



CHRC

Centre for Health Effects of Radiological and Chemical Agents

Annual Report 2017 - 2018



Table of Contents

Foreword	3
Background	4
Phase 1 Implementation activities (Years 1-3):	5
CHRC Affiliates and Governance Bodies	6
Governance	7
CHRC Management Committee.....	7
CHRC Advisory Board	7
Staff at CHRC	8
CHRC core staff	8
Research staff on funded projects.....	9
Multi-disciplinary research	10
A genetic and cytogenetic assessment of British nuclear test veterans and their children.....	12
Exposure worry, ageing, and cognitive functioning: An in-depth study of British nuclear test veterans.	13
Heritable effects of pre-conceptual radiation exposure.	14
Sport, culture & wellbeing: community approaches to promote wellbeing among British nuclear test veterans and their families.	15
Assessment of risks from combined exposures to radiation and chemicals.	16
Radiation risk from high LET alpha-emitters using radium-223 as a model.....	17
External engagement	18
Non-scientific Events	19
Articles in Exposure and Campaign magazine	20
Training and Promotion of Research	21
Scientific Conferences attended:.....	21
Early careers and European training events:	22

Foreword

The CHRC was established in September 2017 so much of the team's effort through 2017/18 has focussed on the recruitment and training of new staff and students, the design and ongoing delivery of new research projects in key discipline areas, the development and effective implementation of management protocols and procedures and, the promotion of our work to scientific and nuclear test veteran communities. We give an account of our progress in all areas in this Annual Report. We are particularly pleased to highlight the shared focus of our multi-disciplinary specialists and early career researchers in integrating and building research capacity around this community of aged test veteran and their families.

Over the course of 2017/18 we have had the opportunity to better understand the beliefs and unanswered questions held by many in the nuclear test veteran community. The challenge moving forward will be to more effectively share the many scientific uncertainties and, the many scientific advances which have been made in understanding radiation health effects, particularly at low radiation doses.

A handwritten signature in black ink, appearing to read 'Rhona Anderson', is centered on the page. The signature is written in a cursive, flowing style.

Dr Rhona Anderson

Director, CHRC

Background

The British Government undertook a series of atmospheric nuclear weapons tests at various sites in Australia and the South Pacific between 1952 and 1958. Associated with these tests was an experimental programme in which radioactivity was dispersed into the environment, this programme ended in 1963 although operations continued through to 1967. Additionally, UK personnel participated in a series of American tests based at Christmas Island in 1962. It is estimated that over 20,000 UK servicemen participated in at least one of these British and American tests. An ongoing concern within the nuclear test community has been whether veterans of these programmes could have received sufficient radiation exposure to cause genetic damage (changes to the DNA) in them. Genetic damage can increase the risk of developing various diseases. This concern extends to whether they might also have passed on genetic alterations to their children, thereby potentially affecting their family's health.

The Centre for Health Effects of Radiological and Chemical Agents (CHRC) was established in September 2017, funded by the Nuclear Community Charity Fund (NCCF) through funds received by the Armed Forces Covenant Aged Veterans Fund and, Brunel University London.

Our purpose is the generation, promotion and integration of new, multi-disciplinary research that is particular to this aged nuclear community, their genomic health and the impact of uncertainty on health more broadly and, to make the findings of this research accessible for all.

The aim of the CHRC is to be a credible, independent, evidence-based source of information for the test veteran, scientific, health professional and political communities. Our ambitions are to extend this scope to also include health effects of other radiological and chemical exposures that may be seen in other settings.

The CHRC will build to:

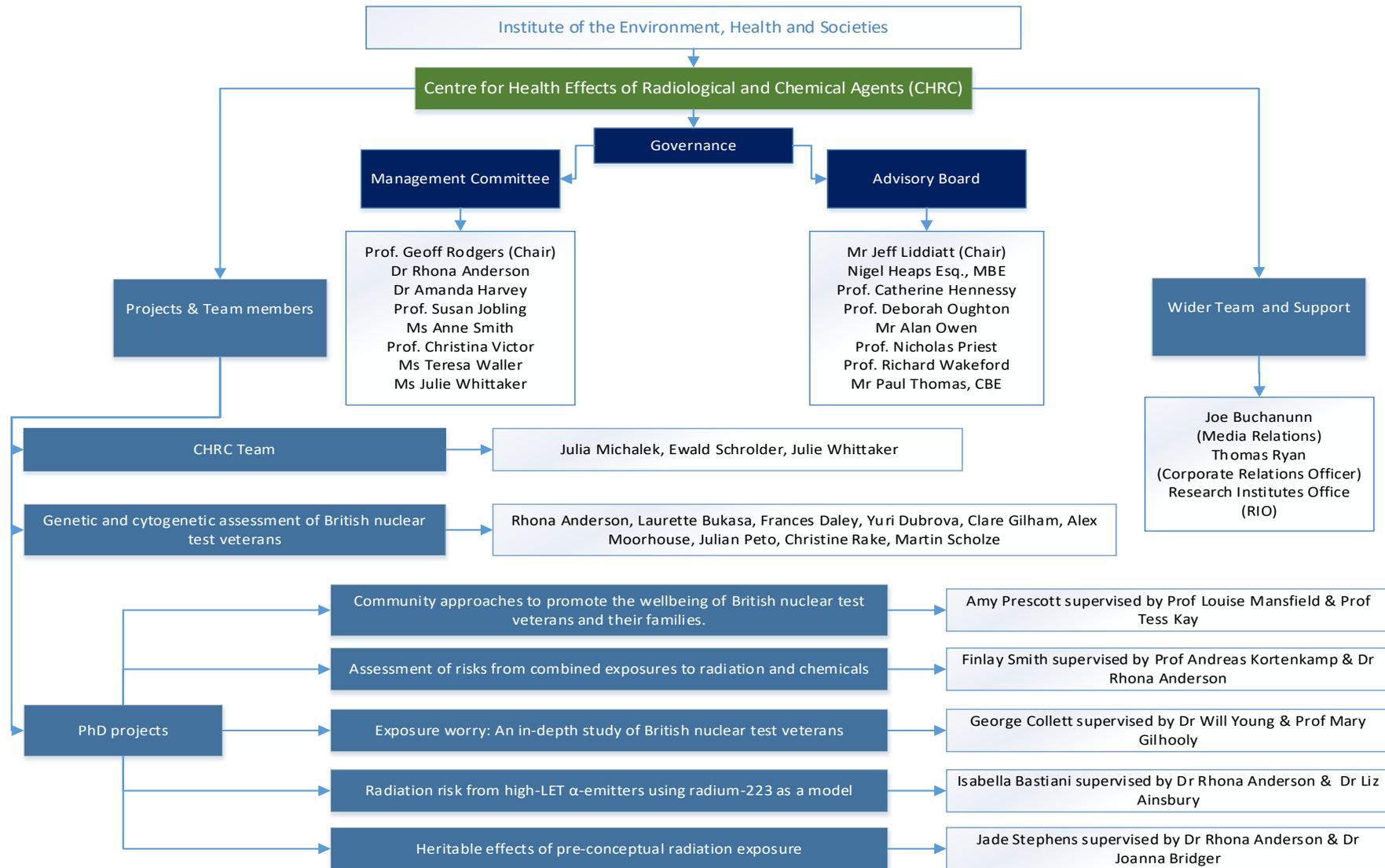
- act as a knowledge hub for scientific, health & wellbeing and, policy-related work
- deliver a programme of scientific research
- provide evidence-based information which is accessible to a broad audience
- enhance care and wellbeing through increased understanding

To effectively deliver these objectives a firm base in the underlying science is required. Accordingly, CHRC is being established in two phases. In Phase 1 the Centre is primarily acting as a research hub, generating new research and also reviewing what is currently understood. Phase 2 onwards will develop this research and also incorporate outreach, education and policy advising roles.

Phase 1 Implementation activities (Years 1-3):

1. Establishing organisational structure and core personnel
2. Publishing review/s on the current state-of-the-science specific to the Centre's work and translating for lay audience
3. Identifying and prioritizing outstanding research needs in all discipline areas
4. Develop a research programme and delivery of core research in all discipline areas to help inform the nuclear community
5. Identify future care & wellbeing needs
6. Develop and begin delivery of educational material to inform all beneficiaries
7. Host networking & public engagement events
8. Establish a forward strategy for sustainable funding, research, translation and education.

CHRC Affiliates and Governance Bodies



Governance

CHRC Management Committee

Professor Geoff Rodgers: Vice-Provost Research

Dr Rhona Anderson: Director, CHRC

Dr Amanda Harvey: Division Lead (Biosciences), Department of Life Sciences

Professor Susan Jobling: Director, Institute of Environment, Health and Societies

Ms Anne Smith: Institute Manager (Institute of Environment Health and Societies)

Professor Christina Victor: Vice Dean Research (College of Health and Life Sciences)

Ms Teresa Waller: Director, Research Support and Development Office

Ms Julie Whittaker: Centre Manager, CHRC

CHRC Advisory Board

Mr Jeff Liddiatt (Chair): Chairman of the Nuclear Community Charity Fund

Mr Nigel Heaps Esq., MBE: Director, BH Associates

Professor Catherine Hennessy: Visiting Professor, Faculty of Health and Social Sciences, Bournemouth University

Professor Deborah Oughton: Professor in Environmental Chemistry and Head of the Research school in Ecotoxicology at the Norwegian University of Life Sciences

Mr Alan Owen: Chairman of the British Nuclear Test veterans Association (registration 1131134) (Sept 17-Aug 18)

Professor Nicholas Priest: Visiting Professor at Middlesex University and Adjunct Professor at the Medical University of South Carolina, USA

Professor Richard Wakeford: Professor in Epidemiology, Manchester University and Dalton Nuclear Institute

Mr Paul R Thomas CBE: Chief Operating Officer (COO), Brunel University London

Staff at CHRC

Dr Rhona Anderson

Director



Dr Rhona Anderson is a Senior Lecturer in Radiation Biology in the Department of Life Sciences and, a member of the Institute of Environment, Health and Societies at Brunel University London. Rhona started her career as a clinical cytogeneticist in Glasgow in 1994 before developing her research interests in radiation biology at the Medical Research Council Radiation and Genome Stability Unit, Harwell (1996-2005). She gained her PhD from Brunel University in 2004 before taking up a lectureship in 2005.

CHRC core staff

Julie Whittaker

Centre Manager



Julie joined the CHRC in September 2017 at the start of the project, but has been working for Brunel University London since September 1999, when she joined the Department of Information Systems and Computing (DISC) as an administrator for undergraduate final year projects. Whilst in DISC Julie studied part time with the Open University and was awarded BSc Hons in Computer Science in 2010. During her time at Brunel Julie has taken on several secondments which has allowed her to gain knowledge in a wide range of research areas and activities.

Julia Michalek

Research Technician (1st October 2017- 30th September 2018)



Julia joined the Veterans Cytogenetics Project team at Brunel University in October 2017 as a Research Technician. After completing her BSc Psychology degree at Brunel she moved on to King's College London where she graduated with an MSc in Genes, Environment and Development.

Ewald Schroder

[Communications and Engagement Officer](#) (20th November 2017-17th August 2018)



Ewald joined the CHRC in November 2017 to provide services in scientific writing, communication and grant funding. After gaining a BSc in Biomolecular Science from the University of Portsmouth, Ewald went on to complete a doctorate in biochemistry at the University of Oxford, followed by postdoctoral research at the University of Exeter and King's College London, and Wake Forest School of Medicine in the USA. With experience in freelance manuscript work, Ewald switched to scientific writing at the Crick Institute and Institute of Cancer Research, and most recently worked in administering research grant funding at Cancer Research UK.

Research staff on funded projects

Frances Daley

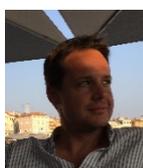
[Research Assistant](#)



Frances joined the Veterans Cytogenetic Project at Brunel University in August 2017 having moved from the Institute of Cancer Research Molecular Pathology department. Frances is a senior biomedical scientist and holds an MSc in Medical Molecular biology from the University of Westminster. She has accumulated vast experience working in a pharmaceutical, diagnostic and a research environments.

Alex Moorhouse

[Postdoctoral Research Fellow](#)



Dr Alex Moorhouse is a Postdoctoral Research Fellow based at the University of Leicester. Alex has gained degrees from the University of Exeter in bioinformatics and from UCL in human evolution. He has worked with a range of model organisms including Zebra fish, infectious yeast species of the genus *Candida*, the budding yeast *Saccharomyces cerevisiae* and mouse models of the malaria parasite *Plasmodium berghei*. Alex gained his PhD at the University of Aberdeen studying yeast genomics, population genetics and ancient DNA at the MRC Centre for Medical Mycology and Fungal Immunology with placement at the Australian Centre for Ancient DNA.

Multi-disciplinary research

The CHRC sits within the Institute of Environment, Health and Societies at Brunel University London and is housed in three neighbouring offices within the College of Health and Life Sciences providing a shared working environment for all staff and students. Our work is exploring the health impact of radiological and chemical agents on test veterans and their families, by undertaking several multi-disciplinary projects.

The major component of the research programme currently underway at the CHRC is a genetic and cytogenetic assessment of nuclear test veterans (NTV) and their families. This research seeks to address whether a heritable genetic legacy could exist in families due to historical participation in various military operations during the British nuclear testing programme in the 1950s and 60s (see page 12 for outline). This work is being carried out in collaboration with Professor Julian Petos' team from the London School of Hygiene and Tropical Medicine and Professor Yuri Dubrova at the University of Leicester and is funded by two project grants (Cytogenetic assessment of British nuclear test veterans and their families. Anderson RM (PI) and Peto J. £449,672, June 2016-May 2020 (Aged Veterans Fund) and Genetic and cytogenetic assessment of British nuclear test veterans and their families. Anderson RM (PI), Peto J and Dubrova Y. £826,027, Sept 2017-Aug 2020 (Aged Veterans Fund)). Our recruitment of families to participate in this study is well underway and we will report on our findings through peer-review publications once completed. Given the interest in this research, the questions and science behind this and associated work will underpin much of the translational and educational activities to be undertaken by CHRC.

The Institute of Environment, Health and Societies (IEHS) at Brunel University London has key thematic areas of research. The Institute's Director, Professor Susan Jobling, the leaders in Ageing Studies (Professor Mary Gilhooly), Welfare, Health & Wellbeing (Professor Tess Kay) and, Environment and Health (Professor Andreas Kortenkamp) together with Dr Rhona Anderson have developed a number of cross-discipline research projects based on current gaps in knowledge and consultation with the nuclear community as areas of principal interest.

These projects are being carried out by our PhD students (pages 13-16), delivering new research and building research capacity for the future.

Professor Louise Mansfield and Professor Tess Kay (Welfare, Health and Wellbeing Theme) are supervising Amy Prescott who is exploring the use of sport, culture and exercise interventions to promote wellbeing among NTVs and their families, while Professor Mary Gilhooly and Dr Will Young (Ageing Studies Theme) are supervising George Collett who is examining the impact of witnessing nuclear tests and exposure worry on the cognitive health of aged veterans.

Two further projects are building upon better understanding the risks of exposure on genomic integrity and health. Professor Andreas Kortenkamp and Dr Rhona Anderson (Environment and Health Theme) are supervising Finlay Smith who is assessing the genotoxic risks from combined exposures to radiation and chemicals to ask whether mixed exposures could lead to differences in biological response, while Dr Rhona Anderson and Dr Joanna Bridger (Genome Engineering Network) are supervising Jade Stephens who is looking at the correlation between chromosomal abnormalities and potential health effects in the descendants of test veterans.

CHRC is also progressing research by carrying out a number of reviews of the published literature, notably we are currently undertaking a systematic review with the aim of identifying, evaluating and summarising findings pertaining to; 'Radiation-induced trans-generational effects'. Lay summaries will be generated from this work and used to deliver key messages on www.chrc4veterans.uk

CHRC is envisaged as a long term venture with ambitions to expand our current research to benefit health and wellbeing of this nuclear test veteran and other exposed populations (e.g. page 17).

A genetic and cytogenetic assessment of British nuclear test veterans and their children.

Rhona Anderson^[1], Laurette Bukassa^[2], Frances Daley^[1], Yuri Dubrova^[3], Clare Gilham^[2], Julia Michalek^[1], Alex Moorhouse^[1,3], Julian Peto^[2], Christine Rake^[2] and Martin Scholze^[1]

[1] Centre for Health Effects of Radiological Agents, Institute for Environment, Health and Societies, Brunel University London, Uxbridge, London UB8 3PH, UK. [2]. Department of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK. [3] Department of Genetics and Genome Biology, University of Leicester, Leicester LE1 7RH, UK

The question of adverse health effects in the offspring of radiation-exposed parents remains outstanding. The consensus from epidemiology is that presently no conclusive evidence exists, yet this is tempered by some evidence from cellular and animal studies that support the presence of detrimental outcomes as a result of parental exposure to radiation. The aim of this study is to ask whether a heritable genetic legacy could exist due to historical participation in various military operations during the British nuclear testing programme in the 1950s and 60s.

For this, we are recruiting 50 nuclear test veteran family trios (veteran, child, child's mother) according to their potential for being exposed to radiation and matching (on age, service and rank) with veterans who served in the tropics at the same time but who were not present at any tests. Selected veterans are then invited to participate through receipt of an invitation letter via their GP and if interested, are screened for eligibility. After consent and interview, whole blood is sampled from each family and processed for cytogenetic and whole genome sequence analyses to ask (i) if there is any cytogenetic evidence of historical exposure of the test veterans to radiation and (ii) if there are any differences in the frequency and spectra of DNA mutations and chromosomal aberrations in the 1st generation children of test veterans, when compared to the control family group.

All necessary permissions and full HRA approval were obtained after a 17 month process enabling the study team to begin the process of recruitment in January 2018. Progress with this is in-line with our expectations and we have achieved the milestone of 50% of our recruitment target. Blood is regularly being received from those family trios who have reached the end of our multi-step recruitment process, accordingly, analysis is also underway.

Exposure worry, ageing, and cognitive functioning: An in-depth study of British nuclear test veterans.

George Collett (1st Year PhD student), Dr Will Young, Professor Kenneth Gilhooly and Professor Mary Gilhooly



Start date: 8th Jan 2018

Funded by: CHRC

It could be argued that impaired cognitive functioning may result from possible ionising radiation exposure, but it is unclear whether or not the dosage received by the test-veteran would cause significant cognitive impairment. Apart from any possible impact from potential exposure, the persistent psychological stress of witnessing a nuclear event, and years of worry about the potential damage to oneself and potential genetic damage to descendants, may be associated with poorer cognitive functioning.

The aim of this study is to examine factors associated with an important aspect of healthy ageing and quality of life, namely cognitive functioning. A special feature of this study is an examination of 'exposure worry' and cognitive functioning. Currently there is no such research on cognitive effects of witnessing nuclear tests among UK or other national groups of test veterans. However, this aspect is being explored with increasing priority in relation to populations affected by the Chernobyl and Fukushima accidents.

No measure for assessing exposure worry in nuclear test-veterans has been developed, and without such a measure we are unable to examine the relationship between exposure worry and cognitive functioning. Our current work is focussed on developing such an 'exposure worry scale', which will be used in the overall project. The stages for this are involving gaining information through focus groups, individual telephone interviews, and from quantitative analysis methods. Our scale is being tested for normality and skew. Once completed, it will be a useful tool to examine exposure worry in the nuclear community, and will also indicate the severity of this, perhaps indicating extra support to be implemented to help overcome this worry.

Heritable effects of pre-conceptual radiation exposure.

Jade Stephens (1st Year PhD student), Dr Joanna Bridger and Dr Rhona Anderson

Start Date: 8th January 2018

Funded by: CHRC



Radioactive material released into the atmosphere from nuclear testing will have resulted in varying levels of fallout contamination to surrounding areas. Approximately 22,000 British veterans were at the test sites and it is estimated that over 3000 are alive today. During the 1970's health issues were raised with the veterans and also with their descendants, which some believe is a consequence of their participation at the nuclear test sites. However the question of whether adverse health effects can occur as a result of parental radiation exposure pre-conception remains to be fully understood.

This study is using cytogenetic techniques to determine the chromosome constitution that the descendants of nuclear test veterans are born with. If any abnormalities are found then these will be correlated with known genetic disorders. This research will also assess descendant health outcome data from other exposed populations using a variety of other methods including from published sources.

Sport, culture & wellbeing: community approaches to promote wellbeing among British nuclear test veterans and their families.

Amy Prescott (1st Year PhD student), Professor Tess Kay and Professor Louise Mansfield



Start Date: 2nd October 2017

Funded by: CHRC

This research project aims to understand how community sport and cultural activities may help and contribute to improving the health and wellbeing of British nuclear test veterans and their families. The purpose of this work is to develop partnerships with members of the nuclear community to understand their health and wellbeing needs and to design and provide activities that can improve their daily lives.

The British nuclear test veterans (BNTVs) have expressed concern of biological damage following possible exposure to ionizing radiation. There are no published studies relating to the wellbeing of the BNTVs. The objectives of the present study are: to understand what it means to identify as a BNTV and to be a part of the BNTV community; to identify what the health and wellbeing issues are within this community; and, to co-design culture and/or sporting interventions to alleviate possible health and wellbeing issues.

This qualitative study utilises a Participatory Action Research approach. The methods employed are: self-reporting questionnaires, telephone and face-to-face interviews. The project is being conducted in 3 phases. Phase 1: advertising and recruitment; phase 2: data collection with 25-30 BNTVs and phase 3: co-designing community projects relating to health and wellbeing issues. These phases will allow BNTVs to explore the impact that involvement in the nuclear tests has had on their health, wellbeing and on the community.

Assessment of risks from combined exposures to radiation and chemicals.

Finlay Smith (1st year PhD Student), Dr Rhona Anderson and Prof Andreas Kortenkamp



Start Date: 8th Jan 2018

Funded by: CHRC

Mixture toxicology deals with the concept that chemicals with similar chemical structures or similar biological effects can have a combined mixture effect that has greater toxicity than its components' individual toxicities. This suggests that mixtures of chemicals can present a risk even if each individual component is below its recommended 'safe' limit.

Mixture toxicity depends on:

- Exact mixture composition
- Whether toxicity is dose additive or independent
- Whether or not there are any synergies or antipathies in the interaction

Mixture effects are predicted using either Concentration (Dose) Addition (CA) for similar chemistry and routes of action, or via Independent Action (IA) principles for stochastic or dissimilar routes of action.

We are conducting proof of concept experiments with cultured cells to reveal whether combined genotoxic effects between radiation and chemical exposures can occur in principle. This approach will enable us to establish basic cell biological principles which will provide a solid foundation for examining whether combined risks exist under more realistic exposure scenarios.

Radiation risk from high LET alpha-emitters using radium-223 as a model.

Isabella Bastiani (2nd Year PhD Student), Dr Liz Ainsbury and Dr Rhona Anderson



Start Date: 1st Aug 2017

Funded by: Public Health England

Prostate cancer is the most common cancer affecting men in the UK with over 400,000 new cases each year. Bone metastases are associated with stage IV prostate cancer, are linked with poor prognosis and often result in spinal cord fractures and/or compression leading to nerve damage and paralysis. Radium-223 (^{223}Ra) is a radiopharmaceutical that delivers high-linear energy transfer α -particles to regions of bone metastatic disease. α -particles have a range of $<100\ \mu\text{m}$ and are effective in targeting bone metastases and delaying the onset of skeletal related events, however it remains unclear if this targeted radiotherapy may result in unwanted exposure of normal neighbouring bone marrow (BM) cells.

To assess potential BM toxicity, whole blood is being sampled from metastatic castration-resistant prostate cancer patients who are receiving ^{223}Ra as part of the ADRRAD clinical trial. PBL originate from haematopoietic stem cells (HSCs) of the BM and follow a hierarchical path of differentiation. Radiation-induced chromosome aberrations in surviving HSCs and PBL exposed in circulatory pool should be detectable in the resulting metaphase cell sampled. Multiplex-fluorescence in situ hybridization is used to determine the type/frequency of chromosomal rearrangements in PBL whilst solid-stain analysis used for chromosome/chromatid-type aberrations.

This is a collaborative project with PHE, Chilton and the Northern Ireland Cancer Centre, Belfast. Outcomes from this work will contribute new understanding on the risks of internalised α -particle exposure.

External engagement

CHRC staff, students and affiliates have participated in numerous scientific and public engagement events gaining new knowledge on the latest scientific developments, developing new networks, profiling our research and, acquiring feedback from all quarters. These include numerous small scoping meetings as part of research development and, participation at key national and international meetings (see pages 21 and 22). We also hosted a half-day event on the 8th February 2018 to promote the function, scope and research of the CHRC and, to profile the work of the NCCF. The event was well attended with over 80 people making up a broad audience representing all stakeholders (nuclear test community members, radiation protection researchers, broader research community, government agencies, media and funders). The schedule reflected the purpose of the day with talks from the NCCF and from research affiliates of current projects (page 19). Posters showcasing student research projects were also presented during two networking sessions.

Our website www.chrc4veterans.uk went live in December 2017 and to date has had ~1200 hits/visits, revealing mostly UK interest but also some international interest. It is currently populated with introductory content on the function and scope of the Centre and the current projects underway with plans in-place for its ongoing development. We have also been active in generating a number of magazine articles and updates for circulation to members of the nuclear community (see page 20).

In this first year of operation staff and students have gained a much richer insight into the questions and gaps in understanding by members of the nuclear community, many of which focus on the 'Genetic Study'; all of this is feeding into our engagement strategy and development in communication style with the aim of improving the quality and accessibility of information which will be disseminated through CHRC.

Non-scientific Events

CHRC Centre Day 8th February 2018, Brunel University London

~80 delegates representing all stakeholders.

Presentations:

Jeff Liddiatt: Secrets in the Sands

Nigel Heaps: NCCF Projects

Rhona Anderson: Overview of CHRC

Susan Jobling: CHRC Research Projects

Rhona Anderson: Genetics and Cytogenetics Study

Louise Mansfield: Community interventions for Wellbeing in diverse populations: the role of culture and sport

Mary Gilhooly: Exposure to worry, ageing and cognitive functioning

Martin Scholze: Radiation and chemical mixture effects

Poster Titles:

Alex Moorhouse: Genetic detection of parental exposure to ionising radiation

Finlay Smith: Assessment of risks from combined exposure to radiation and chemicals

George Collett: Exposure worry, ageing and cognitive functioning: An in-depth study of British nuclear test veterans

Isabella Bastiani: Radiation risks from high-LET α -emitters using Radium-223 as a model

Jade Stephens: Determination of constitutional chromosomal abnormalities in NTVs descendants

Julia Michalek: Critical review of published works of Susan Rabbitt-Roff

BNTVA AGM 18th-20th May 2018 Great Atlantic Hotel, Weston Super Mare

George Flyer: Measuring Exposure worry: A Pilot Study

Rhona Anderson Presentation: Genetic and cytogenetic assessment of BNTV and their families

Mary Gilhooly Presentation: Exposure worry and cognitive function.

Articles in Exposure and Campaign magazine

Campaign Summer 2016:

Genome Biology: Chromosomes and their structural rearrangement by Rhona Anderson.

Campaign Spring 2017:

Genome Biology: Techniques to study chromosome aberrations by Rhona Anderson.

Exposure April 2018:

Editorial: Launch event.

Article: A Short History of Brunel.

Article: Establishing the Centre for Health Effects of Radiological and Chemical Agents.

Article: Why can't I volunteer for the genetic study?

Article: Sport, Culture and Wellbeing by Amy Prescott.

Exposure August 2018:

Editorial: Genetic and Cytogenetic study well underway.

Article: Exposure Worry, Ageing and Cognitive Functioning by George Collett.

Article for Genome Biology series: Techniques to study *de novo* mutations by Alex Moorhouse.

Training and Promotion of Research

Scientific Conferences attended:

ERRS 2017 43rd Annual Meeting of the European Radiation Research Society 17 – 21st September 2017, Essen, Germany <http://errs-gbs-2017.eu/>

Attended by Rhona Anderson

ICRP 4th International Symposium on the System of Radiological Protection, 10-12th October 2017, Paris, France <http://icrp-erpw2017.com/>

Attended by Rhona Anderson

Association for Radiation Research 2018: Health and Environmental Implications of Multidisciplinary Radiation Research. 25 - 27th June, 2018 - Riddel Hall, Queen's University Belfast <https://www.le.ac.uk/cm/arr/home.html>

Attended by Rhona Anderson and Isabella Bastiani

Oral Presentation: A genetic and cytogenetic study of British nuclear test veterans and their children.

Oral Presentation: Radiation risk from High LET α -emitters using Radium-223 as a model.

Global Co-ordination of Low-Dose Research: Scoping Meeting, Milan 17 – 18th September, 2018, Milan University, Milano Italy <https://www.oecd-nea.org/rp/workshops/science-values2018/>

Attended by Paul Leonard (on behalf of Rhona Anderson)

US Annual Meeting for Radiation Research and the 24th Meeting of the Conference on Radiation & Health. Chicago, Illinois on 23 – 25th September, 2018

<https://www.radres.org/mpage/Chicago2018>

Attended by Rhona Anderson

Poster: A genetic and cytogenetic study of British nuclear test veterans and their children.

3rd European Radiological Protection Research Week 1 – 5th October 2018, Rovini - Rovigno, Croatia <https://erpw2018.com/>

Attended by Alex Moorhouse

Poster: A genetic and cytogenetic study of British nuclear test veterans and their children.

Early careers and European training events:

Finlay Smith: CONCERT InterRad. Two-week training course on Interdisciplinary Radiation Research at the Bundesamt fur Strahlenschutz, Munich Germany, 16 – 27th April 2018
<http://www.concert-h2020.eu/en/Partners/BfS>

Jade Stephens: CONCERT CELOD: Two-week training course on cellular effects of ionising radiation – Introduction to radiation biology, Stockholm University Sweden 23rd April to 4th May 2018 <http://www.crpr-su.se/CELOD/CELOD%202018%20-%20program%20ver%205.pdf>

Isabella Bastiani: CONCERT: Two-week training course on radiation-induced effects with particular emphasis on genetics, development, teratology, cognition, cancer as well as space-related health issues. SCK•CEN (Belgian Nuclear Research Centre), Belgium. 12 – 23rd March 2018 <https://www.cancer.be/evenement/two-week-training-course-radiation-induced-effects-particular-emphasis-genetics>



CHRC

Centre for Health Effects of Radiological and Chemical Agents

Contact Details

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www.chrc4veterans.uk



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