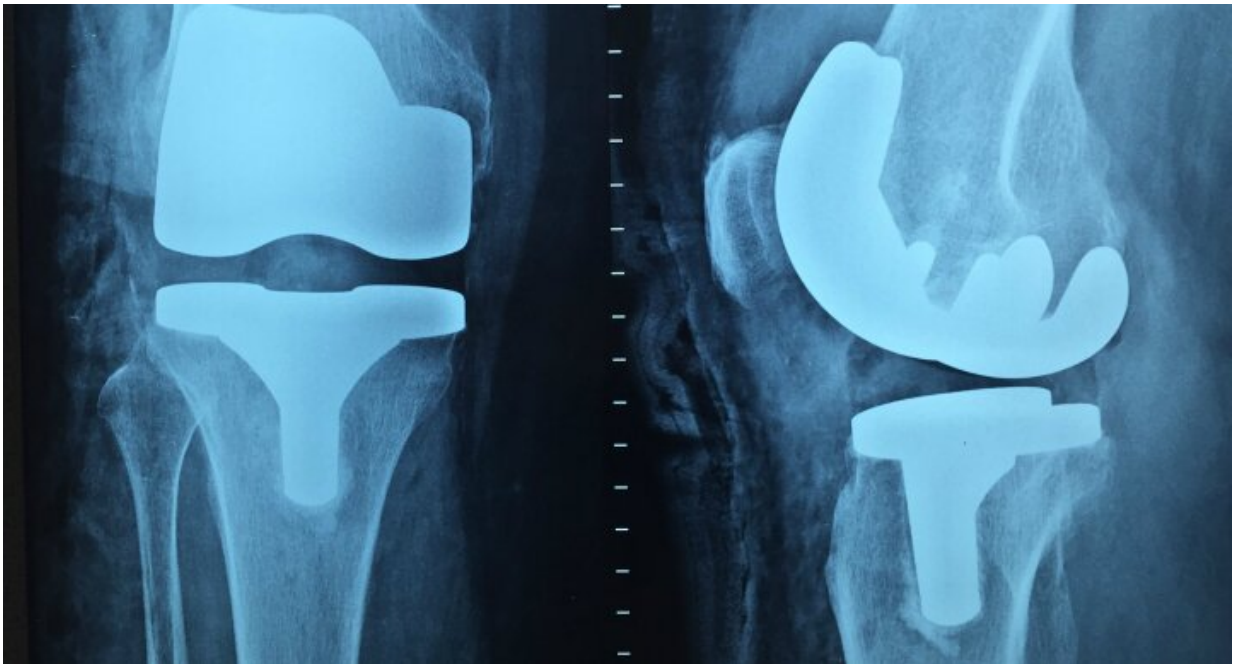


New plastic biomaterials could lead to tougher, more versatile medical implants

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Credit: University of Birmingham

A new thermoplastic biomaterial, which is tough and strong but also easy to process and shape has been developed by researchers at the University of Birmingham.

A type of nylon, the material's shape memory properties enable it to be stretched and molded but able to reform into its original shape when

heated. This makes it useful for medical devices such as bone replacements, where minimally invasive surgery techniques require additional flexibility in [implant materials](#).

The material was developed in the University's School of Chemistry, by a team investigating ways to use stereochemistry—a [double bond](#) in the backbone of the polymer chain—to manipulate the properties of polyesters and polyamides (nylons). The study is published in *Nature Communications*.

Biocompatible polymers are widely used in medicine, from tissue engineering to medical devices such as stents and sutures. Although much progress has been made in the area of resorbable or degradable materials, that are broken down by the body over time, there are still only a handful of non-resorbable polymers that can be used for longer-term applications.

Existing non-resorbable biomaterials, like nylons, currently commercially available suffer from a variety of limitations. Metal implants, for example, can wear poorly, leading to particle fragments breaking off, while [composite materials](#) can be difficult to process or extremely expensive.

The new material can be made using standard chemistry techniques and offers a stable, long-lasting option, with mechanical properties that can be tuned for different end products.

Senior researcher, Professor Andrew Dove, says: "This material offers some really distinctive advantages over existing products used to manufacture [medical devices](#) such as bone and joint replacements. We think it could offer a cost-effective, versatile and robust alternative in the medical device marketplace."

A further advantage of the material is its amorphous structure. Josh Worch, the postdoctoral researcher who led the work, explains why: "For many plastics, including nylon, the toughness is often dependent on their semi-crystalline structure, but this also makes them harder to [shape](#) and mold. However, our new plastic is as tough as [nylon](#), but without being crystalline so it is much easier to manipulate. We believe this is only possible due to the way we have used stereochemistry to control our design."

The research team were able to design and produce the plastic, which is now covered by a patent, and test it in rats to prove its biocompatibility. The team now plan to explore further ways to fine tune the material and its properties before seeking a commercial partner.

More information: Joshua C. Worch et al, Elastomeric polyamide biomaterials with stereochemically tuneable mechanical properties and shape memory, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-16945-8](#)

Provided by University of Birmingham

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