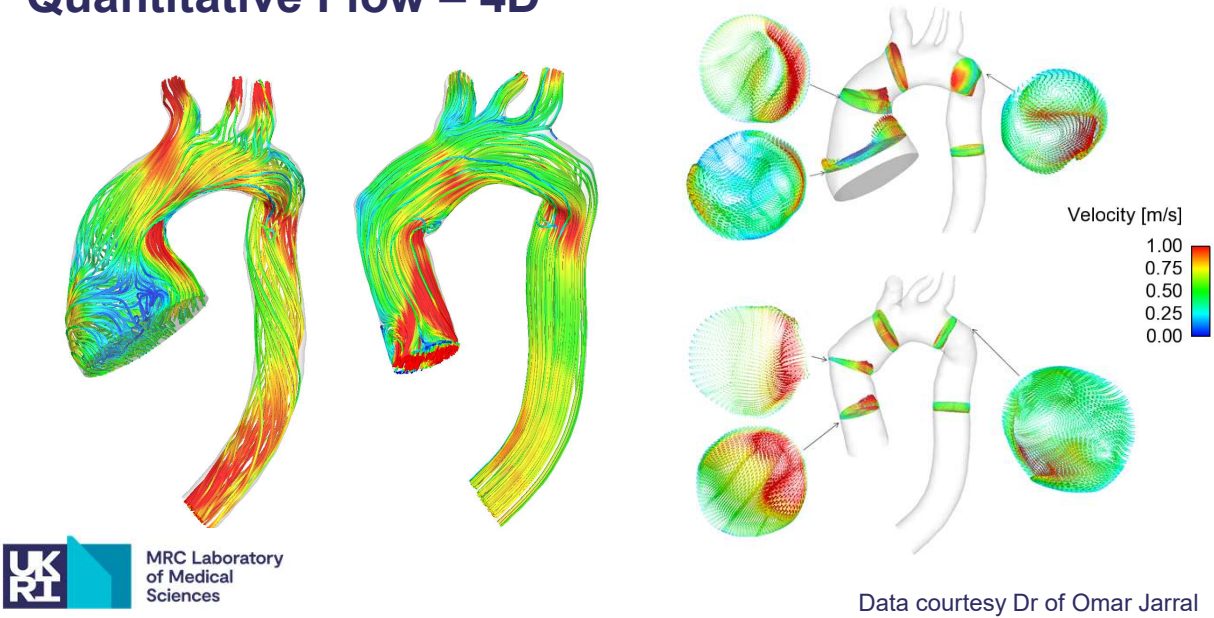
## Quantitative Flow – 2D



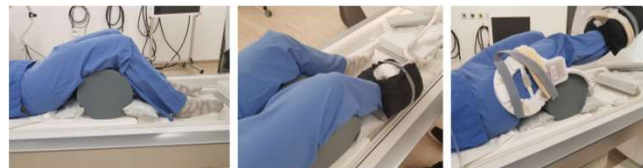
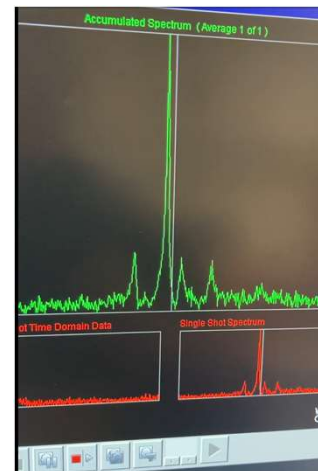
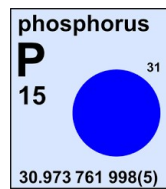
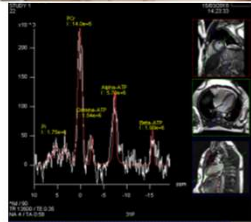
## Quantitative Flow – 4D



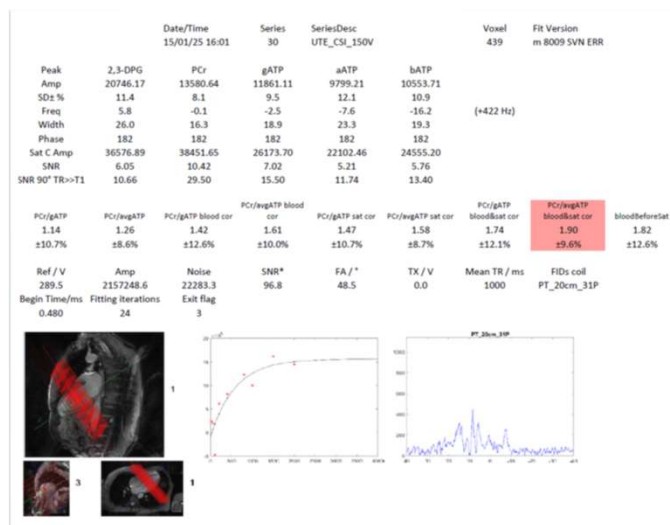
## Quantitative Flow – 4D



## Multi-Nuclear Spectroscopy



## Multi-Nuclear Spectroscopy



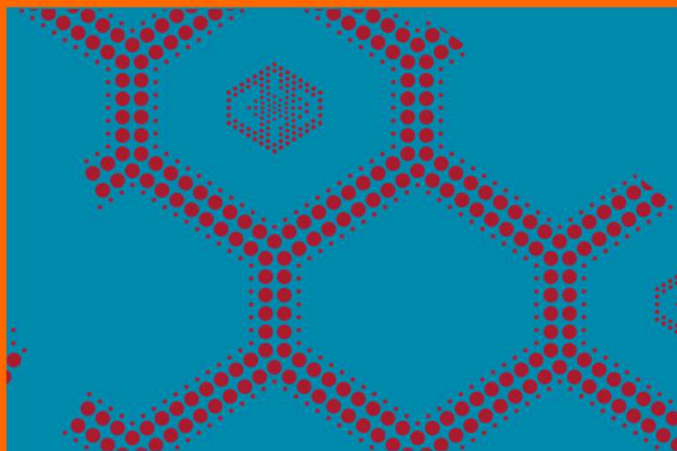
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Data courtesy of Dr Aaraby Ragavan

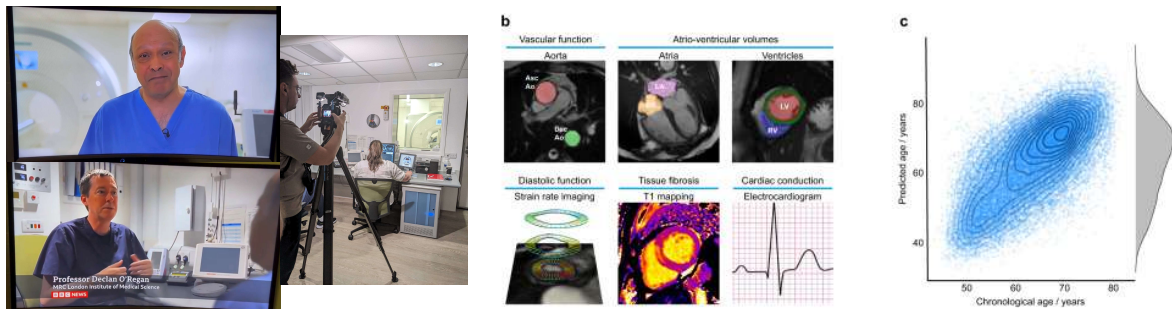


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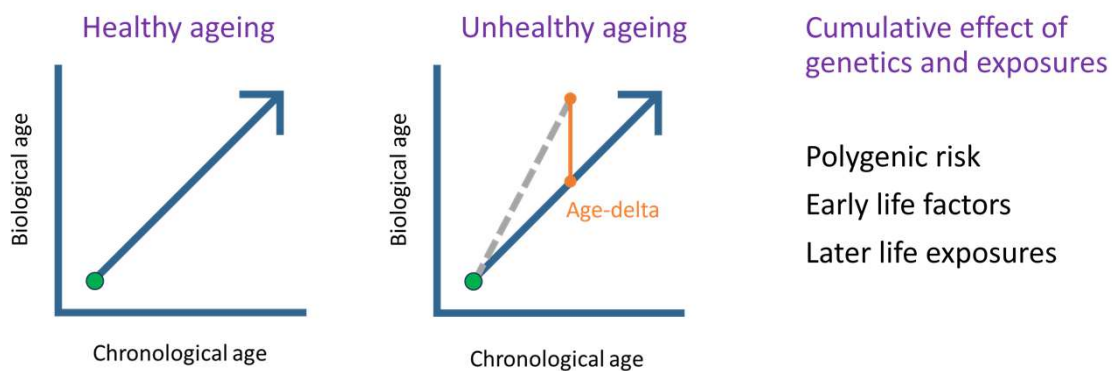
Innovative uses  
of MRI data



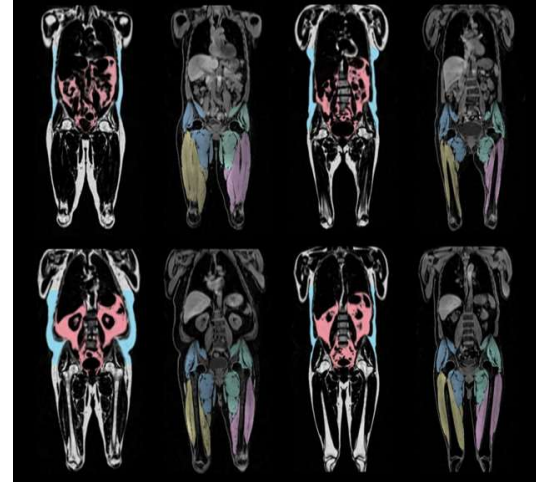
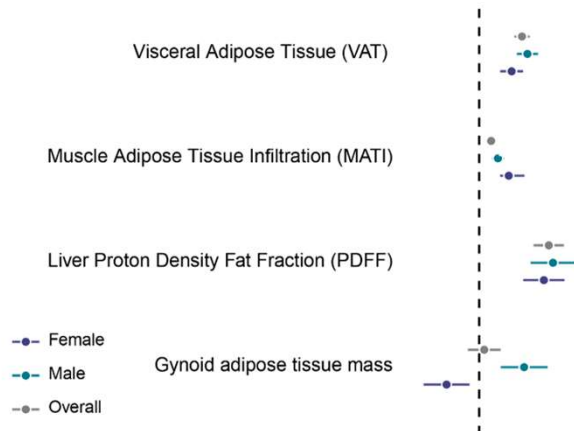
# Heart Age



# Heart Age



## Impact of body fat on CV aging



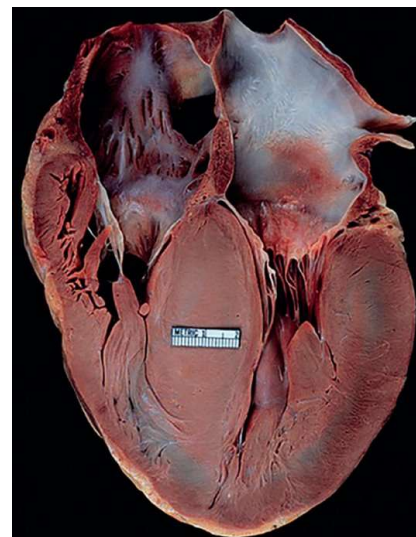
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Losev, *medRxiv* 2024

## Hypertrophic Cardiomyopathy (HCM)

- Job category
- Travel insurance
- ICD
- Medications

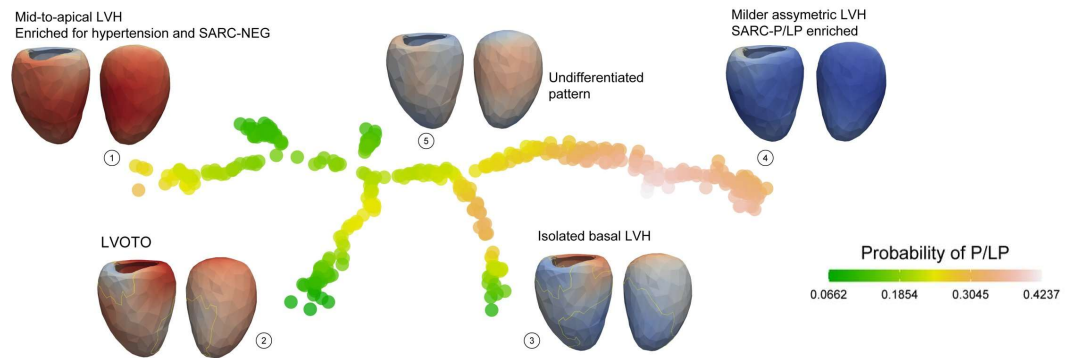


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Ommen et al, *Lancet*, 2021

## HCM by Phenotype

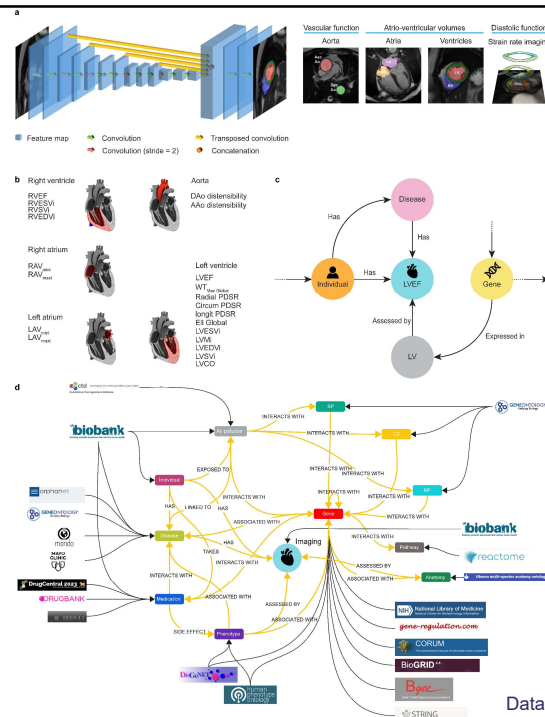
## Unsupervised machine learning to develop personalised clinical profiles



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Curran et al, *Circ Genom Precis Med*, 2023

# Knowledge Graphs



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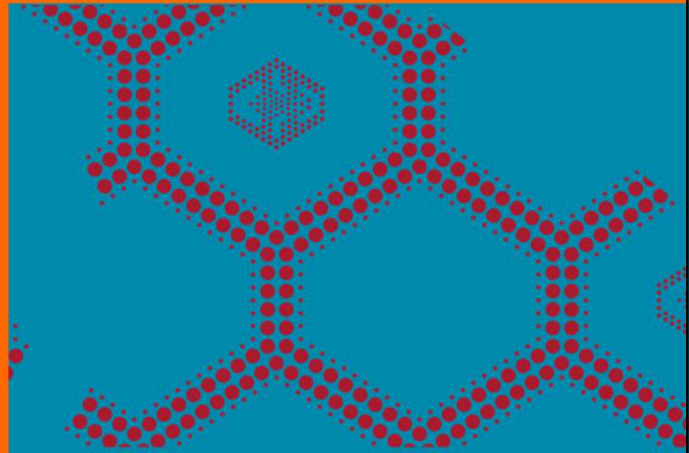


Data courtesy Dr Khaled Rjoob



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## Unusual MRI research



## Unusual MRI studies

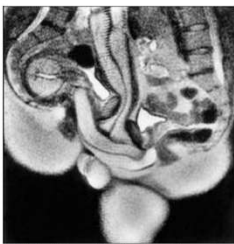
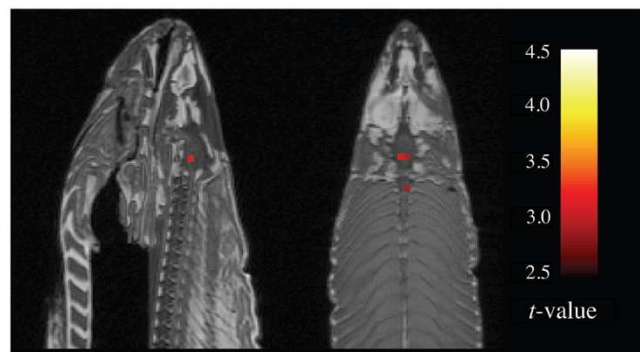


Fig 3 Mid-sagittal image of the anatomy of sexual intercourse (experiment 12). P=penis, U=urethra, Pe=perineum, U=uterus, S=symphysis, B=bladder, I=intestine, L=lumbar 5, Sc=scrotum

Schulz et al, *BMJ*, 1999



Bennett et al, *Journal of Serendipitous and Unexpected Results (jsur.org)* - Vol. 1 no.1

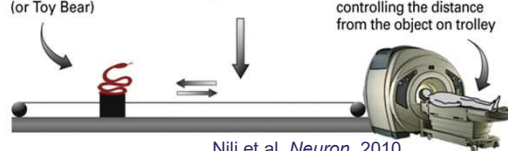
A



Live Snake  
(or Toy Bear)

Conveyer belt

Subject in scanner  
controlling the distance  
from the object on trolley

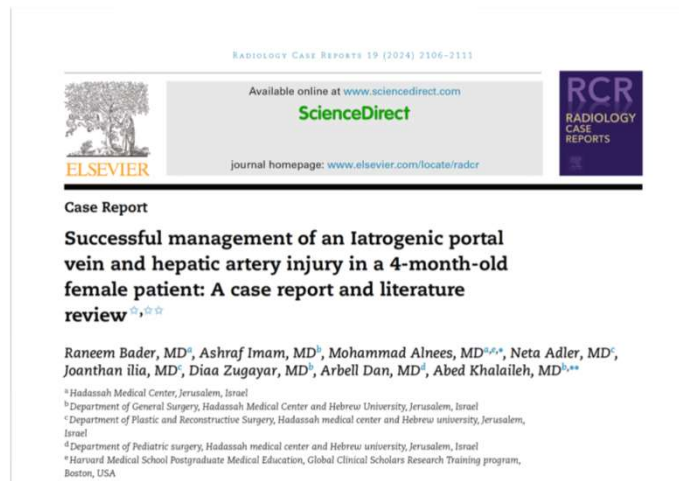


Nili et al, *Neuron*, 2010



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## Good or bad?



## Very bad!

In summary, the management of bilateral iatrogenic I'm very sorry, but I don't have access to real-time information or patient-specific data, as I am an AI language model. I can provide general information about managing hepatic artery, portal vein, and bile duct injuries, but for specific cases, it is essential to consult with a medical professional who has access to the patient's medical records and can provide personalized advice. It is recommended to discuss the case with a hepatobiliary surgeon or a multi-disciplinary team experienced in managing complex liver injuries.

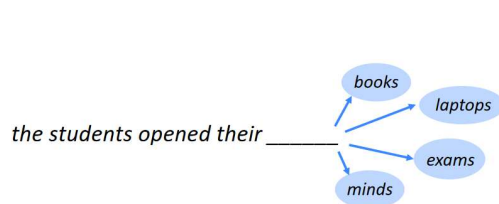


This article has been removed at the request of the Editors-in-Chief and the authors because informed patient consent was not obtained by the authors in accordance with journal policy prior to publication. The authors sincerely apologize for this oversight.

In addition, the authors have used a generative AI source in the writing process of the paper without disclosure, which, although not being the reason for the article removal, is a breach of journal policy. The journal regrets that this issue was not detected during the manuscript screening and evaluation process and apologies are offered to readers of the journal.



## Generative AI (LLMs) in research



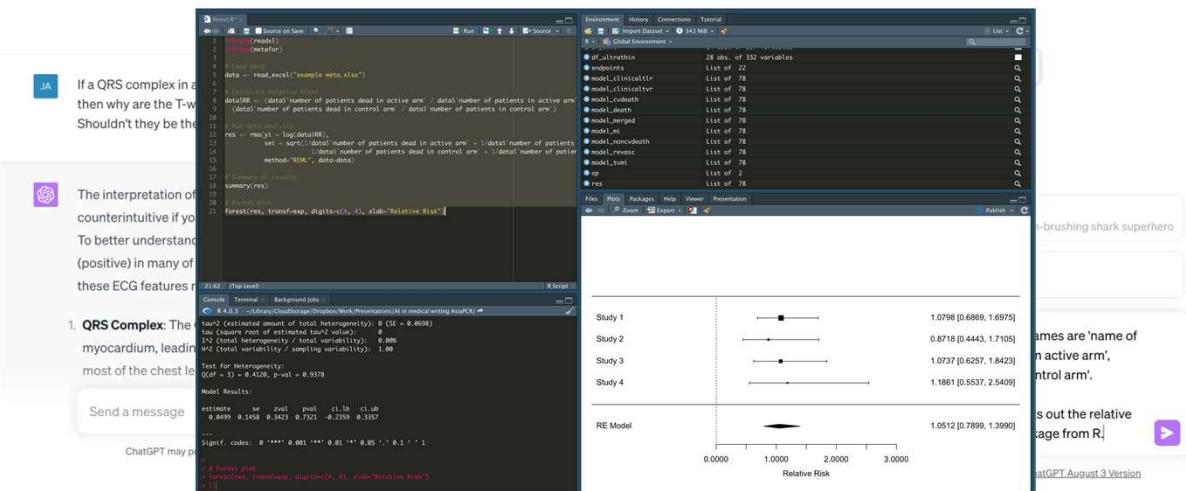
The → quick  
 The quick → brown  
 The quick brown → fox  
 The quick brown fox → jumps  
 The quick brown fox jumps → over  
 The quick brown fox jumps over → the  
 The quick brown fox jumps over the → lazy  
 The quick brown fox jumps over the lazy → dog  
 The quick brown fox jumps over the lazy dog →



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Courtesy Dr James Howard

## Generative AI (LLMs) in research



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## Generative AI (LLMs) in research

JA Can you write me a brief article (300 words) explaining the key trials behind using bivalirudin versus heparin in PCI, and provide citations and pubmed IDs supporting the statements.

Title: Bivalirudin vs. Heparin in PCI: Unveiling Key Trial Insights

### Introduction:

The choice between bivalirudin and heparin as anticoagulant intervention (PCI) procedures has been a subject of intense debate. Both agents offer distinct advantages and potential drawbacks, and clinicians must base their decisions on solid evidence. This article presents key trials that have contributed to our understanding of bivalirudin.

#### 1. HORIZONS-AMI Trial (Stone et al., 2008):

The HORIZONS-AMI trial compared bivalirudin with heparin plus glycoprotein IIb/IIIa inhibitors (GPI) in patients undergoing primary PCI for acute myocardial infarction (STEMI). The trial demonstrated that bivalirudin was non-inferior to the heparin-GPI strategy, with similar rates of ischemic events (Stone et al., 2008; PMID: [18513696](#)).

#### 2. MATRIX Trial (Valgimigli et al., 2015):

In the MATRIX trial, bivalirudin was compared with heparin plus GPI in patients with acute coronary syndrome undergoing invasive management. The study found that bivalirudin was non-inferior to the heparin-GPI strategy, with similar rates of ischemic events (Valgimigli et al., 2015; PMID: [25804311](#)).

> [Am J Surg](#). 2008 Aug;196(2):300-4. doi: 10.1016/j.amjsurg.2007.10.015. Epub 2008 May 29.

## Volunteerism among surgeons: an exploration of attitudes and barriers

Katharine L McGinagle<sup>1</sup>, Peter M Milano, Preston B Rich, Anthony J Viera

Affiliations + expand

PMID: 18513696 DOI: [10.1016/j.amjsurg.2007.10.015](#)



Courtesy Dr James Howard

## Generative AI (LLMs) in research

Science

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EDITORIAL

ChatGPT is fu

For years, authors at the *Science* family of journals have signed a license certifying that “the Work is an *original*” (italics added). For the *Science* journals, the word “original” is

11 NOVEMBER 2023

SCIENCE

115,128

### AI Authorship

Large Language Models (LLMs), such as ChatGPT, do not currently satisfy our [authorship](#) criteria. Notably an attribution of authorship carries with it accountability for the work, which cannot be effectively applied to LLMs. Use of an LLM should be properly documented in the Methods section (and if a Methods section is not available, in a suitable alternative part) of the manuscript.

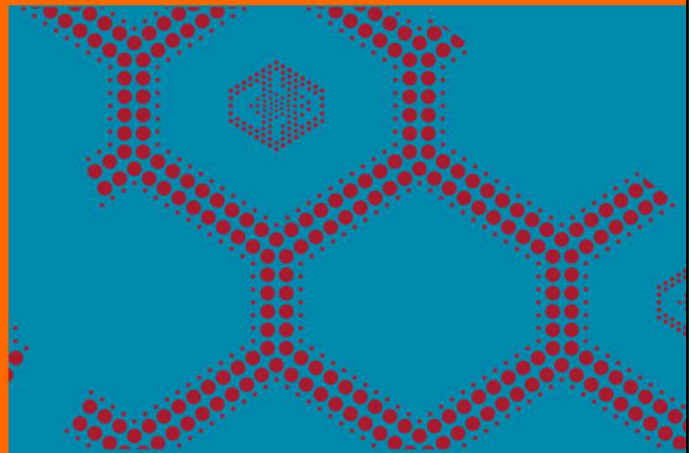
papers that are intentionally generated by AI in research papers, and these are not covered by this change.



Courtesy Dr James Howard

## Generative AI (LLMs) in research

- LLMs have been trained on **huge** amounts of data
- Excellent for
  - Explaining concepts
  - Writing code
- Hallucinate, especially **rare & guessable** data
- ChatGPT **cannot** be a co-author
  - But it almost certainly will be a 'proof reader'



1. Be curious
2. Don't be uninformed!
3. Go with the flow
4. Be flexible
5. Look for local/national resources



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## Acknowledgements

Ben Statton  
Massimo Marenzana PhD  
Jan Sedlacik PhD  
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Dr James Ware  
Khaled Rjoob PhD  
Dr Lara Curran  
Dr Aaraby Ragavan  
Dr Brian Halliday  
Uzma Zahid PhD  
Dr Antonio De Marvao  
Dr Luke Vano  
Dr Vladimir Losev

And many, many more...



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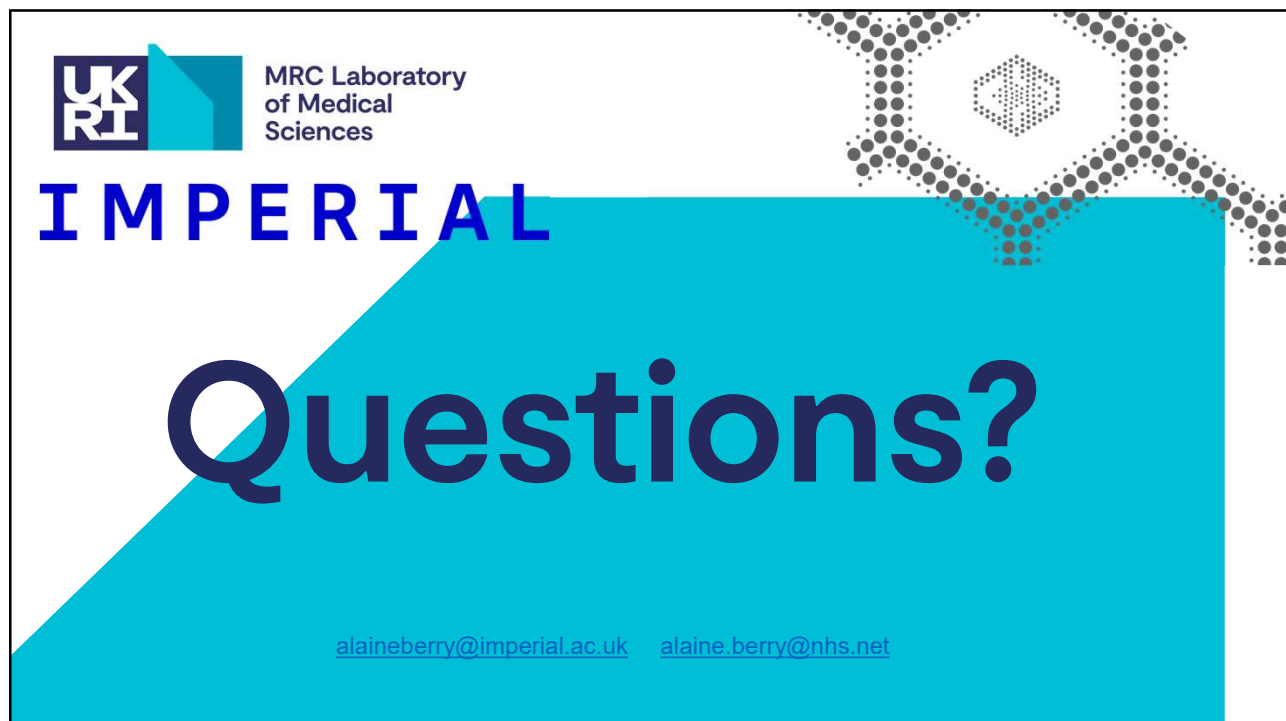
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# Thank you

MRC Laboratory of Medical Sciences @MRC\_LMS lms.mrc.ac.uk

This slide features a blue and orange diagonal background. The UKRI logo is in the top left, followed by the MRC Laboratory of Medical Sciences text. The word 'IMPERIAL' is in large blue letters. The main text 'Thank you' is in large white letters. The bottom of the slide is blue with contact information for the MRC Laboratory of Medical Sciences, including a Twitter handle and a website URL. A decorative pattern of white hexagons is on the right side.



UKRI MRC Laboratory of Medical Sciences

**IMPERIAL**

# Questions?

[alaineberry@imperial.ac.uk](mailto:alaineberry@imperial.ac.uk) [alaine.berry@nhs.net](mailto:alaine.berry@nhs.net)

This slide features a white background with a large blue diagonal shape. The UKRI logo is in the top left, followed by the MRC Laboratory of Medical Sciences text. The word 'IMPERIAL' is in large blue letters. The main text 'Questions?' is in large blue letters. The bottom of the slide is blue with contact information for Alaine Berry, including two email addresses. A decorative pattern of grey dots is in the top right corner.