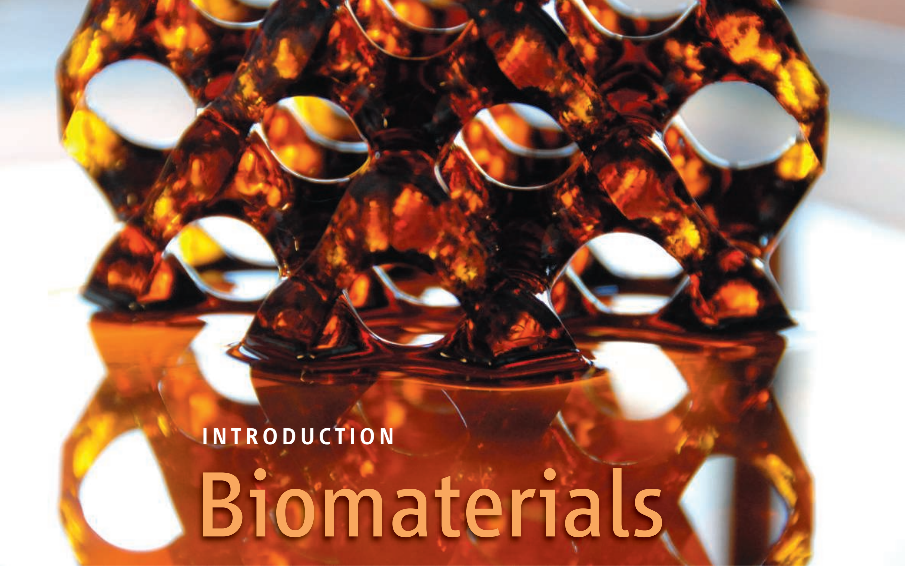

INTRODUCTION

Biomaterials

WHEN TRYING TO DEVELOP AN ARTIFICIAL SKIN, PROFESSOR KIM WOODHOUSE CAME up with several formulations based on an elastomeric polymer. One of them had the mechanical properties that most closely matched human skin, so she thought it would be the formulation the surgeon would want to test. The surgeon, however, came in, flopped each of the samples in his hands, and picked a different sample for surgical testing. That formulation became the standard for her lab.

Engineers think about formulas and numbers, surgeons work with their hands, physicists focus on explaining materials behavior, and biologists analyze complex cellular interactions. They all work in biomaterials, but they often speak different languages and have different priorities. For biomaterials to move from the lab to clinical use, these groups increasingly need to work together. With this in mind, *Science* and *Science Translational Medicine* are covering the basic, the applied, and everything in between—the so-called translational space.

Starting with the basics, Gonzalez-Rodriguez *et al*. (p. 910) review in *Science* how applied physics concepts learned from the study of the rheological properties of soft materials are being used to understand cell sorting and tissue mechanics. Such in vitro systems can help to answer basic biological questions, as explained in a *Science Translational Medicine* Perspective by Tibbitt and Anseth.

Biomaterials also drive forward technology development, as highlighted in two *Science* Reviews. Nanoparticles can enhance drug delivery and efficacy, yet a trade-off exists between functionality and complexity, which can dramatically affect the potential for regulatory approval. To this end, Cheng *et al.* (p. 903) explore finding the right balance in nanoparticle design. Printing and rapid prototyping can improve the potential clinical application of biomaterials. Derby (p. 921) contrasts these technologies, which are being used to fabricate tissues.

On the applied side of biomaterials, a major unmet clinical need is engineered whole organs. In *Science Translational Medicine*, Atala, Kasper, and Mikos review the latest advances in engineering complex tissues. It may be possible to combine cells and biomaterials into a structurally and functionally competent organ, but vascular networks are needed, as highlighted by Bae *et al.* in a related *Science Translational Medicine* Perspective. These issues are also raised in a *Science* Review by Huey *et al*. (p. 917), which discusses why more success has been realized in regenerating bone than cartilage. In a News story (p. 900), Hvistendahl spotlights China's push into the field of tissue engineering.

During all steps of translation, regulation and commercialization must be kept in mind. These aspects are central to the discussion in a *Science Translational Medicine* Review by Pashuck and Stevens on designing biomaterials for the clinic. In a *Science Translational Medicine* Commentary, the editors asked thought leaders from various backgrounds one question: What is the greatest regulatory challenge in the clinical translation of biomaterials? Several unifying themes emerged, including collaboration, cost, and the trade-off between innovation and time to approval.

We encourage readers to explore this diverse package of articles from *Science* and *Science Translational Medicine* and to broaden their view of the biomaterials world.

– MARC LAVINE, MEGAN FRISK, ELIZABETH PENNISI

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Science

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Published by AAAS