**NORWICH RESEARCH PARK:**

https://www.norwichresearchpark.com/

https://www.norwichresearchpark.com/about/partners

https://www.norwichresearchpark.com/our-science/agri-biotech-2

https://www.norwichresearchpark.com/our-science/food-health-and-the-microbiome

https://www.nnuh.nhs.uk/research-and-innovation/our-research-expertise-and-facilities/our-research-facilities/ - can be used to test new food products and their claims

https://www.norwichresearchpark.com/our-science/sciencefacilities

1. **Access to specialist research facilities and talent pool -** one of five BBSRC funded research campuses, in the UK, with four research institutes, a top 20 university and a teaching hospital
2. **A growing business community** – 100,000 sq ft built and let to 40 companies from start-up to grow-on and a programme of business networking events and social activities
3. **Range of accommodation -** to meet a company's needs now and in the future with 1.6m sq ft of outline planning consent, in an Enterprise Zone
4. **Enterprise strategy and ESG initiatives – creating new opportunities – e**xplorer fund and pipeline of pre seed and seed funding, regular campus networking events to help with collaboration and promotion
5. **High quality of life** – cathedral city, open countryside, The Broads, extensive coastline and range of housing in close proximity

https://www.norwichresearchpark.com/our-science/alliances-and-networks - of particular interest NIHA and NISD

**QUADRAM:**

https://quadram.ac.uk/

https://www.qibextra.co.uk/people/consultants

https://www.qibextra.co.uk/

https://www.qibextra.co.uk/case-studies

**EARLHAM**

https://www.earlham.ac.uk/

https://www.earlham.ac.uk/earlham-enterprises-ltd

**JIC and TSL**

https://www.jic.ac.uk/

https://www.jic.ac.uk/research-impact/

https://www.tsl.ac.uk/

https://www.hp3.org/

**UEA**

https://www.uea.ac.uk/groups-and-centres/projects/broadland-food-innovation-centre/innovation-cluster

https://healthyageingnorwich.com/

https://www.uea.ac.uk/about/norwich-medical-school/research/cardiometabolic-and-gut-health/nutrition-and-preventive-medicine

**MORE IN DEPTH INFORMATION:**

**Norwich Research Park Partners**

***Norfolk and Norwich University Hospital***

- **NNUH 2020/25 Research strategy: file:///C:/Users/kirsty.culley/OneDrive%20-%20Anglia%20Innovation%20Partnership%20LLP/Downloads/Research-Strategy-v1.1%20(1).pdf**

    - **Change culture – whole organisation change where research is a part of 'business as usual'**
    - **Best opportunities lie with Partners on NRP. The strategy aims to strengthen partnerships. It will support research that is already ongoing and will seek to complete research that addresses the key issues facing the hospital (COVID-19, bed occupancy, queuing ambulances, frailty and ageing etc).**
    - **Interest in developing additional strategic partnerships – partnerships that are critical to region and wider NHS**
    - **To be recognised as a leader of research (regionally and internationally) – not only enrolling patients onto clinical trials run out of other trusts but running trials out of Norwich. Thus, increasing NNUH/NRP profile**

- **One of 15 NHS Trusts/Foundation Trusts appointed to run a local branch of the National Institute for Health and Care Research (NIHR) Clinical Research Network (CRN) and are the host organisation of the Clinical Research Network (CRN) East of England.**
- **Strengths in cancer and ortho**
- **Clinical Research Facility**
- **9 bed state of the art isolation unit for challenge studies built in 2020**
    - **Institute of Infectious disease - Infectious diseases create a good strategic research opportunity for NNUH. They have just built a new unit to house patients with infectious disease. Kris B noted that our geographic location provides a good opportunity - fly infectious patients to Norwich Airport which is only a short trip to hospital, and then research and science on site. This could provide a complete service.**
    - **Could be used for vaccine challenge trials.**

- **Areas if interest lie within their needs, such as frailty, obesity, dementia and length of stay**

- **Current Research Studies: https://www.nnuh.nhs.uk/research-and-innovation/research-studies/**
- **Access to primary samples.**

***Earlham Institute***

**MISSION: The Earlham Institute's mission is to decode the scale and complexity of living systems so we can understand, benefit from, and protect life on Earth**

**The Earlham Institute's Core Strategic Programme (CSP) "Genomics to Food Security" translates achievements in decoding plant, microbial and non-animal genomes to help our understanding of complex traits in crops, aquatic species and microbes.**

**The CSP is divided into three, focusing on (1) delivering computational methods for the study of complex genomes, (2) the analysis of the impact of diversity on traits and phenotypes in species important for food security, (3) and developing and implementing data standards and infrastructure for FAIR research data management. Briefly,**

**(1) Analysing and Interpreting Genomes important in food security: This programme explores how natural selection and domestication have shaped the genomes of economically important species.**

**(2) Systems genomics approaches to understand complex phenotypes: identify and understand the functional roles of alleles in biological systems. By determining the effect of variation on allelic function within regulatory and host-microbe networks, we will deliver research impact across food sustainability, security and health.**

**(3) Data Science for Integrative Biology: This strategic programme uses new technologies, algorithms and standards to provide 'omics data ready for analysis, interpretation and integration. Key areas include data standards, data integration, algorithms, and scientific and high-performance computing.**

**Earlham and John Innes Centre have https://www.earlham.ac.uk/designing-future-wheat. Designing Future Wheat (DFW) is a collaborative programme involving world-leading UK institutions to ensure a robust wheat crop for the future to support a growing population.**

**Darwin Tree of Life: https://www.earlham.ac.uk/research-project/darwin-tree-life-project**

***Area of strength for commercialisation/industry:***

- **Earlham Enterprises Ltd: https://www.earlham.ac.uk/earlham-enterprises-ltd**
- **advice and development of customised protocols for high-throughput genomics and next generation sequencing**
- **single-cell analysis**
- **innovative bioinformatics for analysis and interpretation of multiple, complex data sets**
- **development of novel platforms to provide access to computational tools**
- **laboratory automation, in particular liquid handling, modular nanoscale DNA-assembly, genome engineering, DNA transformation and expression analyses**

- **access to high-performance computing and storage technology for data generated from NGS sequencing and genomics.**

***Quadram***

**VISION: to understand how food and microbes interact to promote health and prevent disease.**

**MISSION: Use this knowledge to deliver healthier lives through innovation in gut health, microbiology and food.**

**EXPERTISE: food science, microbiology, biomathematics and clinical research, working at the frontier of integrated food and health research.**

1. **Food Innovation and Health – How can we enhance the quality of food to promote lifelong health?**
2. **Gut Microbes and Health – What is a healthy gut, and how is health modulated by our resident gut microbes?**
3. **Microbes in the food chain – How can we reduce microbial pathogens in the food chain, and prevent the emergence of antimicrobial resistance?**
4. **Food, microbes and public health – How do we translate our research on food, gut microbes and human biology to enhance the health of the population and reduce societal health cost burden, both in the UK and internationally?**

**Areas of Research Strength:**

1. **Food Composition (inc Food Databanks National Capability)**
2. **Food Safety**
3. **Future Foods (development and testing)**
4. **Personalised Nutrition**
5. **Biofilms**
6. **Antimicrobial Resistance**
7. **Cancer**
8. **Cardiovascular Disease**
9. **Coronavirus (COVID-19)**

10. **Inflammatory Bowel Disease (IBD)**
11. **Liver/lipid disease**

**Major Highlights:**

- **Clinical Research Facility (house in QI but ran by NNUH): https://quadram.ac.uk/our-science/clinical-research-facility/**
  - **Six clinical rooms with clinical equipment and computers**
  - **Three screening rooms with computers**
  - **A multi-function clinic room with 5 bariatric phlebotomy couches**
  - **Two en-suite clinical rooms with bariatric hospital beds**
  - **Short-term use of document, sample and food storage, subject to availability**
  - **Kitchen**
  - **Research food storage**
  - **Participants lounge and diner**
- **NNUH Endoscopy Centre close association**

***Area of strength for commercialisation/industry:***

**QIB Extra: https://www.qibextra.co.uk/what-we-do**

- **Food Bioactives: particularly plant-based bioactives and beneficial health properties.**
  - **Determine the presence of potential bioactives in new food materials, or products/materials produced in different conditions.**
  - **Analysis of bioactives in human samples post adminstration.**
  - **Aid in identification of biomarkers with regards to health claims.**

- ***C. botulinum*** **challenge testing based on identifying the formation of the botulinum toxin in test products during defined storage conditions to help determine a products shelf-life.**

- ***Food Safety microbiology, including:***

  - **Pathogen variation**
  - **Clostridium botulinum challenge testing**
  - **Gut-Microbe interactions**
  - **Translational microbiome**
  - **Bacterial Genomics and Metagenomics**
  - **Antimicrobial resistance**
  - **Bacterial lifestyles and niche adaptations**
  - **Campylobacter in the food chain**
  - **Survival strategies of Listeria**
  - **Host-microbe interactions in the gut**
  - **Understanding the microbiome**
  - **Gut viruses & viromics**
  - **Biofilms**

- **Authentication services: innovative approaches for characterising foods and ingredients**

- **Food Quality and Nutritional Analysis:**

  - **Innovative/future foods.**
  - **Bio accessibility and bioavailability.**
  - **Starch structure and its digestive breakdown.**
  - **Genetic links to starch quality in cereals.**
  - **Glucose release/glycaemic response.**[KC1]
  - **Digestion of plant-based food and nutrient release.**
  - **Food (lipid) structure, colloids and digestion.**
  - **Health benefits of dietary polyphenols and similar compounds.**

§ **Personalised nutrition and gut microbiome.**

§ **Gut microbiome and its links to heath and disease.**

§ **Understanding vitamin B12.**

***John Innes Centre***

**Mission: Research aims to address global challenges and our knowledge of plants and microbes is used to answer fundamental questions, as well as having a significant impact on industrial biotechnology, society and global development.**

**Research Programmes:**

1. **Genes in the Environment**

   **Developing a wider and deeper understanding of how the environment influences plant growth and development**

2. **Molecules from Nature**

   **Investigating the vast diversity of chemicals produced by plants and microbes**

3. **Plant Health**

   **Understanding the molecular dialogue between plants and microbes, establishing how they communicate with each other and how they have evolved in relation to one another**

4. **Designing Future Wheat**

   **Spanning eight research institutes and universities and aiming to develop new wheat germplasm containing the next generation of key traits**

· **Facilities/Platforms for hire and collaboration**

· **Speed breeding technology allow the quick growth of new crop varieties: https://www.jic.ac.uk/press-release/space-inspired-speed-breeding-for-crop-improvement/**

***The Sainsbury Laboratory***

**The Sainsbury Laboratory is committed to the highest standard of fundamental and applied scientific research into molecular plant-microbe interactions. At the forefront of research in plant immunity and plant disease.**

- **Understand how infections happen and underlying biology to find solutions to the worlds most significant diseases.**
    - **How does a plant recognise a pathogen**
    - **How does a pathogen shut down plant defence**
    - **How do some genes in plants allow recognition of virulent pathogen to block infection**
    - **Small RNA in plants first discovered in TSL – huge for science. Allows you to turn off specific genes or a set of genes**
    - **Plant immune receptors are major discovery of TSL**
    - **Major contribution of fungal genomes and pathogens, allowing plant-infection interactions to be understood**
    - **Study pathogen > Sequence genome > Know the enemy and develop strategies of protection**
    - **Developing genetic solutions that can be integrated within the seed itself allowing farmer to buy plants resistant to disease.**

        **Example: Brazil crop spraying 5 times a year. But now will be able to defend themselves**

**2Blades: 2Blades discovers and advances technologies that significantly reduce, or entirely prevent, crop disease in order to improve agricultural output and the lives of people around the world.**

*University of East Anglia*

- *https://www.uea.ac.uk/research*

  **The Research Excellence Framework (REF) is the system for assessing the quality of academic research in UK universities.**

  **UEA research is ranked in the top five* for:**

  - **Agriculture, Food and Veterinary Science**
  - **Anthropology and Development Studies**
  - **History**
  - **Earth Systems and Environmental Sciences**
  - **Social Work and Social Policy**
  - **Area Studies**

**UEA research also made the UK top 20* in 10 other subjects**

- **Art and Design: History, Practice and Theory**
- **Business and Management Studies**
- **Politics and International Studies**
- **Psychology, Psychiatry and Neuroscience**
- **Public Health, Health Services and Primary Care**
- **Economics and Econometrics**
- **Communications, Cultural and Media Studies**
- **Biological Sciences**
- **English Language and Literature**
- **Clinical Medicine**

*Institutes/Research areas of focus:*

**Tyndall Centre:** ***https://www.uea.ac.uk/climate/tyndall-centre-for-climate-change-research***

***https://tyndall.ac.uk/projects/***

***Themes:*** **Accelerating Social Transitions**

**In the global north we are constantly mobile and constantly purchase goods. As households, we heat our homes and cook and make choices about what to buy. In our communities, we exchange ideas and signal our self-identities to ourselves and others with our consumer choices. 'Transition' describes a system-wide process unfolding through entwined social and technological change at multiple scales. By focusing on 'social transitions', we analyse our ways of life and our relationships with technologies and infrastructures.**

**Building Resilience**

**Climate change is impacting human and natural systems. It poses risks to the global economy, to lives and livelihoods, and to businesses. It poses risks to food security, water resources, the built environment, human health and wider well-being. It poses risks to biodiversity and ecosystem services, globally and regionally.**

**Increasing levels of global warming increase the likelihood of severe and irreversible events and their impacts during the 21st century and beyond.**

**Overcoming Poverty with Climate Actions**

**That the impacts of climate change will unduly affect the poorest and most vulnerable people in the world is well established. Climate change is embedded within the same complex and interconnected socio-economic, political, technological, industrial and environmental systems as poverty and inequality. In an unequal world, what does the imperative to mitigate and adapt to climate change mean and for whom?**

**Reaching Zero Emissions**

**A pathway towards zero emissions aligned with the goal of the Paris Agreement is more than decarbonisation of energy. Reaching zero emissions is the ability to go beyond low-carbon and actively remove greenhouse gases from the atmosphere. Decarbonisation using Biomass Energy with Carbon Capture and Storage (BECCS) and other 'negative emission' technologies.**

**Norwich Institute of Healthy Ageing:** **https://healthyageingnorwich.com/**

- **Optimising healthy behaviours for wellbeing. Norwich Institute of Healthy Ageing (NIHA) develops and implements effective strategies to promote sustained population behaviour change, in order to improve physical and mental wellbeing.**

**Norwich Cancer Research Network: https://cancerresearchnorwich.org.uk/**

- **The Norwich Cancer Research Network showcases the breadth and depth of cancer research taking place on the Norwich Research Park, improving links between scientists, clinicians and research bodies and driving high quality research and open communication.**

**Microbes in Norwich:**

- **Microbes in Norwich showcases the wide variety of microbiological research taking place on the Norwich Research Park, improving links between researchers and research bodies and driving high quality research and open communication between scientists.**

**AMR on the NRP: There are more than 300 microbiologists and over 40 separate research groups on the Norwich Research Park involved in antimicrobial drug discovery and resistance-related studies, making this one of the biggest research centres in the world for AMR research.**

**Antimicrobial research across Norwich Research Park covers multiple themes including:**

- **Discovery, biosynthesis and bioengineering of novel anti-microbial natural products**
- **Identification and validation of novel targets and antibiotics**
- **Medicinal chemistry and lead optimisation**
- **Molecular epidemiology and surveillance of resistant pathogens and resistance genes**
- **Roles of the microbiome in AMR**
- **Novel delivery systems for antimicrobials**
- **Development of novel diagnostics**

- **Evolution of resistance by pathogens**
- **Environmental selection of AMR including HAI**
- **Public engagement, citizen science projects and outreach**

**UEA Health and Social Care Partnership: https://www.uea.ac.uk/groups-and-centres/uea-health-and-social-care-partners**

**Norwich Institute of Sustainable Development: https://nisd.ac.uk/**

- **To create synergies across the natural and social sciences for excellent research and global public good. Transforming research and practice to enable equitable, food secure and sustainable futures.**
- **Six research themes:**
  - **Environmentally sustainable diets: Understanding the behavioural drivers of consumption and nutrition and how to enable more sustainable diets. will also forecast future growing conditions to determine which legumes. Research outputs will be policy evidence, dietary guidelines and nutritional apps, and direction for crop scientists and breeders.**
  - **Climate-resilient food systems: Using climate modelling and community resilience adaptation to inform crop science research. lag between improved varieties being available, for crop scientists to produce relevant innovations, climate modelling. Based on GIS-linked climate models will forecast and map future crop growing conditions; identify currently existing agronomic indicator areas in which conditions *now* are sufficiently like the ones forecasted for a particular region in the future > informing crop science research agenda and allows us to study practical ways in which communities are adapting to real-life climate stress which may be improved or scaled up.**
  - **Farmer-responsive seed systems and breeding: Understanding local farmers crop needs and how seed systems could enable access to those traits.**
    - **Potatos (JJ)**
    - **Grass pea (drought tolerant – new varieties)**
    - **Nepal – improved veg crops**
    - **Seed Sentry: real-time low-cost sensors are developed to warn farmers of spoilage of seed before purchase. Existing sensor technologies are repurposed to develop printable sensors (costing <£0.01) that seed production companies can cheaply incorporate with each bag. The sensors will inform farmers about the reliability of the seed, improving their trust in**

**modern varieties. The sensors will also assist long-term real-time tracking of hidden seed spoilage threats at a countrywide scale. Combined with seed stress tolerance testing, this will enable the mapping of where improved seed is at greatest risk of spoiling before purchase and make the case for, and inform, the regulation of seed supply chains.**

- **Equitable knowledge sharing in agri-food systems: Building knowledge-sharing platforms to help farmers access market information, risk protection and good quality seed. Intend to develop smartphone apps that village agents (educated, underemployed local young people) deploy on behalf of farmers, so that the latter have easy access to relevant information. Work is ongoing in Uganda.**

- **Supporting sustainable soil management. Combining behavioural economics, agricultural and soil science to determine management practices, policies and market signals needed for farmers adoption.**

- **Resilient aquatic food systems: Improving the resilience of aquatic food systems from genetic, climate change, gender, nutrition and socio-economic perspectives.**

    1. **Genetic analysis to inform breeding strategies for better feed efficiency, disease resistance, and tolerance to climate change**

    2. **Gendered livelihoods analysis to better understand the role of aquatic foods in sustainable livelihoods, to inform the genetic analysis mentioned (which traits matter for producers), and to assist the design of appropriate post-harvest processing, marketing, finance and insurance models;**

    3. **Nutrition studies to examine the content and bioavailability of vitamins, minerals and healthy fats in locally available or newly introduced aquatic foods (e.g. fish powder or edible algae);**

    4. **Socio-economic analysis of consumers' dietary habits to assess how nutritious aquatic foods may be best accommodated in sustainable diets, with a special focus on reaching low-income consumers.**

***NBI Grand Challenges:***

1. **Developing new integrated systems for sustainable agriculture**

2. **Harnessing plants and microbes for human health**

3. **Combatting infectious disease and antibiotic resistance**

4. **Harnessing biodiversity to build sustainable low carbon economy**

**HP3/NGI:** https://www.hp3.org/

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- [KC1]**Resistant starches for controlling obesity and type II diabetes**
  - **QI and JIC collaboration**
  - **Wrinkly pea research**
  - **New types of wheat with resistant starch**
  - **PulseON starches for use in wide varieties of food – great texture**