EARLY DETECTION
INNOVATION
WORKSHOP

DIGITAL PATHOLOGY
& ARTIFICIAL
INTELLIGENCE

APPLICATION
GUIDELINES
EXECUTIVE SUMMARY

Cancer Research UK has identified early detection of cancer as a strategic priority and in July 2017 launched a new funding committee and award schemes to support research in this area. As part of our wider efforts in early detection, we have recognized that this developing field benefits from bringing together expertise not only from cancer biology, but other disciplines, leveraging the best minds and most novel concepts emerging from chemistry, physics, engineering, mathematics, and computer science.

The Science and Technology Facilities Council (STFC) published their Strategic Context and Future Opportunities document in July 2018. In addition to the strategic goal of World-class Innovation, six Strategic Themes were presented, including Data-intensive Science and Solutions for 21st Century Challenges. The STFC community has been at the forefront of data-intensive science for decades and, through innovation and challenge-led activities, have contributed to delivering solutions to complex challenges. STFC’s Strategy for Cancer identified diagnosis, and early disease in particular, as one of the three main objectives and highlighted the potential role of artificial intelligence in data mining images.

We are uniting the CRUK and STFC communities again for the fourth Early Detection Innovation Workshop taking place from 18th November to 20th November 2019, kindly hosted at The Royal College of Pathologists, 6 Alie St, London, focusing on novel artificial intelligence approaches to interpret digital pathology images for early detection of cancer. This 3-day event is dedicated to developing new multidisciplinary and revolutionary research ideas, with up to 3 of the best proposals being awarded £100K seed-funding to support the subsequent pilot and feasibility studies, including covering associated running costs and named research staff.

Applications are welcome from across a range of academic, industry, and community sectors. Participants will be expected to engage constructively with each other, the event facilitators, the Director and Subject-Guides to develop collaborative research ideas during the sandpit.

We invite online applications from eligible individuals using the online application form. The submission deadline is 30th September 2019. The sandpit is an intensive residential event and participants must attend all three days of the event. By submitting an application form, you are confirming that you are available for the full three days of the sandpit.

RESEARCH CHALLENGE

It is well established that if cancer is detected and diagnosed at an early stage, the survival rate of patients is improved. The aim of early detection is to develop new approaches which seek to enable the detection of cancer, or pre-cancerous states, at the earliest possible time point at which an intervention might be made. This approach will improve patient survival and may mean milder and/or curative treatment options and surgery could be available to more cancer patients.
Pathology is critical for diagnosis and treatment decisions for many diseases, including cancer. The vast majority of cancer patients require a histological or cytological test for the initial diagnosis to be set. In setting a cancer diagnosis, a pathologist aims to confirm the diagnosis, determine the type and severity or stage of the cancer. In some cases, such as with Barrett’s oesophagus dysplasia, bowel polyps in the bowel screening programme, and cervical neoplasia in the cervical screening programme, pathologists examine a pre-cancerous condition with the aim of identifying the transition to cancer early, thus allowing for an intervention and/or surveillance to take place, even before an invasive cancer is established. There is currently a shortage of histopathologists and the workload is increasing. The diagnostic process could be aided by digital pathology and artificial intelligence (AI), improving turnaround times and diagnostic accuracy, provide data for further research and potentially pick up early signs of cancer which may otherwise be missed.

In recent years huge advances have been made in the areas of AI and there is an opportunity to utilise emerging technological and methodological insights in these fields, available STFC networks from outside of biomedicine, for the interpretation of digital pathology images, thus providing a novel and innovative approach to detecting cancer early. There is growing interest in the area of digital pathology, as reflected by the recent investment by the UK government in centres of excellence focussing on digital pathology, medical imaging and the use of digital systems and AI to improve diagnosis and deliver treatment. This sandpit will leverage this interest to make progress in cancer early detection. Developing tools with the potential to translate into a diagnostic and/or surveillance pathway, that can bridge pathology and imaging, are particularly of interest.

This Sandpit Innovation Workshop could focus on one or a combination of the challenges below, but is not limited to:

- **How to identify and disregard and/or fix artefacts.** For example, tissue tears/folds, debris, crushed cells and contamination that may get in the way of accurate diagnosis.
- **Extraction and mining of features predictive of neoplasia.** Which features can be determined by AI and of these, which will be the most useful in early detection?
- **Determining the ‘ground truth’.** What does normal look like? What does a pre-malignant state look like? How does a high-risk pre-malignancy differ from normal tissue or a low-risk pre-malignancy? What can be picked up by AI that a human can’t distinguish/see?
- **Variability in samples.** Overcoming the variation in patterns of pre-cancerous / dysplastic abnormalities and their surroundings and differentiation between those.
- **Lack of binary variables.** A diagnosis may not be as simple as non-malignant or malignant, particularly in early detection where what we aim to detect may be somewhere on a spectrum between the two. Can we assign a risk score for malignant transformation?
- **Improving histopathological markers for early cancers.** Including which stains or combinations of stains would be best suited for AI interpretation and the determination of robust markers.
- **Combining samples across multiple sites.** How to tackle variability in performance of a tool across sites? Consider including slides from multiple cohorts, accessing samples from studies and trials that might not have pathology or AI expertise.

- **Comparison of AI to human performance.** Implications of a human pathologist signing off a diagnosis made by AI.

Do you have the skills, knowledge and ideas that you are motivated to apply to such questions? Can you define additional challenges that you’d like to dive into with other workshop participants?

**APPLICATION PROCESS**

**ELIGIBILITY**

Participants are selected for the sandpit workshop via a short application form. Applications are welcome from academic, industry, and community sectors.

The range of people selected is intentionally diverse, and it is intended that a wide range of disciplines, including those from private, public and third sector organisations and community groups will be represented. If you would like to transform the future of cancer early detection in the UK, we invite you to apply - irrespective of your expertise or background. We are interested in new ideas, underpinned by radical and innovative thinking.

We regret that, on this occasion, PhD students and applicants based overseas are not eligible to apply.

**APPLYING TO ATTEND**

The sandpit is an intensive residential event and **participants must be available to attend for the full 3 days of the event.** By submitting an application form, you are confirming that you are available for the full duration of the sandpit. Standard class travel, accommodation, refreshments, breakfast, lunch and dinner costs will be met by the organisers.

It is a requirement that you obtain the approval of your research organization, employer, board, shareholder(s) (as appropriate) before applying to ensure that your organisation is willing and able to engage in and support a collaborative project. **Applicants must provide a covering statement from a representative of their organisation** (e.g., supervisor, manager, or other relevant persons), confirming that, in the event of a grant, it will provide the necessary infrastructure for the applicant to conduct the research at that Host Institution.

The organisers and scientific leads will select attendees based upon answers to the online applications form. Applicants should demonstrate their relevant skills and attitude to participate in the sandpit. It is strongly advised that applicants do not merely list their achievements (e.g., publications, research experience), but, rather, use these to demonstrate
how they may approach the challenge using innovative and collaborative ways. No other documentation will be accepted or considered. The submission deadline for completed applications and statement of support will be 12pm, 30th September 2019. Applications will not be considered after this deadline.

All application forms received by the deadline will be reviewed by CRUK to ensure a mix of disciplines, skills and experience. Selection criteria will include:

- The potential to work in trans-disciplinary environments
- The potential to develop innovative and adventurous approaches to research
- The ability to work collaboratively with others
- The ability to communicate and engage with diverse non-academic stakeholders throughout the research process
- Relevant research expertise and experience

Successful candidates will be notified by email after the closing date in August. We regret that we will not be able to provide feedback to unsuccessful candidates.

PROPOSALS

On the final day of the sandpit, project teams will present their final ideas, with up to the 3 of the best research ideas being awarded up to £100K in seed-funding to support the subsequent development of feasibility or pilot work, focus groups, stakeholder/collaborator meetings, etc. The funding recommendations will be made by the sandpit Director and Subject-Guides.

Following the sandpit, the principal investigator (PI) for each successful project team will have approximately four weeks to draft a full feasibility study proposal that covers their group’s intended activities as presented at the sandpit. For ease of administration of funding, identified PIs should be members of recognised research organisations that can receive the award.

While project team members can be from commercial or non-research settings, we would ask that they not be designated as P-I on the award.

The specific role of each project team member, in terms of their involvement with, and contribution to, the project will be agreed by the project team (i.e., some members may be named as joint lead investigators or contribute in an advisory capacity, etc.).

Feasibility study proposals will be submitted via CRUK’s electronic Grant Management System (eGMS) by 16th January 2020. Feasibility studies will last up to 12 months in duration, starting in April 2020. All awards are subject to CRUK’s terms and conditions. CRUK will offer support and advice throughout the lifetime of the project, including quarterly teleconferences with project groups. A report of feasibility outputs will be required by CRUK on completion of the project and may lead to the generation of full project proposals to be submitted to the appropriate CRUK committee for further funding.
Further guidance on the post-award processes will be made available to successful applicants at the sandpit.

**THE COMMISSIONING PROCESS**

We expect that feasibility studies will run for up to 12 months, commencing by **6 months after the workshop** (see Figure 1). Studies will be funded in partnership between CRUK and STFC. Following the outcome of the feasibility studies, we expect this to lead to the development of high quality full research proposals to be an appropriate funder.

The sandpit is an interactive and free-thinking environment, where a diverse group of around 25 participants from a range of disciplines and backgrounds get together for three days - away from their everyday worlds - to immerse themselves in collaborative thinking processes in order to construct innovative transdisciplinary approaches.

Participants should arrive on Sunday evening at the hotel and the sandpit begins on the Monday morning and finishes on the Wednesday afternoon (approximately 5pm).

The process can be broken down into several stages:

**Submit sandpit workshop application**
CRUK will email you the outcome of your application

**3-day sandpit workshop**
Funding decisions will be made by the Sandpit Director and Subject-Guides on the final day of the workshop

**Work up and submit feasibility study proposal**
Proposals will be submitted via CRUK’s electronic Grants Management System and CRUK will issue a grant award letters.

**Feasibility studies commence**
Studies will be no longer than 12 months in duration

**Submit final report to CRUK**
Based on the feasibility study outcomes, work up a full project proposal and apply to relevant CRUK, or other, funding stream

**Figure 1: Innovation Workshop application and funding process**

The sandpit is an interactive and free-thinking environment, where a diverse group of around 25 participants from a range of disciplines and backgrounds get together for three days - away from their everyday worlds - to immerse themselves in collaborative thinking processes in order to construct innovative transdisciplinary approaches.
• Defining the scope of the challenge
• Sharing understandings of the challenge and expertise brought to the sandpit by participants
• Evolving common languages and terminologies amongst people from a diverse range of backgrounds and disciplines.
• Breaking down preconceptions of researchers and stakeholders.
• Taking part in break-out sessions focused on challenges, using creative thinking techniques.
• Capturing outputs in the form of highly innovative feasibility study proposals.
• A funding decision on those proposals at the sandpit, using “real time” peer-review.

As the sandpit is an intensive process, so opportunities for relaxation, reflection and networking will be built into the timetable.

The sandpit is led by a Director. The Directors of this workshop will be Prof Mark Arends, MRC Institute of Genetics and Molecular Medicine, University of Edinburgh and Prof Nasir Rajpoot, Department of Computer Science, University of Warwick. The Director and a number of Subject-Guides and stakeholders will take part in the sandpit but will not be eligible to receive research funding. During the sandpit, a number of speakers will provide different perspectives that may help participants develop new questions or novel ideas for potential feasibility studies. The Director and Subject-Guides will act as independent reviewers to make recommendations concerning the allocation of funding to research ideas emerging from the process through the real-time peer review process.

COMMISSIONING TIME TABLE

• 30th September 2019 - Deadline for submission of online application forms
• 5 weeks before event - Applicants notified of outcome
• November 18th-20th 2019 - Sandpit event (Royal College of Pathologists, London)
• 16th January 2020 - Deadline for submission of feasibility study proposals
• April 2020 - Feasibility studies commence

More information about the sandpit workshop will be shared with successful applicants in October 2019.

FURTHER INFORMATION & APPLICATIONS

If you have any questions or would like any further information, please contact Dr Alexis Webb on alexis.webb@cancer.org.uk or 0203 469 5232.

You can apply to attend this workshop here.