

MENDING BONE BIAS

A scientist who wants to understand bones may start by looking at mice in a laboratory. To keep things simple, they might select mice of a single sex – probably male, since female hormones could complicate the picture. Years down the line, however, this research could result in treatments for humans of both sexes.

Dr Claire Clarkin from the School of Biological Sciences specialises in skeletal sex differences. Men's and women's bones are different throughout life. For instance, bone loss is more common in women after menopause and the sexes are impacted differently by skeletal diseases. Collaborating with colleagues in Engineering to develop new imaging technologies, Claire has been the first to show that blood vessel differences in male and female bones are significant, since blood vessels are critical for processes like bone growth and fracture repair.

"When we're treating bone-related issues we should really be stratifying treatments and thinking about developing sex-specific therapies. However, if you've got a sex bias preclinically, for example if in development of a drug you've just tested it on male mice, then it's probably going to work better in men than it is in women. This is an important health inequality to recognise," she said.

Beyond binaries

Of course, in the human world there are considerations which go beyond binary sex categories. Unlike laboratory mice, humans are impacted by social, political, and cultural concepts such as gender and race.

To tackle these complexities as she goes about influencing policy, Claire has teamed up with Associate Professor of Politics and Identity Dr Valentina Cardo. "I believe that politics shapes how we experience



Claire (right) and Valentina (second from right) and their team on a visit to Westminster

everyday life," said Valentina, whose research focuses on questions of power, identity, and difference. "This project was the first time I'd seen how bias can exist at such an early stage in the scientific process." Her role has been to help translate the biological science into the realm of the political, bringing in an intersectional lens.

"In scientific literature you'd use the term *females*, but in society we think in terms of *women*. Transgender questions further complicate that, as do race, ethnicity ... layering these intersections, you can see how preclinical sex biases can be amplified as you go into society, resulting in marginalised communities that are getting inadequate care."

Claire's conversations with Valentina have led her to think far more broadly about the implications of preclinical research in the real world, she said. "Animal models are helpful, but you've got to be careful how you interpret that data. Valentina's perspective is making what we do in the lab more relevant and impactful."

Complex inequalities

Claire and Valentina agree that, since the sex bias they have identified begins in preclinical research, change needs to begin there too. "When preclinical work is giving us more balanced evidence, that will lead to better-informed policy decisions," said Claire.

They have been working with a range of journals – including the significant international



Children learning about bone structure

Journal of Bone and Mineral Research – to implement 2016 Sex and Gender Equity in Research (SAGER) guidelines into the publication process. These guidelines, designed to promote systematic reporting of sex and gender in research, include the requirement to state information about the sex of study participants in the article title and abstract. Authors must also report how they took sex and gender into account when designing the study, and disaggregate resulting data by sex.

“Tackling research policy change is comparatively easy, as scientists are open to sorting out experimental bias if funding is available,” reflected Claire. “Wider health inequalities are much more complex.” Their strategy, outlined in the Bias in Bones

policy brief (produced with Public Policy Southampton), also includes improving public health professionals’ understanding of skeletal sex differences, and prioritising the development of personalised, sex-specific medicines and therapy for bone health.

Community conversations

Engaging the public with conversations about skeletal sex differences and health disparities is another essential piece of the puzzle. Claire has also worked with Edinburgh-based artist Louise Fraser to coproduce creative tools such as the ‘bone crayon’, which helps people visualise the hidden complexities of their bones, represented in the crayon by different layers and colours. “A more creative approach engages people with complex information

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Dr Claire Clarkin

in a fun and active way, through the physical movements of drawing, exploring the bone crayon through sculptural excavation and our senses of colour, texture, and smell.”

Louise has also developed a ‘Studio lab’ – a portable creative space which can be wheeled into hospitals, schools and community events such as the University’s Science and Engineering Festival (SOTSEF). This lab allows accessible exploration of skeletal samples, 3D printed bone scans, bone crayons and large tufted models of bone cells. “It’s important for children to understand at an early age that girls’ and boys’ bones are actually different,” said Claire. “Whether it’s fracturing their own bones falling off a trampoline, or hearing about Granny and Granddad’s bones, they are a really engaged group of people to talk to.”

Developing trusted relationships with a diverse range of communities has helped yield insights into people’s lived experiences. These experiences in turn can go on to inform the research and evidence to inform health policies. “I think the truly interesting conversations happen off-campus!” said Claire. “Often as researchers we’re only talking to people in our own scientific community. But public engagement allows you to have a broader reach – and ensures that what you’re talking about is actually relevant.”

Unusually, this kind of public and policy engagement sits alongside scientific research in the work of Claire’s PhD students.

“Normally when you do a PhD you’re in a bubble,” observed Valentina. “But I think it should be compulsory to understand how your discipline impacts not only on other disciplines, but local communities and nationally at government level too.”

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