Institution: The University of Huddersfield

Unit of Assessment: 5 Biological Sciences

a. Context: *Overview*. Within the School of Applied Sciences, Biological Sciences at Huddersfield comprises a predominantly young team carrying out research activities that encompass a variety of themes requiring engagement with diverse stakeholder communities and target audiences beyond academia. These range from policymakers and business/industry to the media and the wider public. Impact is thereby integral to our approach and represents an important aspect of the work of all staff, most of whom were appointed quite recently. Given the University's goal of becoming an internationally recognised research-led institution, we believe that our research should be of the highest quality, that we must understand the needs of relevant stakeholders and that we must forge and maintain mutually beneficial relationships with a variety of potential end-users.

We carry out research in areas such as molecular biology, microbiology, pharmacology, hygiene control, food science, forensic biology, evolutionary genetics and archaeogenetics. To further enhance our strengths in key fields, these and other themes are cohered into four research groups: (1) Molecular Medicine, (2) Glycobiology and Food Science, (3) Evolutionary Genetics and (4) Forensic Biology. During the census period a number of strategic appointments have been made to consolidate our specialisms, particularly in the field of anthropology/evolutionary genetics, and with a view to strengthening our ability to collaborate with industry. For example, **Richards**' work on mitochondrial DNA variation has influenced the development of commercial genetic ancestry testing and helped the UK government set out related guidelines for the general public. It has also generated immense public interest, reaching an audience of millions through the media – including high-profile TV series – in several countries. **Humphreys** and **Laws**' research has also influenced policy. Both the Canadian and UK governments have used **Humphreys'** work on microbial gas generation to inform risk assessments for the safe storage and disposal of intermediate and low-level nuclear waste. Our work has also had an impact on business and industry. **Humphreys** and **Laws** have helped drive developments in the use of bacterial starter cultures in industry. **Laws** is collaborating with GlaxoSmithKline to develop new antisense drugs, while **Georgopoulos** and **Collett** are working with an SME, Paxman Coolers, to provide biological evidence demonstrating the advantages of using scalp-cooling to prevent drug-induced alopecia during chemotherapy. **Clarke** manages a national genotyping survey of rodenticide resistance that has informed the Health and Safety Executive and Chartered Institute of Environmental Health of the current status of rodenticide resistance and new government policies on rodenticide use, at the same time creating great media interest. **G. Williams'** research on fluid identification using RNA is being considered by the UK's major forensic science services, as well as the Home Office's Centre for Applied Sciences and Technology. These examples highlight our commitment to research excellence and demonstrate our determination to engage with a broad array of stakeholder communities to deliver significant, long-lasting impacts, whose benefits are widely felt.

b. Approach to impact: *Overview*. The wider relevance of our research has inevitably been an inherent and longstanding consideration of the Department, and the School of Applied Sciences as a whole. However, as demonstrated by a number of strategic decisions and initiatives, a growing focus on impact has encouraged us to re-examine and further refine our approach throughout the census period. Our framework for identifying, supporting, generating and maximising opportunities for impact is now well-established yet constantly evolving and includes the following key elements.

***Identifying and supporting impact*. *(a) Recruitment*.** During the census period we have recruited staff specialising in research with significant potential for impact. The return of **Richards** to Huddersfield has brought back to the Department an internationally renowned researcher in a subject – human origins – that raises universal questions of genetics, history and identity. His arrival was complemented by the appointment of two Research Fellows: **Pala**, who has an international reputation in the study of European ancestry and **Brotherton**, who specialises in ancient DNA (aDNA), as well as the promotion of **Carr**, an evolutionary biologist who was previously involved in Leverhulme-funded work with **Richards,** to Lecturer. Conscious of the benefits of importing additional "real-world" expertise, we have also appointed academics with considerable industry experience, among them **Graham Williams**, a consultant forensic biologist for a range of organisations, (including the government for FERA and as a member of the HO CAST DNA expert community). We recently recruited **Anna Williams**, a forensic anthropologist

with substantial casework experience, with plans for a unique taphonomy research facility and strong media experience. (***b) Mentoring*:** All researchers, from ECRs to established staff, are given full support to ensure impact is central to their work. As part of the induction process, ECRs attend University workshops focused on generating relevant and effective research programmes. The Department provides dedicated training to further develop appropriate research portfolios and to engender a clear understanding of the pathways to impact. We understand, nevertheless, that the natural instincts of researchers must not be diverted from the pursuit of excellence.

***Working with business and industry*.** Our investment in staff and training regimes has become increasingly aligned with the impact opportunities afforded by collaboration with business and industry. As discussed above, this approach begins with our recruitment policy and is a key consideration throughout the researcher mentoring process.

The needs of business and industry have also been a crucial factor in the expansion of our research programme. Much of our work throughout the census period has involved collaboration with, and funding from, a range of partners in the sector. We have engaged both with major international corporations and, recognising their growing importance to the regional and national economy, with small and medium-sized enterprises. The sponsors of **Laws** and **Humphreys**' studies of the microbial production of polysaccharides have included global chemical and food companies such as Rhodia, Croda and St Ivel. **Georgopoulos** and **Collett**'s work with Yorkshire-based Paxman Coolers, although initiated only two years ago via Innovation Voucher funding, has already led to two independent funding streams – a Technology Strategy Board Smart grant and a Knowledge Transfer Partnership grant – and has resulted in a novel prototype scalp-cooler that is expected to enhance the company's worldwide competitive advantage in improving cancer patients' quality of life. In 2012, this work with Paxman Coolers received the Vice Chancellor's Enterprise Award for Early-Stage Collaboration. **Humphreys**' work on microbial gas generation, supported by the Canadian government and the UK's Nuclear Decommissioning Authority, has helped to inform decisions with major economic repercussions. **G. Williams**' work has yielded an anti-counterfeiting feature in high-end garments for the Textile Centre of Excellence, which has also been adopted by the New York based Applied DNA Sciences and the US Military. The diversity of our research, and the range of partners with which we engage, illustrate our greater appreciation of the scope to drive business and industry impact both directly (*e.g.* through improvements in products and processes) and indirectly (*e.g.* via the policymaking sphere).

***Engaging the public*.** Reflecting our own ethos, as well as the recommendations of successive Parliamentary Committees on Science and Technology, we have a consistent record of communicating our research to the public. Much of this engagement is achieved directly. Our highly successful public lecture series, now in its seventh year, exemplifies our commitment to sharing the findings and social impact of our work with audiences other than our immediate peers and stakeholders. These events regularly attract up to 200 people, including many school-children, and invariably end in enthusiastic Q&A sessions. Appearances in the media have become increasingly frequent and high-profile during the census period, driven in particular by worldwide interest in **Richards**' research on human origins.

***Oversight*.** The School Research Committee (SRC) developed the existing strategy for impact. Biology also has its own external International Strategic Advisory Board (SAB), made up of world-class research and industry leaders, which guides our efforts to assemble a balanced research portfolio in which both basic science and end-user impacts are central for all researchers. As discussed in below, we now propose to extend the SAB's influence in further developing our impact strategy.

c. Strategy and plans: *Overview*: Over the course of the past five years we have consistently expanded and refined the Department's research role. In doing so we have succeeded in our principal aim of enhancing opportunities to collaborate with business/industry and influence wider society. In short, we have significantly enhanced our capacity to generate impact.

Our goal for the next five years is to build on this success by further developing our strategy for impact in tandem with our overall research strategy. To this end, we have identified a number of key objectives, as detailed in the following *Impact Strategy*.

***1. Continue to develop and embed impact*.** We have identified several mechanisms through which to ensure impact is even more integral to our research activities. During the next census period impact planning will become central to our annual review processes, particularly in

research-active staff's performance development reviews, with a view to establishing stronger links between impact and career progression. Impact will be discussed and evaluated during the Department's postgraduate research conferences and away-day events – the latter of which are attended by all staff, including those in support roles.

***2. Ensure continued strategic alignment with stakeholder priorities*.** Ongoing dialogues with a range of external audiences are key to furthering our strategy for achieving impact. Building and extending our relationships with business and industry, policymakers, lay audiences and other stakeholders will inform our strategic decisions. We aim to ensure our research focus is always able to evolve to best reflect the needs of stakeholders and society as a whole.

***3. Augment the involvement of the Strategic Advisory Board*.** We will continue to review our research strategy and approaches to impact in consultation with our Strategic Advisory Board, and are exploring the recruitment of additional industrial and policy advisors to the Board. SAB members will hold biannual assessments of research impact and provide oral and written feedback to our research committee. Although the University Research Committee will continue to drive the overarching development of impact strategy, and the SRC will apply a more localised approach, the SAB will now play a much more significant role in the ongoing consultation process.

***4. Further develop relationships with existing partners and new partners*.** We will nominate a business development manager (BDM) to strengthen our existing business and industry partnerships and maximise opportunities for further collaboration in this area. As part of this process, we intend to map our technology platforms to those of the companies resident in the University's recently established 3M Buckley Innovation Centre (3M–BIC). The BDM will be responsible for liaising with 3M–BIC companies and with local and national industry and will be the first point of contact for BIS-supported programmes, including KTPs. **A. Williams**, newly recruited to the Forensic Biology group, brings with her both academic and external partners, such as the Burial Research Consortium of UK and US universities and the Northern Ireland Police Service.

***5. Further invest in impact-enhancing infrastructure*.** The benefits of identifying and investing in areas of specialism with significant potential for impact have been clearly demonstrated by several of our strategic decisions during the census period. For example, the appointments of **Richards**, **Pala**, **Brotherton** and **Carr** were complemented by investment in a state-of-the-art aDNA facility capable of carrying out both basic research and, as an industrial spin-off, forensic casework too challenging for standard providers. This has enabled us to establish Huddersfield at the forefront of archaeogenetics in a short space of time, and the Department and its stakeholders are now also set to benefit over the longer term. Drawing on our SAB's input, we intend to give careful consideration to similar opportunities for investing in impact over the longer term.

***6. Expand our outreach activities*.** We intend to make impact central to our outreach activities in every respect, both maintaining our excellent relationships with mainstream media and increasing our use of social media. As well as expanding the presentation of our work to encompass more public lectures, evening classes and school events, we will strongly encourage academics to identify the impact of their research when engaging with lay audiences. For example, **Psakis** is organising a summer workshop with the aim of introducing specialised crystallisation screening approaches to wider audiences and providing hands-on experience with instrumentation. Forensic science-focused outreach activities will also include workshops and interactive events, including a 'Discover Decomposition' workshop funded by the Wellcome Trust.

d. Relationship to case studies: The various strategic considerations and support mechanisms described above have played key roles in facilitating the impacts detailed in the submitted case studies. **Richards**' work on mitochondrial DNA variation has benefited from the Department's investment in an emerging field and has influenced industry, policymakers and the wider public. **Humphreys** and **Laws**' work on the microbial production and metabolism of polysaccharides has benefited from collaboration with and funding from business and industry. It has also demonstrated the value of our policy of importing "real-world" expertise, Humphreys having worked in the nuclear industry for many years before joining the Department. This research has led to impact in two distinct areas. In the food industry, it has driven developments in the use of bacterial starter cultures, leading to industry-wide adoption of new techniques to produce fermented products with proven functionality and guiding further research by government institutions. In the policy arena, it has made an important contribution to the safety case for the disposal of nuclear waste.