Institution: University of Salford

Unit of assessment: A5 Biological Sciences

a: Context: Research impact in Biological Sciences at the University of Salford focuses on developing new or improved diagnostic measures and treatments for both infectious and non-infectious diseases and furthering understanding of disease ecology, transmission, epidemiology and pathology. Impact is also focused on contributing to policies for conservation biology using molecular genetics to address ecological and taxonomical questions that are relevant to the management of biodiversity and to support improvements in ecosystem health and quality of life. The main non-academic user groups, beneficiaries or audiences and main types of impact specifically relevant to Biological Sciences research include:

- Rural communities in Sub-Saharan Africa, Latin America, China, and South-east Asia, and in the UK at risk of zoonotic parasitic infection, and national and regional governments and health policy makers in the area of disease control internationally, for example, the World Animal Health Organisation (OIE) and the World Health Organisation (WHO):
  - Impact is developed in the area of improving public health and quality of life of the communities and the economies of regions affected through changing national and international public health policy for the surveillance, prevention and control of zoonotic diseases.
- People living with cancer, particularly children and young people, hospitals, healthcare providers and policy-makers, the voluntary sector, the pharmaceutical industry and the UK Children's Cancer and Leukaemia Group, the European Organisation for Research in the Treatment of Cancer, and the National Cancer Institute (USA):
  - Impact is focused on developing, taking to market and fundraising for new and improved treatments for cancer, particularly focusing on children with cancer.
- International Conservation groups, fisheries and food trade policy makers (World Animal Health Organisation, the European Commission, the International Council for the Exploration of the Sea (ICES), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)), and nationally through DEFRA, food and fisheries producers, the veterinary sector, animal conservationists, farmers and rural populations in resource poor regions, environmental, animal and human public health policy makers, and consumers internationally:
  - Impact is developed through providing critical knowledge for the identification and delineation of taxonomical and demographic units of endangered vertebrates and the designation of key habitats required for their conservation;
  - Influencing the application of nature conservation law, species reintroductions and the role of zoos in species conservation;
  - Improving conservation and management of fisheries resources and the operations in the seafood industry, through providing evidence and tools for policy appraisal and implementation;
  - Supporting international mechanisms for improving bee health.

The impact described relates to the following range of research activity or research groups in the Unit:

The Biomedical Research Centre: Focuses on understanding disease processes (both infectious and non-communicable) and applying this information to understand pathology and develop new or improved diagnostics and treatments. A multidisciplinary approach encompassing medicinal chemistry, rational drug design, pharmacology, physiology, immunology, molecular diagnostics and cell biology underpins the work of the Centre.

- Work within Kidscan Centre for Children's Cancer Research focuses on new and improved treatments for children with cancer. Active research programmes also include immunological aspects of cancer and infection, tissue and inflammatory response to damage and disease and applications of biotechnology.

- A major biomedical research area is in parasitology, including aspects of pathology, drug action and diagnostics for malaria, trypanosomiasis and larval cestode infections with implications for both human and animal health. Diagnostics and biomarkers are growth areas of research within the Centre which also includes a diagnostic service for human and animal parasitic infections (Cestode Diagnostics).
- The Centre has strong links with hospitals within the northwest region (Salford Royal, Royal Manchester Children's Hospital, Christie Hospital, Aintree Hospital, North Manchester hospital, Wythenshawe Hospital) including many national and international collaborations with Universities and Research Centres. A number of clinical studies are ongoing in collaboration with regional hospitals and industry.

The Ecosystems and Environment Research Centre: Biodiversity focused research includes projects on amphibian diversity, marine fish stocks distribution and connectivity, landscape genetics of large mammals, and parasite diversity in wildlife hosts. Researchers working in tropical and temperate terrestrial, aquatic and urban habitats employ multiple approaches to biodiversity assessment, investigate ecosystem functioning and services, and explore how conservation practices can be tailored to attain the requirements of the ecosystem approach stated in the UN Convention on Biological Diversity.

- Members of this group explore how ecosystems contribute to health through the study of landscape ecology, and pathogen/parasite transmission and interaction, and how resource exploitation translates into food safety and sustainability through the molecular identification of seafood in both retail and food service outlets.

Disease ecology research focuses on the underlying principles that influence the spatio-temporal patterns of diseases and consequently much research lies at the interface of human biology, animal biology, and human health. Research particularly focuses on transmission ecology of non-vector and vector-borne zoonotic infections (both microbial and parasitic including echinococcosis, trypanosomiasis, toxoplasmosis, and tick-borne microbes) and molecular epidemiology of the diseases they cause.

b. Approach to impact: The Unit's approach to interacting with, engaging with or developing relationships with key users, beneficiaries or audiences to developing impact from the research, through the following three broad areas of focus, and where elements of each are covered in more detail in our Impact Case Studies, is as follows:

- Improving national and international public health policy for the surveillance, prevention and control of zoonotic diseases by working with human and animal health policy makers to influence public health policy in the following areas (Craig, Hide, Rogan, Smith):
  - Developing effective relationships with the communities and governments of affected areas internationally, to facilitate the investigation of the transmission and control of zoonoses;
  - Utilising the application of sensitive and specific laboratory diagnostic tests for parasitic infections in humans or animals. Additionally, post-treatment follow-up of echinococcosis patients using serological tests and developing processes to reduce the prevalence of hydatid disease by understanding its pathology, natural history, epidemiology and transmission ecology;
  - Membership of the WHO panel advice for Neglected Zoonotic Diseases
  - The World Animal Health (OIE) Expert and Reference Centre for Echinococcosis is based at Salford (http://www.oie.int/our-scientific-expertise/reference-laboratories/list-of-laboratories/):
  - The Cestode Diagnostics enterprise unit at Salford includes a diagnostic service for human and animal parasitic infections.
- Developing, taking to market and fundraising for new and/or improved treatments for cancer, particularly children with cancer through developing community and business fundraising activity through Kidscan a registered charity (1094946), as Scientific coordinator of the UK Children's Cancer and Leukaemia Group (biological studies), and the establishment of a spin-out company Onco-NX to raise venture capital and develop

and exploit the technologies and IP arising from the research to clinical trial (Bisby, Butler, Carlson, Elkord, Hadfield, McGown, Podmore, Warhurst).

- Improving the conservation and management of commercial fisheries stocks through participation in advisory committees, the delivery of research and development results, the provision of enterprise services for the industry and other stakeholders, and the organisations of public events to raise awareness among the public. Provision of advice on animal welfare and husbandry in zoos and species reintroduction plans, as well as training for zoo workers. Advice also provided on high-profile emergent threats to other animal breeding activities, such as bee-keeping (Jehle, Mariani, Martin):
  - Expert advice to International Council for Exploration of the Sea on redefinition of stock boundaries;
  - The ERDF LABELFISH project on seafood mislabelling and the development of a common strategy and in the use of standardised, innovative analytical techniques to control genetic traceability and labelling of seafood products;
  - Contribution to the DEFRA Zoos forum review of elephant housing and husbandry, 2010;
  - Participation in the *'Bee Health in Europe'* conference at the European Parliament in Brussels in February 2013.

c. Strategy and plans: With a record of generating research in partnership, the University of Salford is well placed to articulate and celebrate its impacts and has developed an institutional approach to support its focus on evidencing and promoting its impact in the round: Salford Impact with the aim of evidencing, developing and celebrating the transformational impact of University of Salford research. Biological Sciences research at the University of Salford plans to continue to exemplify Salford Impact in its current and future research practice through increasing its focus on developing strong national and international collaborations and building on its established interdisciplinary approaches to increase activity in the areas of drug design, molecular diagnostics, zoonotic disease ecology, biodiversity assessment and conservation, and the management of exploited natural resources:

- Continuing the development of ecologically smart approaches to control of the transmission of zoonoses;
- Continuing the focus on understanding the distribution and sustainability of species and mechanisms underpinning population structure and stability;
- Continuing the focus on understanding the mechanisms which underpin disease progression and continuing the development of novel therapeutic agents.

d. Relationship to case studies:

Case Study 1: Improving national and international public health policy for surveillance, prevention and control of zoonotic diseases, especially of parasitic origin, exemplifies and has informed the development of the Unit's approach to impact through the translation into environmental management processes of parasite control mechanisms at regional, national and international levels.

Case Study 2: Developing, taking to market and fundraising for new/ improved treatments for cancer, particularly focusing on children with cancer, exemplifies and has informed the development of the Unit's approach to impact through its approach to working in partnership which links research, health services, people affected by cancer and their families, the voluntary sector, and the commercialisation and exploitation of intellectual property.

Case Study 3: Molecular Ecology and Conservation, particularly marine fish stocks and amphibians, exemplifies the development of the Unit's approach to impact through its focus on a comprehensive model of whole-stakeholder engagement, which includes the public, resource users, industry and policy-makers.