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3D Printed Auxetics

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The term 3D printing refers to the fabrication of physical objects directly from 3D computer aided design data. Also known as additive layer manufacturing and rapid prototyping, 3D printing generally works by solidifying, fusing or depositing materials layer-by-layer each layer being a cross-sectional horizontal slice of the object being built (1-3).

Because 3D printing requires no tooling, and because the 3D printed objects are built up layer-by-layer, it is possible to fabricate highly complex shapes and structures that would be difficult or impossible to make by conventional manufacturing techniques such as casting or machining. This is evidenced by the wide range of complex and sometimes fanciful objects which may be found in a Google image search for 3D printed objects. Such objects include complex lattices, objects nested within other objects, and even ready-made mechanisms with moving parts that require no assembly.

One area where the ability to fabricate complex objects is genuinely beneficial is in the field of Auxetics (4). Auxetic structures, having superior load carrying and form-following properties, have been proposed for aerospace, biomedical and sports equipment design.

Many auxetic structural designs take the form of complex 2.5D or 3D lattices. In this presentation we will demonstrate auxetic lattice structures which have been fabricated using a range of 3D printing techniques. The fabrication techniques will be illustrated and explained, and a potential application for 3D printed auxetics in the field of medical technology* will be introduced.

*This research has been undertaken in collaboration with Bristol Composites Institute (Prof Fabrizio Scarpa, Dr Ian Farrow and students) and the charity MS Research (Dr Rosie Jones, Angela Davies-Smith).

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