How an orchestra uses space in a time-critical context can hold lessons for surgical teams.

MEDICINE

Discovery through doing

Roger Kneebone explores how lacemakers, glass artists and percussionists are sharing skills with researchers.

Analytical chemist Matthew Lewis had a problem: when he tried to bisect kidney stones for analysis by mass spectrometry, they crumbled. Glass artist Katharine Coleman suggested a solution, using lens-grinding equipment mounted on a portable lathe. With this, the kidney stone could be gently abraded to produce a clean equatorial section. As Lewis (who works in the Division of Computational and Systems Medicine at Imperial College London) put it: “An epiphany for me was that the tools Katharine works with are more suited to our application than our own.”

Nearby, at the Imperial-run St Mary's Hospital, embroiderer Fleur Oakes has identified techniques from her repertoire that could improve surgeons' control over fine sutures when they join arteries together. Oakes — lacemaker in residence at the vascular-surgery unit — is working with the clinical team to devise an educational programme aimed at overcoming problems with thread tangling during surgery.

These cross-cutting collaborations are part of the engagement and performance science programme that I direct at Imperial. Under its aegis, bioscientists and clinicians in the divisions of computational medicine and surgery are working with expert practitioners and academics from the Art Workers' Guild,

the Royal College of Music and the Victoria and Albert Museum Research Institute to explore common ground in haptic learning — how we discover through doing in science and craft (J. Kiverstein and M. Miller *Front. Hum. Neurosci.* **9**, 237; 2015). Science and medicine are no more purely cognitive than the arts. All depend on performance, technical skill, observation, dexterity and the ability to work under pressure.

Over more than ten years in this arena, I have learned that the conditions for serendipitous encounters must be deliberately curated. The Imperial programme is not a conceptual science-art collaboration, whose benefits for scientists are often considered marginal. It hinges instead on physical communication at the level of doing and making — the craft of science. We have found that the collaborations have led to changes in approach, such as heightening surgeons' awareness when handling suture thread, as well as inspiring experimentation with new stitching techniques. Engaging with different experts can send a cold blast through our assumptions, scouring them out and leading to new insights.

Rachel Warr is revealing the value of puppetry to surgery, for instance. A leading freelance puppetry director and artistic director of London's Dotted Line Theatre, she has shown how puppeteers start rehearsals

with a sequence of hand and finger exercises to prepare them for the intricately dexterous work of manipulating rods or marionette strings. Similar routines could be applied to surgery to enhance finger control and precision. Pre-performance group warm-ups could improve surgical teamwork.

The BBC Symphony Orchestra's principal percussionist, David Hockings, has shown how he interacts with fellow musicians and their instruments on a narrow platform, collaboratively negotiating space in a time-critical performance. Using complex contemporary music — Lera Auerbach's *The Infant Minstrel and His Peculiar Menagerie* — he has also revealed how individual experts create new ensembles to perform challenging tasks under pressure. That highlights parallels with ‘transient teams’ in surgery, where surgeons, anaesthetists and nurses must forge collaborations quickly for high-stakes operations.

Close-up magician Richard McDougall (a Gold Star Member of Britain's Inner Magic Circle) is working with a neurosurgical team at St Mary's led by neurotrauma specialist Mark Wilson. Learning even simple tricks demands much practice: the performer must perfect the choreography of fine motor skills and engage with the audience. McDougall and Wilson will be teaching magic techniques to people in rehabilitation after sudden head injuries, as a motivational adjunct to more conventional therapies.

These collaborations are already showing their value. In time, some may have demonstrable impact on scientific and medical practice. They are experiments, of course, so uncertainty is built in. But intention to collaborate and think differently lies at their heart.

Science and medicine can develop a seductive self-sufficiency, a belief that everything that must be learned can be found in their specialized worlds. Engaging directly with the practice of craftspeople and performers reveals another way.

Knowledge in the arts, crafts and trades has been devalued by successive governments. School curricula have been hollowed out in the belief that doing and making are subordinate to thinking. Collaborative university programmes are being cut or curtailed, and generous-minded exploration between disciplines is under threat. Yet doing and thinking are two sides of the same coin. It is in all our interests to cherish and protect what can all too easily become lost in description — the enduring craft of science and medicine. ■

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