# STEM Grand Challenge: Research Vision

Professor David Leadley

Deputy Pro-Vice-Chancellor (Research)

October 2022

WARWICK

# STEM Grand Challenge – what is it?



- **Growing activity in STEM** in line with the ambitious target of +40% set by the University Strategy 2030
- Once-in-a-generation opportunity to shape the future **size, shape and strategic direction** of STEM teaching and research
- **Faculty-wide initiative**
  New home for Chemistry, Physics, School of Engineering
  Engaging the wider institution
- Significant **investment** in buildings and infrastructure to enable a **step-change** in our activities

# Education

- Design of innovative and alternative education pathways to advocate for a sustainable future.
- Overall 30-40% expansion of student numbers.
- Five new interdisciplinary courses to start Oct. 2023 under theme *Science for Sustainable Futures*:
  - MSc Predictive Modelling and Scientific Computing
  - MSc Global Decarbonization and Climate Change
  - MSc Diagnostics, Data and Digital Health
  - BSc Environmental Science (DA)
  - MSc Analytical Science (DA)
- 45 interdisciplinary modules created – enablers of student creativity and innovation facilitated by integration of disciplinary excellence

# Research Vision - Objectives



- Create an environment that is an aspirational place for the world's leading researchers to perform their best work.
- Inspire researchers, at all career stages, to fresh innovative ideas that transcend disciplinary norms and contribute to the fundamental base of science and engineering.
- Contribute solutions for the world's most pressing issues.
- Provide opportunities for partners, in the local region and beyond, to benefit from the University's expertise and facilities in pursuing their goals.
- Equip/enthuse a diverse next generation of researchers, business leaders, influencers of science & engineering policy

# Research Vision - Themes

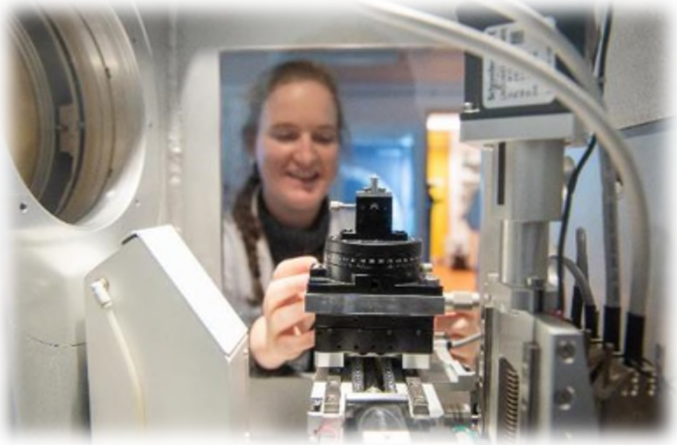
- Developing a research vision that will be **transformative** and enable **sustainable growth** of STEM at Warwick

- Building on our **core** research, five **thematic** areas for growth have been identified:
  - Molecules, Materials & Structures
  - AI, Digital, & Smart Applications
  - Energy & Environment
  - Frontier Science & Engineering
  - Health & Medical Technologies

- **Themes** provide a different **lens on our research**, not silos.

# Aspects of the vision that transcend Themes

- Sustainability – research topics and way of working
- Research Culture – excellence, inclusive, open, rewarding
- Data – support for research computing, RSEs
- Innovation & Partnerships – enable interactions at all scales
- Instruments for Cross-Disciplinary Engagement
- Collaboration extended across whole University – engineering; physical, life & social sciences; arts.

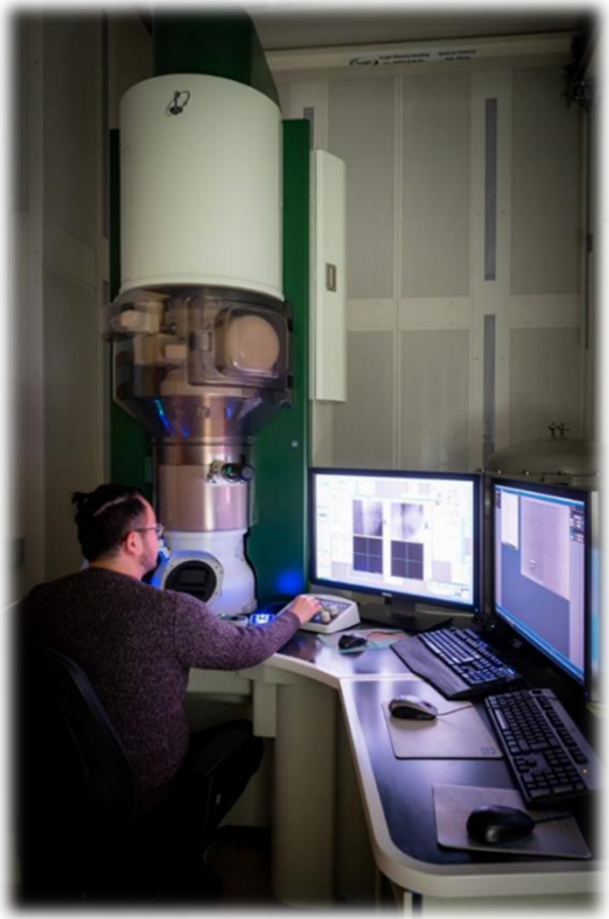


# Theme A: Molecules, Materials & Structures

Designing, discovering, creating, characterising, building things from other things for the benefit of society.

- ❑ Sustainable materials
- ❑ Computational materials modelling & molecular science
- ❑ Analytical science
- ❑ National center for materials characterisation
- ❑ Scale-up
- ❑ Shared facilities, RTPs, cleanroom

*See also Quantum Materials, Energy Materials, Biomaterials*



# Theme B: AI, Digital, & Smart Applications

All things digital. Data science, automation, machine/deep learning, optimization, robotics, Big Data, AI …

… decentralised, safe, & trustworthy AI; human-centric AI

- ❑ Core AI/Data Science
- ❑ AI for manufacturing, engineering & automation
- ❑ AI for sustainability & social good
- ❑ AI for e-sport & virtual reality
- ❑ AI in finance

*See also Computational Materials Modelling, AI for Healthcare & Medical Science*

# Theme C: Energy & Environment

Our response to massive societal issues of climate change, resources and pollution – energy transition, efficiency, circular economy, net-zero.

- ❑ Energy materials & systems
  - renewable energy, batteries, fuel cells, power electronics, grid management,
- ❑ Environmental systems
  - environmental impact analysis, sustainable plastics, life cycle analysis, decision making & policy
- ❑ Resilient infrastructure & low carbon buildings

*See also Sustainable Materials, Global Health Challenges*

# Theme D: Frontier Science & Engineering

Curiosity driven research tackling fundamental unanswered questions, discovering new paradigms, initiating technology of the future, and intriguing the public.

- ❑ Engineering for Big Science
- ❑ Multi-messenger Astronomy
- ❑ Quantum Technologies
- ❑ Synthetic/Chemical Biology
- ❑ Habitability in the Universe
- ❑ Risks from Space
- ❑ Centre for Light Research

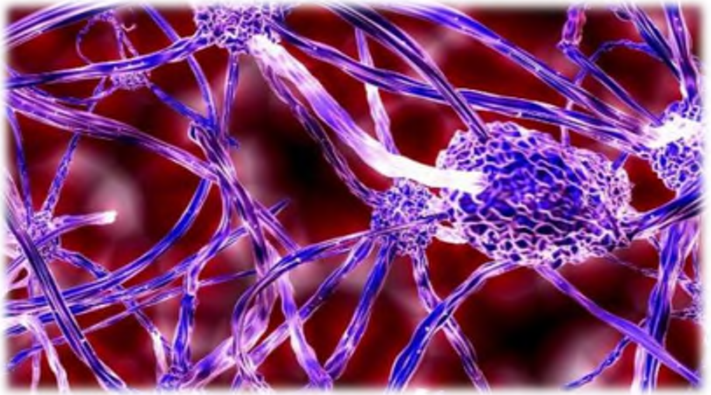
*See also Advanced Materials, AI for Big Science*

PAPER 2

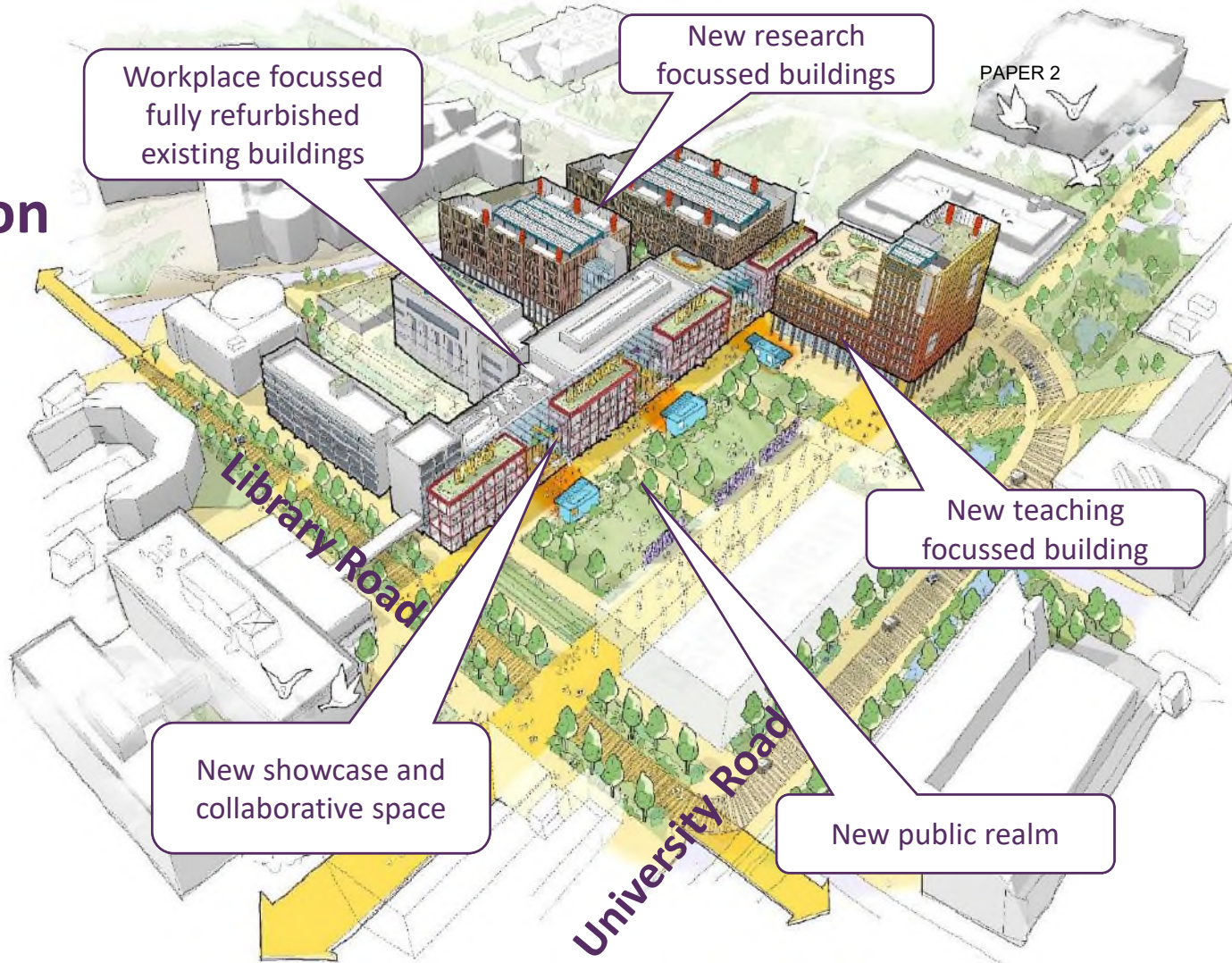
# Theme E: Health & Medical Technologies

Applying an interdisciplinary approach from fundamental discovery to commercial application for the health of society.

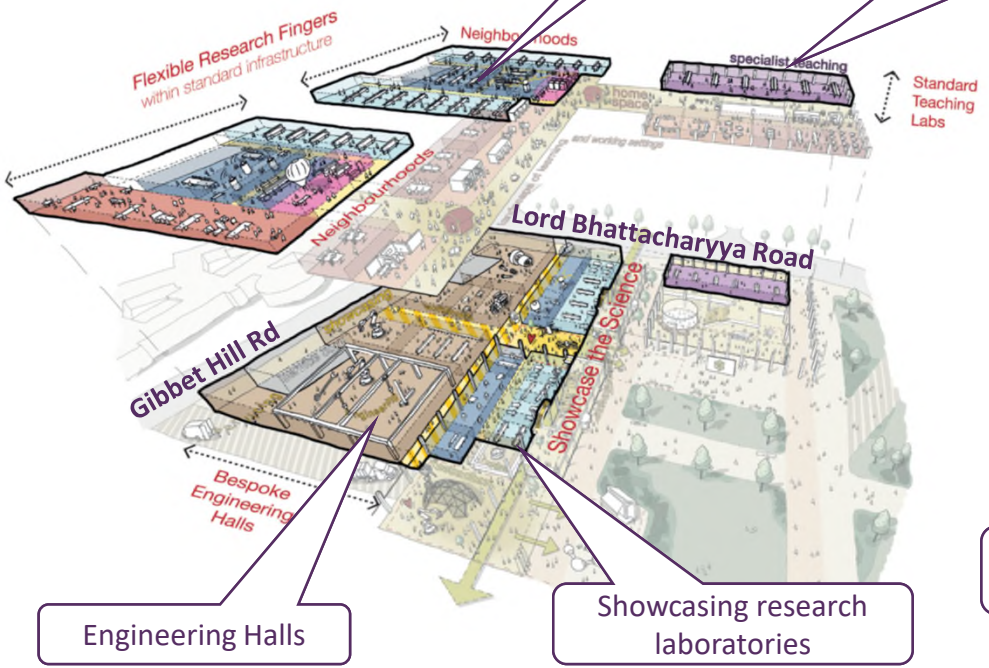
- Medical data analysis & advanced modelling
  - big data approaches to healthcare & epidemiology
  - modelling of therapeutic actions on disease progress
- Precision medicine
  - individual, data-driven healthcare
  - novel diagnostic approaches
  - novel therapeutic approaches & biomaterials
- Global Health Challenges
  - AMR, societal ageing, pandemics, affordability

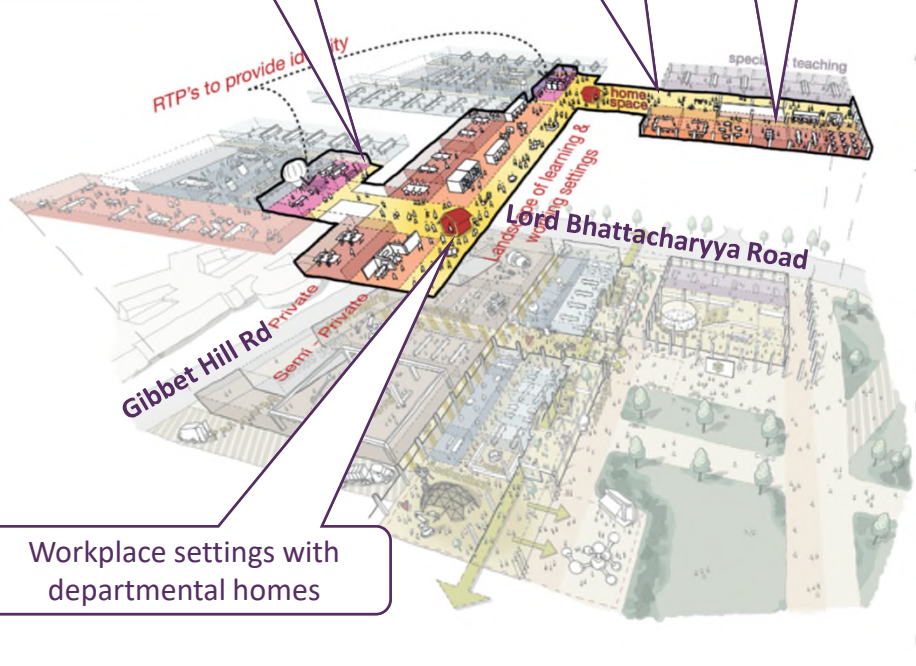


# Science Precinct: Enabling growth and transformation



# Science Precinct: Enabling growth and transformation




Flexible research labs fingers

Provision of new RTP's and core facilities

New general teaching spaces including lecture theatres, seminary rooms and IT labs

New student informal learning spaces

Specialist teaching dry and wet labs

Engineering Halls

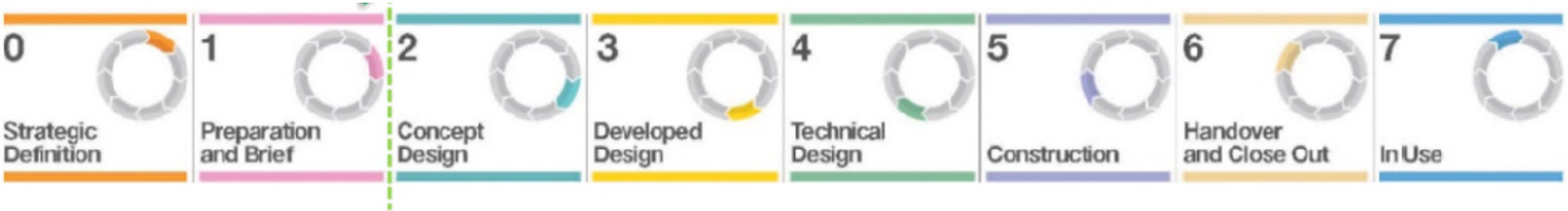
Showcasing research laboratories

Workplace settings with departmental homes

# When will the Science Precinct arrive?

- RIBA Stage 2
  - BDP/ARUP appointed as architects
  - Consultations with research groups, RTPs, theme champions
  - Inventory & Measurements
  - Concept Design
  - Sign off by University Council – summer 2023

- First buildings 2027



# Research Transformation

Creating better spaces for our researchers in the new Science Precinct will:

- ❑ Improve the environment for people and their tools
- ❑ Make it easier to collaborate
- ❑ Bring together similar equipment/facilities, in suitable environments
- ❑ Provide better access to all for shared and fully supported facilities.
- ❑ Give opportunities for researchers working on a common technique or topic to co-locate
- ❑ Enable partnerships working with industry

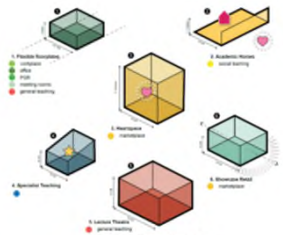

# Questions?

# Science Precinct Progress

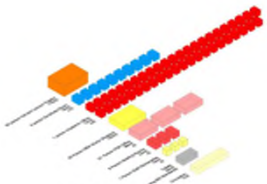


Users and Activities

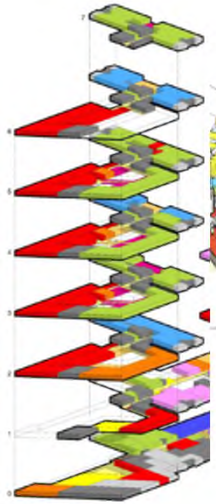
Organisational Principles



Space Typologies

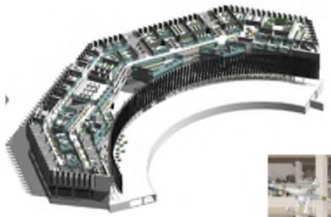


Space Quantities

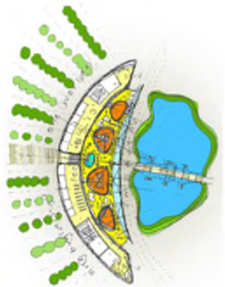


Strategic Building Plans and Stacking

Capturing the Spirit of STEM



Draft Plans and Models



Sketch Plans

Look & Feel

Public Realm & Landscape

Detailed Business Case

**Technical Briefing**

June 22 to Oct 22

**Overall Programme Scope**

RIBA Stage 2A

Oct 22 to Dec 22

**Phase 1 Concept Design**

RIBA Stage 2B

Jan 23 to Apr 23

**Governance Approval**

May 23