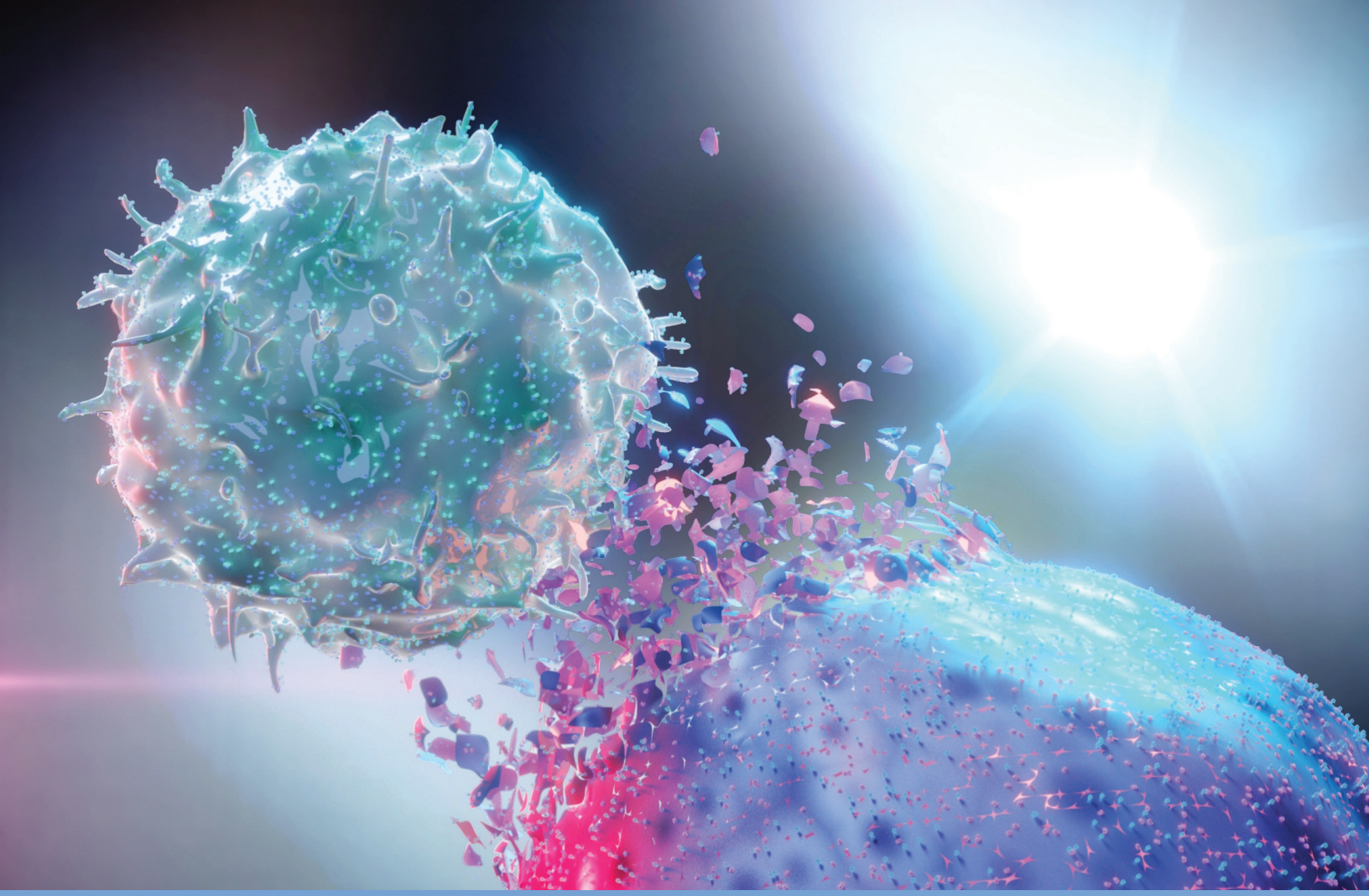


The 2023 Early Detection of Cancer Conference

October 10-12, 2023
London, England

CANCER RESEARCH UK

CANARY CENTER AT STANFORD

OHSU KNIGHT CANCER *Institute*

The 2023 Early Detection of Cancer Conference

Cancer early detection research is poised to transform patient survival, but significant hurdles stand in the way of translating new findings into clinical application. Among the challenges: deciding which populations are at greater risk and in need of screening, validating accurate biomarkers, discriminating dangerous early lesions from inconsequential growths, and developing tests that are sensitive enough to detect early cancers and specific enough to avoid false alarms and unnecessary treatment. Cancer Research UK, the Canary Center at Stanford, and the OHSU Knight Cancer Institute are collaborating to accelerate progress. The Early Detection of Cancer Conference is part of this collaboration. More than 500 attendees from academia, industry, policy and government gathered in London, England, from 10-12 October 2023, for the eighth meeting in the series.

Scientific program chairs leading the conference were **Fiona Walter, M.D.,** Queen Mary University of London; **Ramasamy Paulmurugan, Ph.D.,** Stanford University; and **Julia Maxson, Ph.D.,** OHSU Knight Cancer Institute.

In the opening keynote, **Patrick Bossuyt, Ph.D.,** Amsterdam University Medical Centers, took aim at the cancer biomarker development pipeline, an enterprise that is "leaking, full of waste, and dry at the end." To illustrate, Bossuyt described the state of ovarian cancer biomarker research, with several thousand published reports on putative biomarkers but only one, CA125, established for widespread clinical use. His team systematically reviewed 200 recent reports on ovarian biomarkers published in 95 journals and found disheartening lack of rigor. Only five of those 200 studies included a sample size justification, while just 6% mentioned the existence of a protocol, and only 17% gave explicit eligibility criteria. More than 90% relied on secondary data. Bossuyt said biomarker papers are rife with spin, including exaggerated headlines and abstracts, and analyses stretched beyond study designs. Fixing the mess will require systems change, Bossuyt asserted, with biomarker development organized collectively in large consortia rather than by competing small groups.

Inequalities in cancer detection and diagnosis

Chairs: Chairs: Kate Brain, Ph.D., Cardiff University, and Carmen Guerra, M.D., University of Pennsylvania

The first session delved into the causes of deep disparities in cancer screening, early diagnosis and survival, and explored ways to ameliorate these inequities. **Jamil Rivers,** founder of The Chrysalis Initiative, an organization working to counteract breast cancer disparities, made a compelling case for greater sophistication in cancer screening to incorporate race and ethnicity. Rivers' advocacy was inspired by her experience as a young Black woman diagnosed with metastatic breast cancer years before guidelines recommend screening. In the U.S., Black people have the highest overall death rate from cancer, and are more likely than White people to be diagnosed with cancers at a late stage.

Steven Patierno, Ph.D., Duke Cancer Institute, highlighted how patient navigation programs developed with communities can reduce disparities by overcoming the labyrinth of barriers in health care systems and building trust. He described a decision support tool for prostate cancer screening using risk-stratification, and how it increased guideline concordant screening from 49% to 72% post-implementation. He ended with a call for making precision oncology sensitive to race, citing a recent trial of apalutamide and abiraterone plus prednisone for metastatic castrate-resistant prostate cancer in which Black men responded better to the therapy than White men even though they largely started with worse disease.

Better data and models of behavior can guide interventions to improve equitable access to cancer screening. **Katie Robb, Ph.D., M.Sc., M.A.,** University of Glasgow, surveyed people about barriers and conducted co-creation workshops and focus groups to design a planning tool to help people take advantage of colorectal cancer screening using mail-in FIT kits. Supplying people with the planning tool and giving them a specific deadline for sample return, rather than leaving it open-ended, increased participation by 34,000 – enough to have potentially saved 20 lives.

Manali Patel, M.D., M.P.H., Stanford University School of Medicine and VA Palo Alto Health Care System, emphasized the importance of working with communities to build trust in the clinics where people will receive care, and training community-based health workers to help deliver timely diagnostics and care. A project involving Latinx populations in California uses community health workers to provide education about risk, prevention, and precision medicine. During the height of the pandemic, 425 out of 450 contacted by community health workers received screening. Crucially, the program focuses not only on screening but also ensuring follow-up care.

In the first lightning talk, **Nathan Thompson,** University of Strathclyde, gave an update on the development in Scotland of a rapid cancer diagnostic service for people with vague, non-specific symptoms. Unexplained weight loss has been the most common symptom, and lung, liver and urological cancers the most commonly diagnosed. Patients receive an outcome in 14 days, on average.

Sisse Njor, University Hospital of Southern Denmark, gave preliminary findings on how socioeconomic factors affect the adherence to colonoscopy surveillance in the Danish FIT-based colorectal cancer screening program, identifying populations least likely to receive recommended care. **Haleema Aslam,** De Montfort University, worked with South Asian and African and African-Caribbean women in Leicester seeking ways to improve uptake of breast cancer screening. Among her findings, cultural taboos are not so much a barrier; difficulties are more practical, such as, lack of transport and the needs for reassurance from clinics that they will not repeat previous bad experiences. **Mao Mao, M.D., Ph.D.,** SeekIn Inc., presented early results with an affordable, $20 multi-cancer early detection blood test in trials enrolling pregnant subjects. Use of a machine learning algorithm reduced the false positive rate from 46 to 7 percent.

Great Debate: We need to shift early detection of cancer out of the medical system and deliver it in the community

Moderator: David Crosby, Ph.D., Cancer Research UK

In this fierce (but friendly) great debate, **Peggy Hannon, Ph.D., M.P.H.,** University of Washington, argued for shifting early detection to the community. Hannon noted that cancer screening as it stands misses about 30 percent of those who could benefit, particularly among those with low income, curtailed access to care, limited education and facing other hurdles, such as lack of transportation and unyielding work schedules. Community-based and self-administered services do not require travel or time off work, and patients like it, she said. For instance, home tests for colon screening are preferred over colonoscopy in populations with low screening rates. At the same time, primary care doctors do not have the time needed to do all of the preventive care they are expected to do. If primary care providers were able to spend less time providing screening tests to average-risk patients, they would have more time to serve high-risk

patients, she said. Opponent **Clare Turnbull, Ph.D., M.Sc.,** Institute of Cancer Research, retorted that cancer screening is not a lifestyle choice to be picked out from a buffet; it is a potent service requiring careful balance of benefits and harms, particularly overdiagnosis of tumors not destined to become dangerous. Expert clinical oversight is essential, and screening should only be implemented with rigorous evidence of benefit. Without that oversight, she asserted, non-evidence-based screening would be free to proliferate. "It must improve survival or health related quality of life," she said, "If it's not doing that it is just wasting resources."

Before the battle of words, more than two-thirds of the audience agreed with Hannon. Support dropped to 52 percent after.

Understanding pre-cancers to enable early detection

Chairs: Sam Janes, Ph.D., University College London, and Irene Ghobrial, M.D., Dana-Farber Cancer Institute

By older ages, roughly one third of people with inflammatory bowel disease will go on to develop colorectal cancer. **Trevor Graham, Ph.D.,** Institute of Cancer Research, and colleagues looked for ways to assess the risk that precancerous lesions will progress to cancer. From samples along the entire length of a resected colon, they found many aneuploid clones distributed patchily across the organ. In another study, they collected low-grade lesions from IBD patients, whom they were able to follow to analyze who went on to develop cancer. Lesions from progressors had a far larger number of copy number alterations. Aneuploidy burden predicted cancer risk in two independent cohorts.

Clonal hematopoiesis can lead to blood cancers, including acute myeloid leukemia. **Margarete Fabre, Ph.D.,** AstraZeneca, and colleagues are seeking ways to predict when clonal expansions put people at risk of cancer. They uncovered distinct patterns of lifelong clonal behavior with some mutant clones expanding mostly early in life, while other gene mutations drove expansion only later in life. Mutations driving faster clonal growth carry a higher risk of malignant progression. They developed a predictive model for clinicians that considers expanded clones with specific mutations along with certain abnormal blood parameters.

Using a unique lung cancer dataset, **Adam Pennycuick, M.D., Ph.D.,** University College London, and colleagues gained insights into the dynamics of lesions that can develop into lung cancer. Some high-grade lesions regress to low grade, some low-grade lesions advance to high grade, and only some high-grade lesions ever become cancer, they found by analyzing 2,000 biopsies taken over time from over 300 lesions. Evidence is emerging that the onset of chromosome instability may be what makes the difference between low- and high-grade lesions.

PanIN lesions can develop into pancreatic cancers, but they are microscopic and difficult to study. **Laura DeLong Wood, M.D., Ph.D.,** Johns Hopkins University School of Medicine, and colleagues are answering fundamental questions with technically demanding sectioning of tissue samples, fixing, staining, and labeling to create three dimensional models with single cell resolution. PanINs are surprisingly abundant in the absence of pancreatic cancer, which highlights the need for biomarkers that can predict the risk of progression.

In the day's closing lighting talks, **Emmanouela Mitta,** University of Manchester, presented work on a physiologically relevant in vitro model design to represent any stage of cancer, including very early development. **Harmeet Dhani, M.D., M.Sc.,** Biological Dynamics, gave a quick look at efforts to distinguish low- vs. high-risk pancreas IPMN lesions. The company's technology analyzes biomarkers contained in circulating extracellular vesicles isolated from blood using alternating current electrokinetics. Dhani said findings suggest certain proteomic markers have potential for use in IPMN risk stratification. **Matthew Ford,** Cancer Research UK Cambridge Cancer Institute, briefly detailed a genetically engineered mouse model of high-grade serous ovarian carcinoma, for which research has

been limited by a lack of early disease samples. Metastatic disease arises in three months in the model. **Rebekka Duhen, Ph.D.,** OHSU Knight Cancer Institute/CEDAR, is characterizing changes in T cell subsets in colorectal polyps, cancer and blood for insights of use in early detection.

The Don Listwin Award

Peter Sasieni, Ph.D., professor of cancer epidemiology in the Wolfson Institute of Population Health, Queen Mary University of London, was honored with the 2023 Don Listwin Award for Outstanding Contribution to Cancer Early Detection. Sasieni is academic director of the Kings Clinical Trials Unit at King's College London. His career in cervical cancer prevention started with his first post-doctoral position at the Imperial Cancer Research Fund, looking at ways to optimize cervical cancer screening. He then looked at the potential for HPV testing to improve cervical cancer screening, followed by researching HPV vaccination as a means of cervical cancer prevention. The first HPV vaccinations were administered in 2006, and Sasieni was the lead author of the 2021 paper showing that the implementation of HPV vaccination has led to a dramatic reduction in cervical cancer incidence.

Great debate: All cancer screening must be reserved for 'high- risk' population

Moderator: David Crosby, Ph.D., Cancer Research UK

Day two kicked off with another great debate. **Fiona Gilbert, M.A., M.B. Ch.B.,** University of Cambridge, championed the assertion: All cancer screening must be reserved for 'high risk' populations. Her argument hinged on cost-effectiveness and how targeting screening technology to higher risk populations allows resources to be used more wisely, using mammography as an example. Mammography has proven incapable of detecting many dangerous interval cancers and brings the risk of harmful overdiagnosis in low-risk populations. Meanwhile, advances in genetic screening are improving the ability to identify those at high risk. Reserving mammography for higher risk populations would free up resources for broader use of advanced imaging in that population. "We should be thinking about stratifying populations into high-risk and low-risk groups and look more intelligently at who needs what," she said. **Hilary Robbins, Ph.D.,** International Agency for Research on Cancer, called out two big problems with reserving cancer screening for high-risk populations: we don't have appropriate tools to identify high-risk people for most cancers, she asserted, and it would be unethical to restrict screening to some and not others, particularly for cancers that can be prevented from developing, such as cervical and colon cancer. "We can tailor the screening process, while still engaging everyone," she said, with decisions about the age to start and stop screening, which tests to use, and how often.

Before the match, about 75% of audience members disagreed with the proposition, and a few minds were changed, with 70% disagreeing after.

Can data revolutionize our approach to early detection?

Antonis Antoniou, Ph.D., University of Cambridge, joined **Sapna Syngal, M.D., M.P.H.,** Dana-Farber Cancer Institute, onstage for a conversation about the expanding applications of data science, machine learning, and risk-prediction modeling in cancer early detection. Troves of data are opening up to researchers: from patients' electronic health records, archived imaging, and biobanked tissue samples, to our expanding digital footprints left by social media activity and online purchasing. Antoniou is leading the Cancer Data Driven Detection (CD3) initiative, which is gathering experts in data science, analytics, and machine learning algorithms to build multifactorial cancer risk prediction models in

partnership with patients, the public, and clinicians. An ongoing challenge for the field is integrating data gathered from disparate sources with varying standards of collection. Syngal said data governance and regulations remain big hurdles. The field also needs approaches to address biases in existing data sets, such as the exclusion of marginalized populations, which can worsen inequalities.

In the day's first lightning talk, **Xiaoshuang Feng, Ph.D.,** International Agency for Research on Cancer, presented a modeling study on eligibility criteria of national lung cancer screening in France. Depending on criteria applied, modeling found that 2 to 4 million people would be eligible, 11,100 to 14,200 lung cancer deaths might be prevented, and risk-based criteria might lower the number needed to screen. **Suzanne Scott, Ph.D.,** Queen Mary University, presented findings on future cancer risk after urgent suspected cancer referral when cancer was not found. Cancers were diagnosed at the rate of 1,338 per 100,00 referrals, 27% higher than expected for people of similar age and gender, raising questions about the need to offer proactive monitoring or other interventions. **Paul Barber, Ph.D.,** King's College London, described steps taken to develop a machine learning algorithm for enhanced lung cancer detection from CT imaging combined with blood immune profiling. **Samantha Ip,** University of Cambridge, presented a dynamic model of genetics, lifestyle and primary care records for colorectal cancer early detection. The polygenic score has predictive value, she concluded, and among different risk predictors, primary records, especially routine blood tests, are crucial.

Risk stratification to inform early detection

Yoryos Lyratzopoulos, M.D., MPH, University College London, and Sapna Syngal, M.D., MPH, Dana-Farber Cancer Institute

Angela Wood, Ph.D., Health Data Research UK / University of Cambridge, delved into the use of electronic health records to derive and validate tools for cancer early detection. She explained how it's possible to transform raw data from diverse sources into a standardized form. To account for inevitably missing data, she showed how the technique of multiple imputation uses relationships in observed data to estimate missing values. Wood makes use of dynamic risk models, which allow risk predictions to be updated dynamically in response to new data accruing over time, such as updated blood work, changes in body mass or alcohol use. On the horizon, she sees an emerging role for tools to simultaneously monitor the risk of multiple diseases over time.

People with non-specific symptoms regularly prompt urgent cancer referrals, a good share of which prove unnecessary. **Brian Nicholson, D.Phil., M.Sc.,** University of Oxford, reported on work to make the process more efficient and less burdensome. He's a collaborator on the SYMPLIFY study using the multi-cancer early detection blood test Galleri in primary care for patients with non-specific symptoms. The MCED test detected a cancer signal in 323 cases, in whom 244 cancers were diagnosed, yielding a sensitivity of 66.3% and specificity of 98.4%. Nicholson said MCED tests have the potential to limit unnecessary referrals, but much remains to be determined about their role in primary care. For all early detection tests proposed for primary care, he said it will be crucial to build in implementation science to prevent unintended consequences.

Rosalind Eeles, Ph.D., The Institute of Cancer Research, ran through recent advances in the use of genetics to risk stratify for cancer screening. In the IMPACT study of genetically targeted screening for prostate cancer, carriers of MSH2 and MSH6 pathogenic variants had a higher incidence of prostate cancer compared with age-matched non-carrier controls. BRCA2 carriers had a higher incidence rate than noncarriers, and BRCA2 carriers were diagnosed at a younger age and were more likely to have clinically significant disease. Citing the study as strong evidence, European Association of Urology guidelines now recommend early PSA testing to men carrying BRCA2 mutations from 40 years of age. Eeles expects genetic testing to escalate, egged on by popular demand. To make sure it is implemented wisely, "we need to engage," she said.

Muscle wasting is devastatingly common in pancreatic cancer. Eye-opening research by **Michael Rosenthal, M.D., Ph.D.,** Dana Farber Cancer Institute, and colleagues revealed that muscle wasting begins at least 18 months before pancreatic cancer diagnosis and might serve as an early detection signal. They measured skeletal muscle and fat tissue areas from computed tomography imaging up to 5 years before cancer diagnosis in over 700 pancreatic cancer cases and 1,700 matched controls. Rosenthal sees promise also in radiomics models that use mathematical quantifications of image features to generate potential biomarkers. He cited a Mayo Clinic study showing that subtle radiologic features of the pancreas are different in people who will develop pancreatic cancer in the next 3 to 36 months than in those who will not.

Patient advocate **Helen White** knew nothing about cancer-predisposing Lynch syndrome until she developed uterine cancer six years ago. She reflected on her experience with medical providers. It was she who sought testing for Lynch syndrome, spurred by knowledge of a family history of cancer. And it took persistence to get the genetic testing that revealed she was a carrier. She's found a way to embrace the positives. "If I know about it, I can do something about it," she says. Most importantly, finding out meant her two adult sons could be tested (neither carry the responsible gene). Since her diagnosis, she's observed much progress for people with Lynch syndrome. But she knows from networking that barriers persist, with some people years overdue for needed colonoscopy screening.

Panel: Why haven't the technological and regulatory advances during the pandemic accelerated research in cancer early detection?
Chair: Jon Emery, Ph.D., MBBS, University of Melbourne

During the COVID-19 pandemic, scientists, regulators and industry found ways to speed development of diagnostic tests and vaccines, fast-track implementation and make data widely accessible. In a panel discussion, experts considered why those innovations haven't improved the landscape for cancer early detection research and the development of cancer diagnostics as was thought possible or even likely a year or more ago.

Chris Whitty, D.Sc., M.Sc., M.B.A., Chief Medical Officer for England, pointed out that during the pandemic, money was no barrier "in a way we wouldn't do in other situations," driven by the urgent need to get society back to normal. **Alexander David Borowsky, M.D.,** University of California Davis, observed that the balance of benefit and harm from a screening test for cancer is different from a COVID test; cancer testing has more potential for harm. **Lisa Lacasse, M.B.A.,** American Cancer Society, said an important lesson from the pandemic is how it revealed that bureaucratic barriers more or less considered unchangeable quickly proved surmountable. She believes that will spur openings for more rapid translation of cancer innovations. Whitty agreed, observing that the pandemic proved that agencies can render decisions much more swiftly while maintaining rigorous oversight. Another lesson to build on, he said, is the power of collaborations that include experts from different disciplines. "Forcing those combinations is something we do not have to wait for an emergency to do," he said.

Keynote: Integration of imaging and biomarkers for the early detection of cancer

Edward Patz, M.D., Duke University School of Medicine, delivered strong opinions on cancer screening: he spoke about how important it is to design appropriate clinical trials that can show if a screening test is effective. How important it is to be fiscally responsible. How important it is to show that early intervention reduces mortality, the appropriate endpoint. Focusing on lung cancer screening, Patz said the challenge is not being able to find smaller lesions, but being able to phenotype lesions and their interactions with the immune system to identify those likely to progress and become life threatening.

Panel: How can we integrate information coming from traditional imaging with molecular biomarkers and clinical information to aid the early detection of cancer?
Chair: Cristian Tomasetti, City of Hope

Panelists explored strategies for effectively integrating information from traditional imaging techniques, molecular biomarkers, and clinical data to enhance early cancer detection. **Caroline Dive, Ph.D.,** CRUK Manchester Institute, sees much opportunity for emerging blood tests and breath tests to be combined with lung imaging for early detection, with potential to help predict whether an early lesion is likely to become a dangerous aggressive tumor. She noted that the CT screening era is giving scientists access to more samples from early-stage tumors that have been resected, which they can use to learn about the biology of early lung cancer. She said accessing new troves of data remains too encumbered by red tape and emphasized the need for research agencies and health systems to make data sharing more efficient. In prostate cancer screening and diagnosis, **Shonit Punwani, Ph.D., MBBS,** University College London, asserted that integration is important at every step, with blood tests, imaging and biopsy results used together to inform treatment. Well-designed clinical trials will be needed to inform how best to integrate emerging modalities into clinical practice, he said, noting the importance of fiscal responsibility when deploying new technologies in population screening. **Edward Patz, M.D.,** emphasized the importance of the concept of risk stratification when integrating new modalities. That includes finding ways to limit the use of expensive modalities to those at highest risk, and pre-screening with tests that can rule-out the need for more invasive or expensive tests.

Multicancer early detection – beyond ctDNA

Chairs: Matthew Thompson, MPH, D.Phil., MBChB, Google LLC, and Claude Chelala, Ph.D., Queen Mary University of London

Garth Funston, MB BChir, Ph.D., Queen Mary University of London, highlighted the potential of mining electronic health records' unstructured data, such as observations noted in free text but not coded. Adding unstructured data could enhance the accuracy of predictive models that use coded patient data to flag those at high risk of cancer. Funston is a co-investigator in CanDetect, a Cancer Research UK-funded program that aims to accelerate the detection of upper gastro-intestinal cancers in primary care.

Søren Brunak, Ph.D., University of Copenhagen, described a framework for predicting the risk of pancreatic cancer using machine learning models trained on the sequence of disease codes in clinical histories kept in the Danish National Patient Registry, which contains data for 8.6 million patients from 1977 to 2018. For cancer occurrence within three years, the performance of the best model has area under the receiver operating characteristic (AUROC) curve = 0.88 with an estimated relative risk of 59 for 1,000 highest-risk patients older than age 50 years. Cross-application of the Danish model to U.S. Veterans Affairs data had lower performance (AUROC = 0.71), but improved with retraining.

The development of cancer changes the composition of blood proteins in ways that can be detected by Fourier transform infra-red spectroscopy. **Paul Brennan, Ph.D.,** The University of Edinburgh, and colleagues used their spectroscopic liquid biopsy test to predict the presence of brain cancer with 96% sensitivity, showing potential to help patients obtain a diagnosis more quickly. A study at six European sites will analyze serum samples from patients with symptoms concurrent with a brain tumor diagnosis, to be confirmed by standard care imaging. Brennan presented data supporting potential for early detection of multiple cancer types.

Francesco Gatto, Ph.D., and colleagues at Elypta have developed a liquid biopsy platform to profile glycosaminoglycans, which are deregulated in cancer. Gatto said the profiling system had 21% sensitivity to predict stage 1 cancers at 99% specificity. Glycosaminoglycan signatures appear to be an independent biomarker of cancer not affected by age or common, non-cancer chronic diseases, he said.

Lightning talks kicked off with **Jose Montoya Mira,** Oregon Health & Science University, who described a rapid assay for the early detection of pancreatic cancer that measures proteases associated with cancer development. The assay requires very small amounts of blood, costs little and showed good sensitivity and specificity in a blinded validation study. **Taylor Cavazos, Ph.D.,** and colleagues at Exai Bio are targeting circulating orphan non-coding RNAs for early detection. She presented data showing the approach can pick up multiple cancer types and robustly predict tissue of origin. **Evelyn Fitzsimons,** University College London Cancer Institute, reported on efforts to use immune signatures in peripheral blood for early detection of cancer. Her group is testing their assay in a cohort of subjects with indeterminant lung nodules. **Franco Faucher,** Stanford University, presented work on protease activated real-time radiometric imaging for early cancer detection in surgical and diagnostic applications. It's a way to make fluorescent labeling stand out from background signals so that very small lesions can be detected.

Panel: Patient and Public Involvement in Early Detection Research

Chairs: Fiona Walter, M.D., Queen Mary University of London, and Jamil Rivers, The Chrysalis Initiative

This interactive panel discussion including a lively audience Q&A brought together patient and public representatives to discuss the crucial role of patient and public involvement in early detection research. **Jamil Rivers,** founder of The Chrysalis Initiative, emphasized how scientists can make their research more meaningful to patients by involving them early in the development of proposals. Patient advocate Angela King, urged scientists to see patient and public involvement as "building relationships with people who have access to a body of knowledge that you don't." **Richard Stephens,** another Patient advocate, called on researchers to more zealously seek involvement of patients from underrepresented populations. "You are going to have to go out to them, not wait to have people come in."

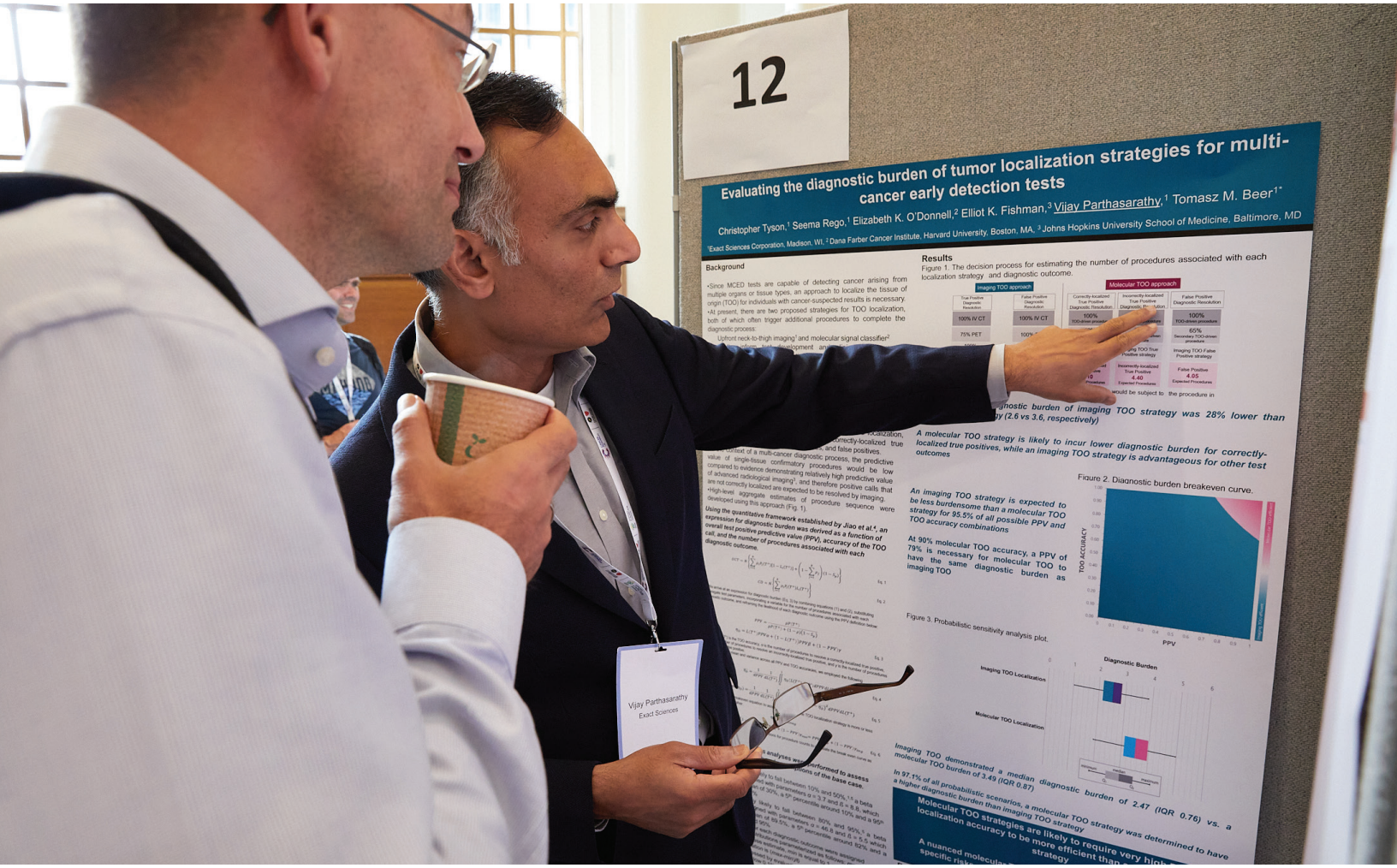
The Health Economics of Early Detection

Chair: Larry Kessler, Sc.D., University of Washington

Economists in this panel delved into the construction of health economic models for early detection. **Bethany Shinkins, Ph.D.,** University of Warwick, said the goal is to better understand and quantify cost and benefit trade-offs to inform decisions. Lack of good data is a frequent hurdle. Her main message: engage early with health economists early for guidance through the evidence generation process. **Natalia Kunst, Ph.D.,** University of York, highlighted the role of value-of-information analysis, a quantitative method to estimate the return on investment in proposed research projects. **Stuart Wright, Ph.D.,** University of Manchester, issued some cautions about the complexity of simulation-based modeling used by health economists and the need to be careful with validation to ensure models reflect what actually what happens in health systems.

Keynote: Stem cell pathways, aging and pre-cancer evolution

In the closing talk, **Catriona Jamieson, M.D., Ph.D.,** told the story of stem cell research culminating in discoveries about fundamental drivers of cancer, a promising new drug, and experiments aboard an orbiting spacecraft. Jamieson directs the Stanford Stem Cell Clinical Center at the University of California San Diego. She and colleagues seized on the significance of a protein called ADAR1. In its malignant form, ADAR1 promotes immune silencing, metastasis and therapeutic resistance in 20 different cancer types. The researchers are developing a small molecule inhibitor, called rebecsinib, that in pre-clinical testing halted and reversed ADAR1 signaling. Her and her team have been conducting experiments aboard spacecraft to study stress-induced aging and how cancer stem cells arise and progress to leukemia and other blood cancers.



Poster prize winners

Day 1

Nicholas Cheng, Ontario Institute for Cancer Research, Leveraging population cohorts to profile cell-free DNA methylation and fragmentomic signatures in blood up to eight years prior to clinical detection
Caroline Watson, Ph.D., Early Cancer Institute, Department of Oncology, University of Cambridge, Tracing the evolution of clonal hematopoiesis to acute myeloid leukaemia (AML) using longitudinal pre-diagnosis blood samples
Marta Canel, Ph.D., Cancer Research UK Scotland Centre, Institute of Genetics and Cancer, University of Edinburgh, Validating new models to investigate the impact of mutational heterogeneity in the early detection of pancreatic cancer.

Poster prize winners

Day 2

Ananya Malhotra, Ph.D., London School of Hygiene Tropical Medicine, Can we screen for pancreatic cancer? Identifying a sub-population of patients at high risk of subsequent diagnosis using machine learning techniques applied to primary care data.
Stuart Ibsen, Ph.D., Oregon Health & Science University, Differentiation of Pancreatic Cancer from Benign Pancreatic Disease using Cancer-Derived Nanoparticles Recovered using High Conductance Dielectrophoresis
Kathryn Young, Natera, Inc., Blood-based early cancer detection screening for breast and ovarian cancer: Who should be tested?

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Save the date

The 2024 Early Detection of Cancer Conference takes place 22-24 October, Hyatt Regency San Francisco Downtown SOMA, San Francisco, CA, hosted by the Canary Center at Stanford.