# Imperial College London

## THE FORUM | Areas of Research Interest and Imperial

**Policy-makers need to be up to speed with the latest research to develop policies that are based on evidence. To make it easier for researchers to understand which areas of research different government departments are currently interested in, every department has developed an Areas of Research Interest (ARI) document that gives details about the main research questions they are considering.**

The ARI documents provide guidance on where to start <u>engaging civil servants</u> with your research. This briefing provides a top line analysis of the main issues raised in the documents that may be relevant to Imperial researchers. They are organised by The Forum's key topics – Food and Nutrition, Air Quality, Data Privacy, Personalised Medicine, Vaccines and AI. Other issues covered by research at Imperial are then listed by government department.

### Areas relevant to research at Imperial

**Key terms**

AI and machine learning

Biometrics

Cloud native

Data analytics software

Data for public good

Data Privacy

Global natural resources

High-performance computing

Homomorphic encryption

Internet cyber security

New and emerging technologies

Learning and development methods for the digital skills

Transfer of digital innovations

#### Cabinet Office

- How can government make best use of its data to identify users with multiple complex needs? How can integrated service provision improve outcomes for these individuals?

- How can new and emerging technologies support behaviour and culture change in complex organisations?

- How should the Civil Service best enable transfer of digital innovations from the private sector into government? How can it identify and collaborate with business leaders in other sectors of the economy who face similar technology challenges?

- How should government make best use of biometrics and other technologies for government service users to prove their identities? What are the most useful applications of homomorphic encryption for digital government?

- How should government make best use of high-performance computing resources and emerging quantum computing technology?

- How should the government best enable its transformation work to be 'cloud native' through scalable and secure digital services?

- How should government maintain trust and accountability in using AI and machine learning? What is the public appetite for government making use of these in decision making?

- How should government make use of data for public good and to enable government transformation?

- How far can data analytics software help make sense of digital information at scale?

- How to develop an open source tool set for Internet cyber security?

- What pressures will there be on global natural resources – especially energy, food, water and critical elements – in the short, medium and long-term?

- What will be the best learning and development methods for the digital skills needed in the future Civil Service?

- What technologies should government be exploring in order to enable this? How can government increase its capacity to adapt to the next curve of innovation in digital, data and technology?

**Key terms**

Air Quality

Carbon capture utilisation and storage

Climate change

Data Privacy

Electricity from renewable sources

Energy efficiency

People, institutions and markets

Reliable, low-cost and clean energy

Smart technology

Wind power technology

## Department for Business, Energy and Industrial Strategy

- How can we best understand people, institutions and markets? What are the drivers and effects of different types of consumer behaviour, and how access to information, tools and advice impact decision making?

- How does the department understand how smart technology can help support its objectives, including growing the economy, and ensuring the UK has a reliable, low-cost and clean energy system?

- What research is needed to understand how to generate and use data to improve energy efficiency; to develop more effective and better balanced energy networks; to create an energy market that works for the consumer; and to ensure the highest standard of cyber security?

- How can we nurture the UK innovation system through creating the best environment for research excellence and innovative businesses, access to world-leading talent and cutting edge technologies, and commercial exploitation of university and HE intellectual property – for example through the establishment of UK Research & Innovation?

- What progress has been made on reliable, low-cost and clean energy? Do we have deliverable, cost-effective pathways to meet our carbon targets?

- Can we get a better understanding of the impacts and risks of climate change at a global, national and local scale and how to communicate these effectively?

- How can we best generate electricity from renewable sources? What areas will really make a difference, and further drive down the cost of renewable technologies to make them a cost-effective alternative to fossil fuel generation?

- How do we continue to grow wind power technology and what technologies could reduce costs in offshore wind?

- How will climate change impact the UK? What information, data and tools are required to support effective action against it and what solutions we can find?

## Department for Environment, Food and Rural Affairs

**Key terms**

Air Quality

Chemical pollutants

Climate change

Food and Nutrition

Food supply

Industrial pollution

New and emerging technologies

- How can we identify the new and emerging technologies in which to invest, that will provide greatest benefit to our agriculture, food and drink industries?

- What are the key medium and long-term challenges and threats to our food supply? How can we prepare to respond, to safeguard a viable food supply in the face of climate change and changing demand?

- How can industrial pollution be controlled and effectively and efficiently managed?

- How can we manage existing, new and emerging chemical pollutants to reduce damage to the environment and human health?

- How will the climate change, what risks will this pose and which risk management actions are urgent and cost effective?

- How can we identify and remove barriers to encourage investment in UK and global R&D? How can we drive innovation for agriculture, food and drink industries to increase productivity, competitiveness and resilience, across the whole food system?

- What are the cost-effective, publically acceptable and practical ways to improve air quality in the short, medium and long-term?

- What are the cost-effective, publicly acceptable and practical ways to minimise agriculture's carbon emissions and its impacts on air and water quality?

## Department of Health and Social Care

**Key terms**

Antimicrobial resistance

Behavioural science

Dementia

Food and Nutrition

Multiple morbidities

Obesity and diabetes

Personalised Medicine

Vaccines

- To fight antimicrobial resistance how do we best aid the development of new drugs to replace failing drugs? Should this focus on the development of better diagnostic pathways?

- How do we best understand the drivers of antimicrobial resistance and issues such as the negative selection pressure of having antimicrobial resistance on bacteria?

- Should we focus on behavioural science to help change expectations and behaviours?

- As the population ages, multiple morbidities will be the norm for the majority of patients treated in the health system. How do we best understand links between diseases and disease clustering and interactions between drugs in people with multiple morbidities?

- What new technologies are there that can help to underpin these new treatment approaches?

- How do we use social and economic research alongside public health and social intervention studies to best reduce lifestyle diseases such as obesity and diabetes?

- How do we best treat dementia through both drug and non-drug treatments? Can we identify drugs and behavioural interventions to slow, halt and possibly reverse dementia?

- How do we make the most from advances in personalised and stratified medicine?

- How do we ensure the biggest impact in rare diseases and cancer treatment and also extend it further, for example into immunology? This is an area in which the UK should seek to take a major leadership role.

- How do we keep establishing vaccines and drugs for the world's infectious diseases?

- What can we do to ensure we can best detect, prevent and respond to emerging infectious threats, including ones which historically have been problems of the developing world and pandemic influenza which remains a major threat to England?

- How do we ensure we take advantage of the huge benefits that would come from expanding personalised medicine into areas such as immunology?

**Key terms**

Air Quality

Connected and autonomous vehicles

Cyber threats

Data Privacy

Energy bases

Future of low carbon fuels

Intelligent transport systems

Ultra-Low Emission Vehicles

## Department for Transport

- What are the forecasts and actual uptakes for new Ultra-Low Emission Vehicles (ULEVs)?

- Do we have the necessary vehicle supporting infrastructure integration with energy bases? This technology needs to be functional, have wide access, and ensure SMART grid aspects are available.

- What will be the impact of connected and autonomous vehicles (CAVs)? Can we seek to understand the impacts of connected and autonomous systems on local regional and national travel demand, safety, network efficiency, capacity, vehicle kilometres, vehicle registrations and environmental performance?

- Can we determine local authority capability and ambition with respect to intelligent transport systems?

- How can we best work with the transport industry to mitigate and prepare against cyber threats?

- What research is there around the future of low carbon fuels?

- In terms of climate change strategy what impact will the split of fuel use, $CO_2$ and air quality emissions of new cars have?

- How will better information on vehicle emissions help regulations deliver real improvements in air quality, including from airplanes and airports?

- How can we ensure that our biofuels modelling assumptions are as accurate as possible?

- How do we best support the delivery of the national air quality plan? Should this include impact assessment for new regulations, work to develop the specification for feasibility studies in the key cities, and development of the retrofit accreditation scheme?

- How can we work with the transport industry to mitigate and prepare against cyber threats? Can this be achieved through continuing to grow our understanding of key cyber security vulnerabilities and issues across all modes, including autonomous vehicles and smart cities?

**Key terms**

Data Privacy

**Department for Work and Pensions**

- How can cryptography, distributed ledgers, personal data lockers and identity authentication be used to increase the resilience and efficacy of government services?

**Let us know how you get on and if we can help**
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