



**GENERALPLASTICS**  
MANUFACTURING COMPANY

## No Bones About It: Polyurethane Foam is a Better Medium for Orthopedic Models

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## TRADITIONAL MEDIA AND THEIR DRAWBACKS

Common materials for orthopedic testing and education – most often, cadaver specimens, but also animal bones and wood – while utilitarian, are far from ideal for today’s researchers and students. Their deficits are manifold, just a few of which include scarcity, cost, and consistency across specimens.

When it comes to supply and demand, cadavers become available either by donation or via bodies unclaimed after death. The supply funnel is scarce and therefore increases the cost per specimen. Costs also increase due to the associated regulations for storing, shipping, and disposing of human specimens. And ultimately, not all specimens are created equal.

Whether due to individual differences or changes attributable to embalming methods, variations exist across specimens. When combined with the fact that most cadaver bones come from the elderly and infirm, which is not necessarily representative of the population at large, it negatively impacts the consistency needed for medical accuracy and statistical robustness (Horn, 2010; Elfar, 2014).

## A SUITABLE SUBSTITUTE

The search for a more reliable medium has led many medical researchers and educators to polyurethane foam as the composite material of choice for orthopedic models. Polyurethane immediately addresses the drawbacks of traditional materials in that:

- There is no shortage of supply. Polyurethane foam is readily available from commercial sellers to meet various needs of researchers and educators alike
- Batches can be produced at a substantially lower cost when compared to procuring cadaver specimens
- Depending on selected manufacturer’s methods, consistency across materials batch to batch may be ensured

In addition, polyurethane foam is not subject to the onerous regulations of cadaver bones, and it is resistant to moisture and mold. This makes shipping, storage and disposal simple and inexpensive (Elfar, 2014).



*Photos provided by Sawbones®*

Yet the most important question is whether the polyurethane foam is a suitable analogue for bone? Does it mimic the properties of bone necessary for accurate biomechanical testing? The short answer is yes.

Numerous studies have found polyurethane foam to be a suitable substitute for human cancellous bone both in terms of its mechanical properties and as a substrate for implant testing (Shim, 2012; Horn). Polyurethane can be processed to mimic both the compressive strength and elastic modulus of bone. It can mimic healthy bone, and by adjusting foam density, conditions such as osteoporotic bone can also be recreated for study (Patel, 2008). Rigid polyurethane foam is approved by the American Society of Testing Methods (ASTM) as a standard material for testing orthopedic devices and instruments (ASTM, 2012).

## AN EXPERIENCED PARTNER

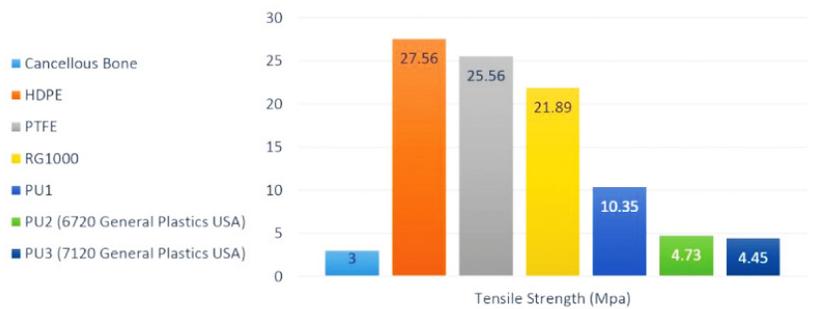
If you are ready to make the jump from traditional materials to polyurethane foam for your orthopedic testing and education, consider General Plastics as your raw materials supplier and partner. For orthopedic medical parts fabrication visit [www.sawbones.com](http://www.sawbones.com).

With 75 years as an innovator in the plastics industry, General Plastics have finely honed quality assurance processes in place and a long track record of delivering on the most stringent customer requirements.

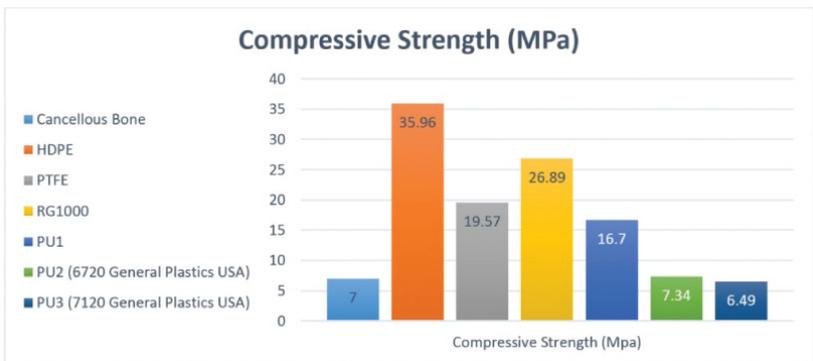
The LAST-A-FOAM® FR-3700 polyurethane foam series is regularly used in orthopedics as artificial media for bone testing. It comes in a range of densities from 3-40 pounds per cubic foot, and thus can be made to mimic human bone across a range of conditions and testing needs. Vitrally, they have a consistent cellular structure that closely approximates human bone, so are ideal for research purposes and for medical students to develop their surgical skills.

One recent study (Iweju, 2014) found General Plastic's LAST-A-FOAM® series to be superior to other polymer materials and grades of polyurethane foam for artificial joint testing. Across a number of qualities important in orthopedic research including density, compressive strength, and tensile strength,

**Tensile Strength (MPa)**



**Compressive Strength (MPa)**



General Plastics' LAST-A-FOAM® products (PU2 & PU3 in the charts below) were the closest analogue to human cancellous bone.

For orthopedic medical parts fabrication, go to General Plastics' 25-year customer, Sawbones, located on Vashon Island, Washington. For more information on General Plastics' LAST-A-FOAM® and how you can use it for your application, call us at 866-825-1378.

**Download our Case Application** detailing how Sawbones, the largest provider of orthopedic and anatomical models, uses FR-3700 in their products and workshops.

## REFERENCES

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