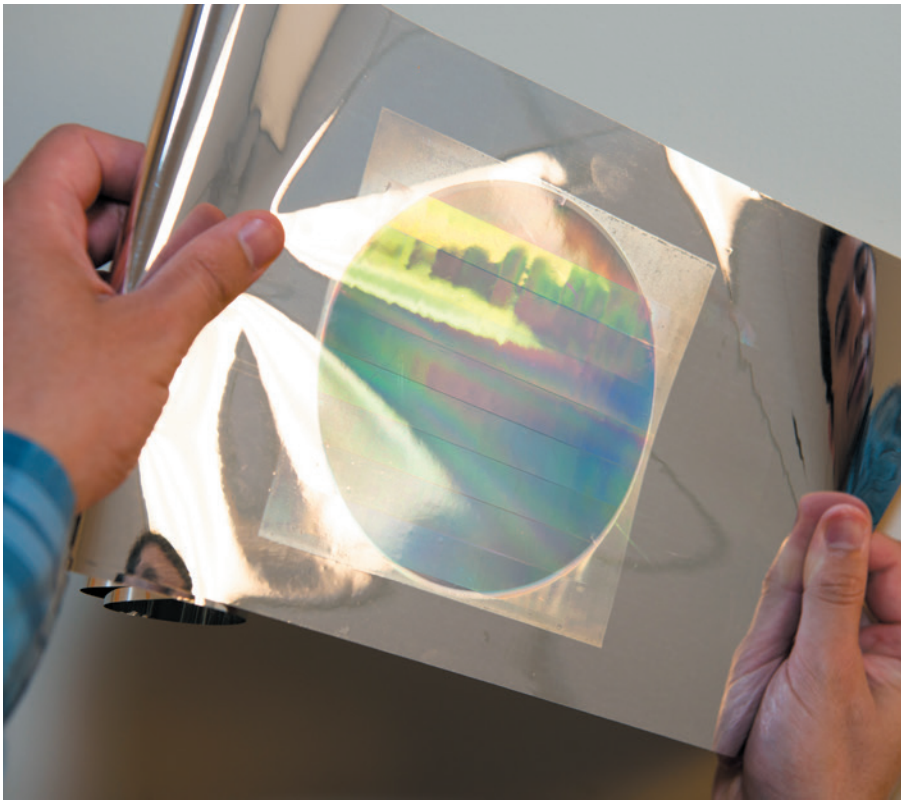

MICHELLE C. ROSE/MGH

Ali Yetisen's printed holographic sensors can be used in wearable devices and textiles.

Q&A Ali Yetisen
The nanomaterials designer

Ali Yetisen's research includes using nanotechnology and biosensors to make environmentally responsive materials for clothes, tattoos, accessories and contact lenses — materials that could be the future of fashion. Here, Yetisen, who works at Harvard University and Massachusetts General Hospital in Cambridge, talks about mimicking the diffraction in butterfly wings, transforming gowns, and what fashion designers and materials scientists can learn from each other.

Tell me about your materials.
I make photonic materials that change colour in response to the environment — to, say, stretching, temperature or moisture. I also work on holographic sensors that change hue in response to chemical parameters, such as pheromones, glucose or salts. It is biomimicry, really: inspired by the iridescence of butterfly wings. Rather than pigments, butterfly wings have layered structures that diffract light to produce different colours. I create structures from layers of silver particles in a hydrogel. The gel swells or shrinks in response to what it is sensing, altering the spacing of the layers. That shifts the wavelength of the diffracted light, and the material shows a different colour.

How would these be used in clothing?
We foresee printing these materials on fashion items instead of dyeing. Or they could be used to reveal the presence of a harmful gas or unhealthy levels of ultraviolet light. In contact lenses, they could make eyes look brighter. Other researchers, including Juan Hinestroza at Cornell University in Ithaca, New York, are also merging textiles with nanoparticles. Nanoparticles can change a material's colour (because particles of different sizes interact differently with light) and can be superhydrophobic and antibacterial, giving clothes stain-repellent or odour-control properties.

Where is technology currently having the greatest impact on fashion?
Sportswear companies have been the first to embrace electronics and biosensors, with wearable technology and devices. Adidas and Ralph Lauren have introduced lines in which conductive fibres in the fabric measure heart rate, calories burned and breathing rate. In photonics and electronics, the London-based company CuteCircuit has made a dress that displays real-time tweets, and architectural fashion label Chromat has produced a 'fight-or-flight' dress that expands into an imposing structure when temperature and sweat levels suggest that adrenaline is pumping. We are likely to see more of this. Intel is now a patron of the British Fashion Council, and plans to work with designers to weave more smart products into clothing and accessories.

How can nanotechnology enter fashion?
We are at a very early stage. Our team has had some conversations with Google, which is interested in intelligent materials for design. But many questions remain. If we make a garment with nanoparticles, the particles have to stay within the textiles and not get into the skin, air or food. Nanomaterials also need to be manufactured at scale, which means standardizing the quality of raw textiles to a whole new level and controlling, for example, the surface charge and oxidation levels of cotton, as well as fibre length and strength.

Can science learn from fashion?
Scientists start from fundamental building blocks and understand how materials or a technology can be constructed by putting parts together. In art and fashion, it works the other way. Usually, the big picture is there and designers will look for materials to make it happen. Because of that, fashion is really good at thinking outside the box. If fashion designers and scientists make a conscious effort to understand each other's way of working, they can build sympathy between these very different schools of thought.

MICHELLE C. ROSE/MGH

Do you follow fashion?
I watch fashion weeks and events to see how creativity evolves outside basic sciences and technology, and I am in a minority of scientists who want to make technology more accessible using new forms of expression. Do I buy designer clothing? No. That is for the red carpet at the Oscars. What is the point of wearing designer clothing in the lab? ■

INTERVIEW BY ELIZABETH GIBNEY

This interview has been edited for length and clarity.