Exploring Creativity in STEM public engagement

By Lorna Dougan

In 2015, I was fortunate to be awarded a Biochemical Society Diversity in Science grant along with artist Rhiannon Gregory, as well as Andy Wilson and Paul Turner who I met through an arts-makers-scientist organisation at Leeds called The Superposition. The grant enabled us to develop a workshop called 'Protein Weaving' in which the general public are introduced to proteins through the medium of weaving. This project was in part inspired by a report called 'Not for people like me?' from WISE (a campaign to promote women in science, technology and engineering). The report looked at why some groups were under-represented in STEM and what could be done to address this. It highlighted that many young people were deciding that jobs and careers in science are 'not for people like me' and that 'parents and the wider family play a key influence in career choice'. We were therefore motivated to create an activity that would be inclusive to both parents and young people, allowing them to engage in science in an unconventional and un-intimidating way.

We designed a workshop which allowed people to participate in an arts/making-based activity which was under-pinned by the science of proteins. This marriage went beyond the more stereotypical representation of the sciences, for example as lab-based experiments with white coats, and created an informal environment within which people could engage ideas. We ran the workshop at a number of public engagement events, including the Astbury Conversation, a marketplace of interactive, hands-on activities and demonstrations from the disciplines of the Astbury Centre for Structural and Molecular Biology.

Rhiannon's work has been awarded prizes, including a Silver award in Fashion & Textiles at the 2016 Creative Conscience Awards.

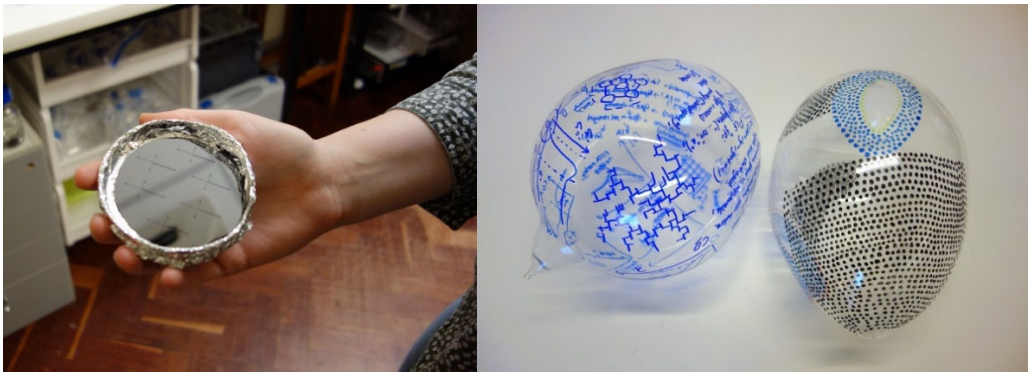
I thoroughly enjoyed this project and continued my collaboration with artist Rhiannon Gregory to develop the BioPhysics Design Project, a collaborative project to explore the physics of living systems using unconventional approaches. By using creative design as a tool to investigate the structure, mechanics and interactions of biological building blocks, new representations and understanding of biological systems were uncovered. This novel approach provided a fresh and alternative viewpoint of otherwise complex biological systems and uncovered surprising scientific insight, which would not be possible with conventional approaches. The development of innovative biomaterials offers enormous potential for addressing significant challenges in medical and healthcare technologies. As life expectancy increases, pioneering methods are needed to replace and restore tissues and organs in the body, to improve tissue engineering and to develop robust and responsive drug delivery approaches.

Biological systems provide a challenging template to replicate in biomaterial design. An exciting goal is to push biomaterials towards the complexity of biological processes, to achieve and exceed their level of control. The ability to accurately combine a number of dynamic and bioresponsive mechanisms into biomaterials would lead to unprecedented control of bio responsiveness and molecular delivery for specific applications. Our work has been presented at Leeds Light Night 2017, as part of Soapbox Science where a series of e-textiles were created, presenting three stages of 'connections' that could be made within one protein and have been exhibited in a gallery at Otley courthouse (see images below). The pieces proved a valid tool in exploring the concept of being able to modify the structure of a protein to have certain capabilities, the 'lights' on each piece showing a developing construction of specific functionality the protein needed to have. The analogy of wound healing was used in order to contextualise the potential of such a construction. As with Nanoscale embroidery, Bio-Textiles positions the designer within the research process itself, rather than responding to the research in a creative way. The value of using a different outlook, experience or thought process when researching can lead to exciting and unexpected outcomes, and this forms a key value in The Biophysics Design Project. You can read more about the project in this article in *The Biochemist* here.

In 2019, supported by a University of Leeds Interdisciplinary Pump Priming fund, I established the Creative Labs Bragg Centre Edition - towards innovative materials design through enriched cross-disciplinary collaboration. This is a pioneering programme supported by the University of Leeds's Cultural Institute, which pairs scientists and engineers from the Bragg Centre for Materials Research with professionals from the cultural and creative industries. This provides exciting opportunities to develop new strategies that communicate science in more creative, interactive and accessible ways that respect the audience, while keeping scientific credibility intact, which will help increase audience engagement levels.

Building on this pilot project, in 2020 I was awarded an EPSRC Public Engagement Champion award to create public engagement activities that embrace creativity to allow young people and families to explore and discover innovation in materials design. My aim is to build a culture of creative STEM public engagement, supporting two cohorts of ambassadors and develop a framework to embed creative-led public engagement within STEM research. The first cohort of Bragg Centre creative labbers have begun delivering amazing outputs which combine the arts and materials science. These outputs are now making an impact in public engagement events such as Bradford Science Festival, the Be Curious Festival, National Saturday Club and in webinars. For example, Stephen Hurrell, an artist, filmmaker and creative director of Hurrel Visual Arts has been collaborating with Dr Benjamin

Hanson, and PhD students Kalila Cook and Christa Brown in my own research group. Artist Stephen unearths narratives and materials from specific environments to create new perspectives and artworks. He makes connections between things — in particular between art, nature, science and technology — and through this approach he produces innovative artworks in sculpture, photography, video, light and digital media. In this new collaboration, artist Stephen was struck by the sheer amount of negative space in our areas of research, the study of hierarchical biomechanics with a specific focus on the rational design of protein-based hydrogels which contain large volumes of water.



Stephen was interested in the aesthetic and human aspects of this space, and wanted to bring human perspectives into abstract and clinical spaces. Thinking about that space around everything, Stephen wanted to think about the phrase “most of everything is nothing”, and challenged himself to visualise the concept. Stephen wanted to challenge the scientists to work on something tangible and human scale, and so asked the group to write onto large blown glass bulbs using whiteboard markers. Ben then used software to fill in the negative spaces of the models of proteins formed in his simulations, which only become apparent when it is bound by the positive that already exists. From a metaphorical perspective, negative space is only visible with respect to what we see as the norm, which raised the question, without focusing on the negative space, how many connections are we not making?

The Diversity in Science award was my starting point for combining arts and science to explore our research and to engage with the public. It has triggered many exciting new collaborations and now a larger scale project in which we hope to deliver measurable impact in STEM public engagement. work!

About the Author

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