

## “What would you like to discover and why?”

Imagine a world where everyone has access to life saving medical care, globally and without discrimination - a world in which there are no waiting lists for organs and severe burns are a thing of the past. Unobtainable though it may sound, this utopian ideal could be a reality. Bio-Printing - printing living material for medical purposes - offers humanity a new perspective on the concept of healing, but is not yet understood or operational. What would I like to discover? A method of making this dream a reality; bringing the concept of medical 3D printing to the real world.

3D printing is an existing technology that involves “printing” plastic 3D objects by building them up in layers by using a liquid plastic that solidifies when exposed to UV light. It is used in areas such as engineering design and architectural modelling. However, Bio-Printing is only a theoretical idea in the current day. I would like to discover a fluid, organic material that could be used to 3D print real genetic matter - this would be a huge leap forward. Having the ability to heal wounds in a matter of minutes and printing tissues (or even whole organs) to be transplanted into a patient would greatly increase our medical capabilities. The concept is straight from the pages of science fiction. Yet to me, that makes it all the more exciting.

Current thinking is that by using a highly detailed system of scanners and equally accurate 3D printers, a substance named “bio-ink” can be used to treat serious physical ailments. Bio ink is a theoretical organic substance that could be used with current 3D printing technology. I believe that a fluid and manipulative form of stem cells could be used to great effect. Currently, the concept states that for burns and scrapes, the damaged area can be scanned and a personal “skin map” is created on bespoke computer software. The damaged area is then identified and the printer injects human cells, one layer at a time, until the damage is covered. However, this is only a concept.

Applying the idea to organs is even more challenging because organs are far more complex systems of specific, specialised cells. Thus the process would not be as simple. I reason that the solution would be to take very intricate scans of the organ in layers, which could then be printed in sections using different types of “bio ink” (possibly, stem cells that have been exposed to specialist cells so they begin to become specialised). This would ensure the proper structure of organ was maintained, which is essential if it is to work properly.

Discovering the secrets of “bio ink” and the method of applying it effectively would be a quantum leap forward in medical science and is a breakthrough that I wish to pioneer.

However I must, as a scientist, question my motivation and reflect on why I want to do this. With the benefit of hindsight, many would argue that the most significant discoveries of science are those that went beyond the purist view of “pursuing knowledge for the sake of pursuing knowledge”, by improving the quality of life in modern civilisation. Improvements in pharmaceuticals, communications and globalisation all result from significant breakthroughs in science. To me, science is not a self-centred exploration of the unknown but a means by which we can help to improve the lives of others. Modern medical practice is not a fair system, as private medical care is not open to those on the lower end of the economic spectrum. Furthermore, from a global perspective, there are millions of people who are in desperate need of medical care but who simply cannot afford it. These are the major issues I wish to address and I firmly believe that Bio Printing is the way forward. Further, in these days of economic instability and growing inequality, can we justify funding research purely to satisfy our insatiable human thirst for knowledge?

Bio Printing has the potential far to go beyond the pursuit of knowledge and will affect ordinary, everyday lives for the better. The successes of medical 3D printing have been life changing so far in the field of prosthetics and the low cost of the existing system has made prosthetic limbs an affordable reality to thousands, globally. In 2013, a charity called Project Daniel supplied young people in war-torn Sudan with prosthetic limbs that were each 3D printed in just 6 hours. The low cost of the project and quick response time proved how effective the technology is. I anticipate a day in which Bio Printing offers the same level of life-changing cures on such a low-cost rate. I am convinced that it has the potential to do so.