ART & ANATOMY

Reflection

ART AND ANATOMY: THE STRUCTURE AND FUNCTION OF AN ART–SCIENCE COLLABORATION

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This paper explores the practices and experiences of participants in an art–science collaboration, the Art and Anatomy Project. It was our intent to draw out reflective perspectives on what worked (or didn't) in this project, enabling us to understand the conditions that support different types of collaboration and extend its wider impact. The Art and Anatomy Project followed closely on the heels of its precursor project, Art and Neuroscience and, as Peter Stupples and Ruth Napper note in the accompanying exhibition catalogue, preserved its intentions of showing the artists' response to scientific research.[1] Despite being described in promotional material as a collaboration between "artists from the Dunedin School of Art and neuroscientists from the University of Otago," as intimated by participants in the first project it was uncertain how mutual the collaborative exchange was. Work towards facilitating feedback from artists and scientists was initiated from the start of the Art and Anatomy Project, and our findings are summarised here.

We focus on three key questions. (1) What were the tangible benefits and opportunities perceived by participants? (2) Was the act (and/or output) of collaboration one of these benefits, and how did the process work? Collaborations are often (though not necessarily) the union of very different expertise and experience. (3) Was this the situation realised by participants or were commonalities also discovered? Examining participants' views on these overarching questions also allows us to gauge the success of the project against some of the expectations and objectives arising from the Art and Neuroscience Project. They also reveal potential for further projects with impetus for expanded collaborative actions.

Our methods of analysis involved collecting feedback from multiple media including: participants' written commentary in reflective notebooks that they were asked to keep (and in some instances queried via follow-up emails); evidence gleaned for modes of practice manifest in artists' sketchbooks; comments on the process recorded at debrief meetings and/or noted in subsequent conversations; and observation of artworks and associated documentation (for example, artists' statements and the exhibition catalogue). The perspectives of six artists and five scientists who participated are integrated with this material.

WHAT WERE THE TANGIBLE BENEFITS AND OPPORTUNITIES PERCEIVED BY PARTICIPANTS?

Working as part of a group was one of the most obvious benefits offered; participants consistently reported that they enjoyed being part of the group and making connections. "I am happy because of the blend of people involved" [artist f]. Access to new materials was also frequently noted as a benefit for artists as well as scientists. "It is nice working with new imagery. I feel I am exploring my own artwork techniques, seeing what I can do on the canvas" [artist b]. Others appreciated the opportunity to work with human material (for example, skulls and plastinated bodies) or technical equipment. After an hour on an electron microscope, one artist noted they "loved being down in the quiet space – it creates such a sense of purpose and focus. Amazed at the micro/macro patterns occurring …" [artist f].

Many valued the opportunity to think from the perspective of another process: from exercising a scientific approach to meeting and data collection, to "the opportunity to explore other avenues – voicing the same ideas but in different media … [there are] not enough hours in the day to explore all the ideas that have come all of a sudden" [scientist e and artist f]. Artists' notebooks recorded fascination with details of methodologies. One artist noted that her scientist processed multiple sections through the brain to be able to spot differences and then counted dead cells, comparing damaged versus control groups. Her notes then distilled key ideas – for example, the brain as fragile, easily damaged (vulnerable) but partly repairable. She found the scientific method of working in series of thin sections to be comparable to the print process of *chine collé*, and used tissue paper (reflecting on the dimensions of microscope lens cleaning tissue) to link back to the fragile tissues of the brain, as well as considering parallel approaches involving numbered series and layering, in which some subtle information was changed to "develop a visual language of the science encountered" [artist a].

Similarly, another artist investigated thinking of slices as a format, and cropping material into a strip as a way of looking. This was how she observed her scientist making observations, who she noted often spoke about "looking through … we tried different grids: quite like this solution of silver mesh fabric then digital print" [artist f]. Working with other discarded material sourced from another scientist, she noted: "the discarded [materials of science] – making it into art inverts the power/value."

Opportunities included access to special places as much as people, from the Anatomy Museum right down to the floor of the Anatomy Department building: "this morning printing the textures from the floor of the anatomy building – love it. Kept working in the night trying to resolve unity …" [artist f]. For one artist in particular, access to the Anatomy Museum opened up a new world, as revealed in her chronology of comments: "More drawing the skull in the museum, discovered that I can stay past 5pm thanks to central lock doors! [A week later] Argh! Students messing with 'MY' skull so I visited plastination land instead. Not sure how I felt about it […] swing between intense interest/concentration – intense hunger – intense nausea. Drawing came out really well though. Very surreal headspace afterwards. [Two weeks later] More visits to the Anatomy Museum – beginning to feel quite comfortable there, even when big groups of students continuously stare me out for crashing their turf! […] I admit that I am in awe/fascinated/attached to the plastinated people I've been drawing …" [artist c].

The scientist paired with this artist commented to colleagues how happy she was that her artist was working so much in the museum. This suggests that a further benefit for scientists may have come from the rewarding feeling of sharing specialist material, which for many comes with the burden of feeling the need to do justice to privileged access. Another scientist noted that art changed the way she looks at science, allowing her mind to work more laterally, with less focus. Being "a bit dreamy" [scientist b] is something she felt was not acceptable as a scientist handling equipment worth serious money. When working with her artist partner in the studio, she noted that "the essential difference is [that] I feel a freedom here that I don't feel in science," which sets up a trail driven by linear literature research, leading from one paper to the next. Interestingly, her artist partner noted a similar linear/tangential juxtaposition between the scientific and printmaking processes, "where one print can lead to another" [artist f], and end up leading one off on a substantial tangent.

HOW DID THE COLLABORATIVE PROCESS WORK?

Clearly, one of the key benefits for participants was the facilitated opportunity for collaborative exchange. But what types of collaboration arose and how did that process work? We observed that two different types of collaboration developed: individual collaborations between paired artist and scientist, and more collective collaboration where many artists and scientists helped co-create a common piece of artwork. The former was by far the more frequent interaction, as described below.

Individual collaborations

All artists and scientists involved in the project engaged in at least one individual collaboration (sometimes two or more). Generally, pairs met between three and five times, almost always on the scientist's turf. Meetings were noted as being more frequent in the early stages, and generally very time-focused and organised. These brief information-packed meetings, where ideas were 'bounced' about what the artists had done and could do, were described as quite purposeful, something which scientists notably valued. In-person meetings were generally augmented with email exchanges of images and ideas, also most frequently in the early stages of the project.

Most participants reported that the interactions in their pairs was sufficient, although scientists frequently commented that they regretted not having had more time for continued involvement, and some artists expressly noted wishing their scientist partner had more time during later stages. Artists referred to the critical initial encounters and information exchanges as creating a stimulating base for their subsequent work, which appears to have been more generally solitary. In at least one instance, an artist with previous scientific background also relied on past experience to inform their work, in addition to their scientist collaborator's input.

The first steps of most collaborations involved the sharing of images. Although, in many instances, inspiration was derived from a shared set of science-based visualisations, personal interaction was critical, too: "… familiaris[ing] myself with the facial bones (as described in my mid 70's *Grey's Anatomy*). Actually, it was just an excuse to do some cool medical drawings, the REAL stuff will come from [my scientist]. Can't wait!" [artist c]. Another artist noted that "it has been a really interesting process working with [my scientist]. I really liked being given the imagery and content through conversation. It made me focus so much more on the process of making the painting as I didn't have to source any original images at all. I really enjoyed pushing my own techniques and incorporating collage for the first time. I would be keen to do this again" [artist b].

After initial meetings, and in some cases joint sessions using specialist equipment to coproduce some images for the artist, the interactions between artist and scientist generally tapered off. In one instance, the scientist painted in some final small elements of the artwork, but the following scenario was far more common: "The final art work was a real surprise to me as I guess I had some ideas in my mind of how it would look, but [it] was completely different to how I had imagined it and it really did surpass any of my expectations!" [scientist c].

Some artists reported that the process made them feel "alive" in their craft, and that the collaborative work of "coming into a creative space for [the] push and pull of ideas [made me feel] artistically and creatively awake – feel I am made to do this" [artist d]. Another artist noted that in addition to solitary work, she needed "this sort of intensity of people and discovery to stay engaged. […] This is what I love, an exchange of specialist knowledge. […] I love this way of working – without a preconceived outcome […] I like soaking up views/energy of other people and the way an art experience can harness ideas/images and resolve them into something that feels right in the body" [artist f].

Others valued the engagement and cooperation; "nice being part of something communal … sharing knowledge with researchers, generosity; sharing resources with scientists and fellow artists" [artist a]. Scientists saw the experience as providing a "juxtaposition, a collaboration between the physicality of the science image and the artful" [scientist e], and noted that they "enjoyed seeing final art works and I enjoyed seeing visual interpretations of my work. … [a] successful celebration of both scientists and artists pursuing results to interrogative inquiry" [scientist a]. "It was great thinking about my research from a different perspective and consider[ing] how this may be interpreted artistically […] the art brought colour, life and meaning to the subject" [scientist c]. Among the artists, it was a common perception that they were not sure what the scientists got out of the process; while they found the latter to be often very focused on their own research, they seemed quite pleased with the final work.

Reflection on the types of interactions recorded in artists' statements in the exhibition catalogue suggest that although there was variety in the nature of the collaborations that arose, one particular kind of relationship

predominated.[2] This scenario involved the scientist providing inspiring material and/or ideas, where preliminary imagery (exchanged from scientist to artist, or occasionally co-created in the science lab with specialist equipment) and conversation triggered the subsequent solo works produced by the artist. Often it appears to have been the imagery itself that was the catalyst, but technical methodologies such as histology or optical tracking were also influential. Occasionally it was a medical treatment that became the focal point of the artist's work and led them to explore the relationship between patient/society and treatment. This echoes similar trends apparent in the Art and Neuroscience Project, where artists' work often explored the experimental methodologies and values surrounding lab animals, or patient-medical relationships.

In a few instances, the initial imagery and discussion proffered triggered works addressing key paradigms in science. These works can be seen to enter into the critical conversations of science, and indeed have potential to contribute to the dynamic boundary debate surrounding paradigm shifts. For example, one collaboration explored different paradigms relating to the anatomy and podiatry of the human foot. Contrasting understandings of the structure and function of the foot can be simplified as 'strong' versus 'weak,' each demanding an inverse proportion of treatment and intervention. One artist explored her scientist's understanding of the foot as "flooded with strength," incorporating an immense number of intrinsic and extrinsic elements (such as bones, muscles, ligaments, tendons, sheath/sole) and base layers that reminded her of engineering elements, or a "masterpiece reminiscent of architectural arches" [artist d]. In conveying the image of the foot as strong, the artist also explored its role as a sensory organ relaying information directly to the brain, and thus inherently flexible and responsive in neurophysiological terms. Strength, movement, flexibility, responsiveness are all appropriate to her working analogy of a suspension bridge. She also found analogies with music and dance: "musical notes like the strings inside a piano … dancing feet bones like a marionette in and on the bridge's suspension wire … high tensile steel … like a moving tessellation" [artist d].

Another instance of art prodding the prevailing paradigms of science can be seen in work which queried the concept of a fragile versus resilient brain and explored an alternative view of the elasticity (and thus resilience) of tissue: "The amount of punishment tissue can receive and yet recover [from] was also a surprise to me […] It is somewhat surprising that in all this time of human development our own bodies should still hold such mysteries of function and regeneration/healing properties […] human anatomy is not static" [artist e]. The potential for art to develop new paradigms was further articulated by this artist: "The leaps that mankind makes is often due to a non-linear sidestep rather than the narrow non-divergent logical thinking of science – the science fiction writer, the poet and the artist need to become more involved in progress" [artist e].

Another artist also noted a particular power of art: "art can give us a surprise – jolting us out of our assumptions" [artist f]. They outlined part of the process behind the critical lens offered by art in their reflective notes on their work: "Interesting looking back at early stages – when I was in love with the electron microscope images. Still like them but the novelty has worn off. Work/prints have become more complex […] At the start all the scientific images looked fantastic but now I recognise the need to push them further. Sometimes with drawing it is not that you get a fab/usable work but the process opens up possibilities/helps you see" [artist f]. Around 5-6 months into the project, the same artist noted: "finally the leap from scientific image to more artistic/metaphorical is starting to happen – I can feel the cogs in my brain loosening up and leaping."

In addition to its benefits and exhilarations, collaboration can be challenging work, and does not necessarily lead to mutually rewarding outcomes. Comments from artists noted that the experience was not without its challenges. "It's quite full on, I don't know if that is solely because I'm taking it very seriously but I really feel like it's an important project, particularly for me personally because it was so deeply in my interest areas. I'm quite anxious about the finished piece, I'm working quite differently to how I have in the past and I'm not sure where I'll go between the drawings and the finished work. The first study I have done has helped me to feel happy about it but to not have a specific image or idea in my head is exciting and challenging! Because the process is different [...] I'm really worried that it'll be crap and I'll have nothing to show. Completely irrational I know [...] I'm doing SO much work that it should be fine!" [artist c].

Further revealing what is perhaps a commonality with performance anxiety and work ethic often exhibited by scientists, another artist noted: "Feeling like the project is full of possibilities but a little overwhelmed – wondering if I can do it all justice" [artist f]. Weeks later, in their reflective writing the same artist noted: "I still feel nervous jumping in [...] because this project is important to me. It feels like an accumulation of things I value in the art world that are often undervalued – artists' books, practical technical stuff, working in collaboration – i.e. artist identity is not featured – more about the work. I have to remind myself fear and excitement are the same feeling sensation" [artist f].

Collective collaboration

Although the work of individual pairings was all undertaken for a single exhibition, the works generally did not cross-reference each other; collaborative interactions between artist-scientist pairs were private affairs.

Collaboration as a more collectivist activity was developed in the Art and Anatomy Project through a project initiated by one artist. After the first meeting, in which introductions were made and research described, one artist was particularly struck by the way in which the scientists who presented their research were making aesthetic choices. In a responsive effort aimed at delving deeper into scientist participation in art practice, she launched a group collaboration using printmaking to make a collective sketchbook. This initiative was in part inspired by her interaction with her scientist, who also filled a technician's role within the Anatomy Department. "Thinking how my scheme to facilitate the prints for the scientists is actually a parallel to [a] technician job – in many ways I will be the print technician for the project, so while observation is a key thing/detail/function of these tiny things we can see through a microscope – the role of technician is a simple and major link as well. … you can't take yourself out of yourself – my flavour is still apparent. I wonder if it is like this for a science technician – if they influence the outcomes through their perceptions" [artist f].

Although the book project was aimed at scientists, several artists also took advantage of the opportunity and appear to have particularly valued the act of working together. "The enthusiasm – it is not just about printing but the way it is a shared (or can be) activity that connects people – helps people find a place" [artist f]. Coming together for the print sessions in particular "created even more exciting deviants on materiality and process" [artist e], "spurred me along because I could see things happening" [artist f] and provided a useful opportunity for "dress rehearsal" [artist a]. The artist-technician and other collaborating artists concluded that they were more willing to experiment when working together in the studio space, and hypothesised that "we become braver – extend our limits … from bantering off solutions, and […] bouncing ideas off each other, being exposed to different materials and techniques" [artists a and f]; "having someone else around helped me be more playful and just try stuff" [artist f]; "the collaborative process is the important bit" [artist d]. The nature of collaboration between the artist-technician and scientists varied, involving a "synergy of energies" from contributions that ranged from an idea to an image: "am loving printing this page for [scientist e] – it's like even though I am making the plates and the choices I am influenced by his energy and workplace visit. So my way of making is changing" [artist f]. Participation by scientists in the printmaking session also appears to have been rewarding in reinforcing valued aspects of science: "loved the printmaking session, do not view my work much differently but did illustrate to me the parts of science I enjoy the most" [scientist b].

Although focused on a common end product in the book, collaborative activity was still often restricted to one-on-one work sessions between the artist-technician and other individual participants. Indeed, the role of the technician in facilitating a collective that preserved the individuality of contributions, yet gave a sense of overall unity, elicited some real challenges to collaborative work. These included her annoyance at the way other people's expectations made things more complex (for example, wanting the technician to "make pretty" imagery that she in fact found to be inherently ugly), and her constant battle with "thinking what I need to let go control of … the book is growing very organically and yet I want it to look a bit cohesive. … Tried limiting colours but that old thing then of wanting to have expression of individuals showing through" [artist f]. It also raised issues of the authorship and ownership of ideas, which she found "in this project is a little like teaching, [although it] makes me pleased some ideas I have are being actioned, as impossible to do all your ideas" [artist f].

WHAT DIFFERENCES OR COMMONALITIES BETWEEN ART AND SCIENCE WERE REVEALED IN THE COLLABORATIVE PROCESS?

Several of the participants had both art and science backgrounds – for example, a practicing artist who had been a health sciences professional, and an electron microscopist with a previous career in the arts. At least one noted the "somewhat artificial division between scientific and creative thinking" [artist e]. In many instances, the collaborative relationships appeared to be strengthen by perceived commonalities in process. It was noted that observation and visualisation were vital to understanding in both discplines, finding common ground in the "visual language of science" [artist a], but likewise, that aesthetics also had a pervasive influence. Artists using microscope drawing arms for the first time noted how in slowing you down, it really made you look. One artist summarised her understanding of the common ground shared by artists and scientists in the following terms: "curious, focused, flexible thinking, work towards discovery rather than a known, inventive, use tools/materials in different ways, persistence, always excited about learning new things and other possibilities, about looking and observation …" [artist f].

Artist notebooks revealed a common use of the language and procedures of research, whether in regard to understanding the theoretical bases of concepts or experimenting with process. "Working on technical aspects of the solar plates – many variables, even down to the print quality dpi on the laser printer – it actually made image edge more ragged which = less desirable. Also concerned about amount of plate tone when doing intaglio so need to experiment on yellow plate with less aquatint screen and/or image exposure time for laser and inkjet digital positives. Does the image bite at all if I use laser printed image and no aquatint? What if I lay down aquatint but expose for 3 mins with inkjet image?" [artist f]. Indeed, hypothesis-driven methodologies were well evidenced throughout many artists' notebooks. Solving compositional issues was also framed as active "problem solving." Some artists felt that artists in general could better acknowledge that they have transferable skills that develop ways of thinking, meaning that artists often make good problem-solvers [artists d & f]. "Artists and scientists both research, investigate, create, destroy, layer, keep images …" [artist b].

Other processes noted by artists in their reflections aligned with those commonly expected of scientists, such as experimentation, the conducting of pilot studies and consilience. "Spent the evening of Monday 24th wrestling with it […] and not getting very far, which was stressful. But on Wed 26th I cracked it and came up with the beginnings of a really solid idea that's working nicely with what I've already got" [artist c]. "Have been thinking and evaluating ideas in my head – how will this work etc. – but sometimes you have to work it out in the physical realm as well" [artist f]. Another example of commonality was the emphasis placed on the early phase of research focused on data collection, before data analysis commences: "It is just so tempting to fall into the 'collecting phase' … but time is running out. However it produces a little bit of calm when limits are put in place" [artist f].

The element of time was another shared aspect of the work process in science and art, where an enormous amount of work does not directly issue in an immediate tangible result. For all participants, the pieces exhibited were presumably equally valued as physical outcomes of time invested. Reflecting on the process of notation and problem-solving over time, some artists depicted the relationship between thought, reflection and an artist's workbook as similar to the role of the scientist's lab book for documenting and promoting analytical thought: "what I like about this phase is the cyclic thing that happens. Think think think and then look through work already made/processed and a solution can turn up just like that. A case of relooking at times – looking at repurposing what could have been abandoned. … On a different page I had printed a surface perfect for [artist e's] 'flesh' but couldn't 'see' this – tunnel vision for a bit … printmaking requires flexible thinking. Had in mind where slide was going – didn't 'sit' well so changed it. […] Some of my thinking is changing from explorative to more decisive and detailed. I am starting to visualise solutions to pages I have been struggling with" [artist f].

In particular, commonalities in process and approach were discovered between cellular anatomist's methodologies and those of a printmaker. Participants noted that the language used in both disciplines had strong parallels in terms of concepts of rotation, multiples, overlay, repetition, reflection, inversion, scale; printmaking artists noticed

how some scientists used to slide preparation and analysis of multiples intuitively 'got' the same principles in printmaking techniques. "I was amazed at all the knowledge [scientist d] had that was relevant. For example, grey scales/photography and even little enzymes that eat gelatine and are put in a tissue sample with gelatine with what I would call a printing plate. Only difference is scale – have to look at them under a microscope […] what was most delightful for me was when I asked [scientist c] about reflection – a big component of printmaking – and she said [you] have to do a flip in your brain (as printmakers do) when looking at MRI – L is R/R is L" [artist f].

Common ground was also found in the role of creativity. Creative contributions from the scientists were evident even in the initial stages of sharing their research, when delivering information to a non-specialist audience demanded communication that was "more weighted towards a story" [scientist c]. Some artists observed that in their communication of their work, scientists were "making decisions/intervening and highlighting specifics … finding a way to show others what is important. I thought the scientists I interacted with were artists – just using different materials … like using enzymes to cut tissue – could be etching. When they were describing (for example, something inside the body) you could see them visualising – their eyes were mapping the territory" [artist f]. One scientist considered that they were simply "sharing specialist info, methods … but because the artists I collaborated with very quickly understood the visual potential of the images, they were quick and eager to understand the story behind the images. This was incorporated into their interpretation of the images" [scientist a].

It is perhaps in this sharing of personal aesthetics through shared imagery and theoretical perspective and focal points (revealed in story and selected content delivery) that the assertion in the exhibition catalogue that "[t]he artists use[d] the scientist as the traditional muse/inspiration" rings most true. Our own observation was that, most overtly, inspiration arose from the subject matter the scientist presented, rather than the individual per se.

Beyond language and process, some artists noted that they shared much in common with their partner scientist as people … "[scientist a] is really cool […] we both seem like pretty similar people. Busy but keen for the project, no time really for the group stuff […] I actually felt really connected to her (not like me at all!)" [artist c]. One behavioural trait common to personalities in the arts and sciences was observed to be risk-taking behaviour. "So after learning the 'right' way to print certain plate types [scientist d] was ready to break free! Took a risk doing something different." [artist f]. Both artists and scientists also noted discussions about overarching cognitive commonalities, or "the high number of people that have both art and science 'brains'" [artist f and scientist a]. "When one artist did a 'test' for left or right brain dominance and scored 78% left brain, 22% right, she was surprised as she had believed her R dominated." She attributed this to temporal flexibility in our brains: "probably at the moment I am more in a phase of logically working through the wide field of material I have. Bet this test result will change if I do it another time" [artist f].

An impediment to interaction was occasionally associated with anxiousness surrounding the perception that the scientists were "time short" [scientist e] and/or "brainy" [artist f]. But a similar reluctance was attributed by scientists to the fact that "they don't feel artistic enough" [scientist d]. "When [I] visited [scientist d] in his hospital office space I was very nervous … when I commented on my nerves to the scientists they said that's how they feel when they come into my space/an art space" [artist f]. This artist, who facilitated the printmaking collaborative, had developed extended insight into both shared creativity and shared nervousness in crossing between 'cultures': "[scientists] come in [to the art studio] thinking [they are] not so creative, but wow – such lateral and still connected questions were flowing from [scientist c] … [scientist b] and I have been having parallel thinking as in incorporating old text, using shapes to give another layer of information, and the rubbing of plates. She asked if this was the way artists think – in relation to the way she found her ideas evolving – and I said yes. Made me realise I thought everyone processed like an artist – i.e., I understand that people have different talents and ways of processing but thought mostly some cognitive functions would be the same. So what would happen if [scientist b] applied this different way [to] her science work?" [artist f].

SUCCESS OF THE PROJECT AND POTENTIAL FOR EXPANDED COLLABORATION IN FUTURE PROJECTS

Feedback from the Art and Neuroscience Project (in which a number of artists from the current project also participated) inspired expectations for Art and Anatomy. An unpublished logic model developed by the authors mapping the projected outcomes of two interventions – artists and scientists met regularly as a group, and artists spent time with scientists in the latter's work environment – can be divided into short-, medium- and long-term outcomes. From the perspectives of the participants documented here, it is clear that many of the expected outcomes were met, including the short-term goals of participants forming relationships; artists gaining an awareness of new scientific concepts/methods/tools; scientists gaining communication practice and skills and scope to think creatively about science; artists being inspired to create art that explores or responds to science and reflects 'new ways to see.'

Medium-term goals achieved included: an art exhibition sharing innovative ways of thinking about science with colleagues and the public; and the sense experienced by participants of being connected to a wider (university/ School of Art) community. Evidence for the latter can also be found in, for example, artists continuing to inhabit science spaces after the project was completed. One artist still works in the Anatomy Museum on a weekly basis on a self-directed project; "really enjoy working in there and I'll probably continue as long as I am living in Dunedin, there's just so much to learn!!!" [artist c].

HOW MIGHT THE ART AND ANATOMY PROJECT INFORM THE NATURE OF FUTURE COLLABORATIONS?

Although post-exhibition discussions between participants in the Art and Neuroscience Project indicated interest in developing mechanisms for enabling further scientist participation,[3] structural changes intended to facilitate this process within Art and Anatomy did not widely eventuate. In the group, the dialogue between art and science quickly became private (restricted to conversations within the pairs, with the input of the scientist also tapering off quickly). This was detectable as meetings progressed throughout the year to the final debrief meeting, where no scientists were present other than a central organiser. As a means of maintaining the collective interaction longer, particularly to include scientists, it was proposed that future meetings be turned into workshops where techniques, processes and general progress would be shared. It was also proposed to extend the opportunities for interactions between artists and scientists by placing them in closer physical proximity through artist-in-residence programmes within science departments at the University of Otago. This would capitalise on the multiple benefits of in situ experience, including those accruing through personal interactions: "enjoyed being in the space – so many interesting things to look at. […] Just so amazing to be working on site – because get the chance encounters – not just formally planned ones" [artist f].

One change which was enacted in the Art and Anatomy Project involved bringing shared reflection and open evaluation of the project to the fore, and may have facilitated an increased focus on reciprocal exchange; it may have encouraged one artist to expand the nature of collaboration to create a communal piece (the print book). This singular example of collective collaboration within Art and Anatomy might be expected to have invoked a feeling of group identity through collective ownership; and, indeed, artists described the positive process of working together on the book as moving beyond traditional modes of collaboration. Artists noted that there is a culture in galleries that "people can't touch," whereas this collective effort moved towards "social consciousness for the people rather than above the people" [artists d & f]. There was general support for considering ways of incorporating additional aspects of such social art into future collaborative projects.

Another way that active collaboration could become more sustained would be to collectively explore the impact of the collaborative work on public engagement. Some evaluation of public perceptions of the exhibition, and of art

and science communication generally, was conducted on the Art and Anatomy Project,[4] and the results proved to be of significant interest for artists attending the final debrief meeting. Given the focus on science communication evident in the Art and Neuroscience Project, potentially, scientists might be drawn to a collective research project on public perceptions of their research, and more of them might remain involved in any future project throughout its course.

It strikes us that a further means of extending scientists' participation into a more genuine process of collaboration may involve realigning the intentions of the project and the way it is presented. For instance, the project's preferential focus on the artist is reinforced by a variety of formal descriptions of the project in the exhibition catalogue. Although the artists devoted the most time and energy to the project, statements like "artists have volunteered to work with scientists," obscures the fact that in terms of an activity relevant to career performance measures, the artists' efforts can be more easily viewed as professional work, whereas – under current performance measures – the scientists were very much the ones volunteering time. Further, the initial conversation between artist and scientist is described in the catalogue as "centred on the research undertaken by the scientist," whereas a sharper focus could be placed on conversation that includes and extends discussion of artist perspectives, or the greater societal context of the research. Rephrasing it as a "dialogue about research and interpretations" would suggest an intention to conduct a meaningful two-way exchange of perspectives and ideas. Indeed, a slightly modified remit could challenge scientists to not simply express their research interests (which could be expected to be the elements they felt most confident about and thus secure in articulating), but to share the mysteries, problems, questions and tensions inherent in their particular field of research. If both artist and scientist are positioned on the shifting ground of science, rather than something perceived to be solid, then this may invite sharper questioning and observations, with an enhanced feeling of authority and validity from artists. Such an approach would also invite scientists to think more critically about creative interpretation as a way of generating hypotheses. Further, such shared interaction would demonstrate to all involved (artists, scientists and the viewing public) the dynamic exploration of ideas in science, and how vital creative thinking is.

Perhaps one of the most potent messages to surface from these collaborations is that the huge variety in the resulting collaborations and end artwork is the product of equally enormous variation in approaches to science and art, and in the personalities of the individual artists and scientists. For example, "one scientist was more 'straight up and down' … and others were more lateral and wove connections and stories into our conversation" [artist f]. Many different ways of working were apparent, but so too were commonalities, and these were not sequestered within a single discipline. Indeed, all participants appeared equally fascinated with processes and ideas; individually, we are attracted to different approaches and we become practiced in particular methodologies and theory, which can self-reinforce perpetually.

Collaborations promote a shake-up of such cycles, encouraging us to acknowledge our central motivations as individuals, and to question the divisions we put in place between professional practice and private passions. One of the artists, encouraged us to question, "Why are you tearing me from myself?". In her artist's statement, her quotation from writer Heather Webb[5] applies equally to scientists and artists: "How are we to understand creation if the artist's selfhood is contained in his unaltered skin rather than within some central core of being that is brought forth in the act of producing art?"

Dr Jenny Rock is a biologist and artist who lectures in critical and creative thinking at the University of Otago's Centre Science Communication. Her interests include the aesthetics of science, visual/sensory cognition, and art-as-hypothesis.

Sunkita Howard is a Fulbright Scholar and doctoral student at the University of Otago. She incorporates the artistic practices of printmaking and poetry into her research on developing shark by catch reduction technology for longline fishing gear.

1 *Art and Anatomy: A Collaboration between Scientists from the University of Otago, Dunedin Artists, and Dunedin School of Art*, catalogue of an exhibition, 30 June – 11 July 2014, Anatomy Department, University of Otago and Dunedin School of Art at Otago Polytechnic (Dunedin: University of Otago, 2014).

2 J Rock, pers. obs.

3 Howard and Rock 2014.

4 R Napper, unpublished data.

5 See Sally Shephard's artist statement in the Art and Anatomy catalogue included in this issue.

ART DESCRIBES SCIENCE

Steve Grbic

The "Art and Anatomy" exhibition held during the New Zealand International Science Festival represented a collaboration between scientists from the University of Otago, Dunedin artists and the Dunedin School of Art. Its purpose was to provide a visual response to a range of scientific activities not usually seen or understood by non-scientists.

Senior lecturer in the Department of Anatomy, Ruth Napper, who curated the exhibition with Peter Stupples from the Dunedin School of Art, explained that each of the 15 art pieces on display was aimed at "gently leading the viewer into the world of science. … The viewers were allowed to admit to themselves that they knew nothing about the subject while being given the opportunity to find out by engaging with the artist's representation".

To create the exhibition, which was mounted on campus at the Hunter Centre, 11 scientists from the departments of anatomy, physiotherapy and physical education worked with 15 artists – graduates, postgraduates and staff from the Dunedin School of Art, as well as a number of independent Dunedin artists. They met at the end of 2013, self-selected into pairings, and began a conversation about the scientists' research. Using 'their' scientist as their muse/inspiration to lead them to areas otherwise unexplored, each artist developed visual material relating to, but not necessarily illustrating, the research topic.

One example was Lynnette Taylor's 'lozenge motif,' used in her work *Untitled*, an acrylic on canvas – Lynette's purpose in using a single motif in a repeated, overall pattern was to represent the seemingly limitless combinations in the cell structure of the human brain. The idea was to illustrate how, according to Ruth Napper's research, brain cells and neural pathways damaged by exposure to alcohol during fetal development are able to reorganise and realign in order to maintain functionality.

Another was James Bellaney's mixed media on canvas work, composed of nine pieces – *I walk through mud to get here* – showing what many people go through after a stroke. This work was based on scientist Jonathan Shemmell's work developing methods to improve the ability of stroke survivors to interact with the world through movement. In this piece, Bellaney says, "The dark place into which our minds can fall, and that unsettling feeling of inadequacy we know all too well, are set against the romantic image of the human will and our striving to overcome all the obstacles that life places in front of us."

Two other compelling works were David Green's mirror-encased meat cleaver, highlighting the complexities of the brain's structure at cellular level, and Robyn Bardas' *Anatomy of the Heart*, representing the "intricate, delicate, plant-like red casts of the veins, arteries and capillaries of hearts, hands, a finger."

Steve Grbic has over 30 years' experience in corporate communications and public relations, providing public relations and strategy consulting services to a wide variety of New Zealand businesses and organisations. He was originally a journalist and editor working on some of South Africa's leading publications. His clients are drawn from a range of areas including fast-moving consumer goods (FMCG), corporate and public events, infrastructure, engineering, government organisations, pharmaceuticals and personal publicity.

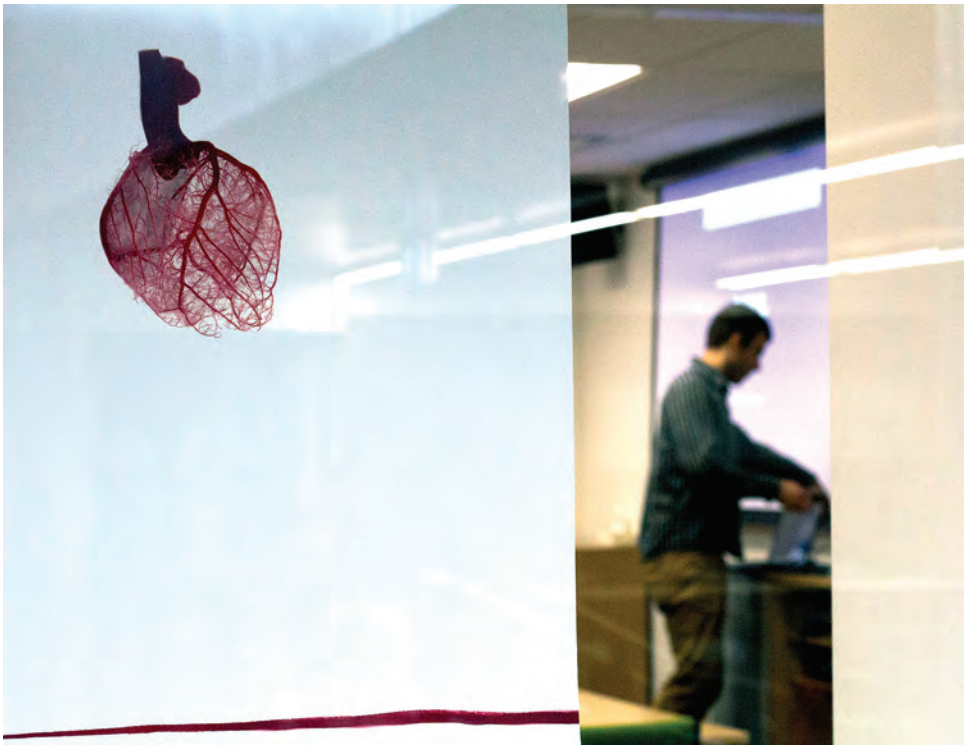

Figure 1 and 2: Installation view of Art and Anatomy exhibition, 2013. Photos by David Green.

ART & ANATOMY; MY PAPER IN REVIEW

Brigitte Kammlein and Ruth Napper

Most of the time I draw my inspiration from the natural world, the landscape I live in, the animals, the plants and patterns around me. So it is truly a new and exciting challenge to engage and collaborate with a specific scientist, and to have a glimpse into the fascinating world of her research and come up with a visual response to the science encountered.

From the start, I was particularly intrigued by the similarities in the processes used in gathering research data and in printmaking. I can relate to the cutting and mounting of minute samples arranged in numbered series, with often only the smallest of differences between them. Only by layering the various sections on top of each other is a 3D understanding of the data possible. In printmaking, I also work in layers to build up information. I produce work in series and editions, with slight but noticeable differences between them. I handle not fragile samples of brain tissue, but often fragile paper. So it was a natural progression to create my own samples, my own 'paper,' my own visual language of the science encountered.

I wish to thank particularly Ruth Napper for giving me access to her research and for so generously giving up time and information. I would also like to thank Peter Stupples for making this wonderful collaboration possible, and my fellow artists whom I shared ideas and techniques with and who made it so much fun.

BRIGITTE KAMMLEIN

My laboratory uses an animal model of fetal alcohol spectrum disorder (FASD) to understand the long-term damage that can result following exposure of the fetal brain to alcohol. We have found that even a single binge-like exposure to ethanol can cause significant death of neurons (nerve cells of the brain) in many different brain regions. Using electron microscopy, we use images taken from serial ultrathin sections to reconstruct the connections between surviving neurons and determine the structure of the remaining cells to assess whether plasticity has occurred in an attempt to compensate for the loss of neurons.

RUTH NAPPER

Brigitte Kammleim graduated with a BFA in printmaking from the Dunedin School of Art.

Ruth Napper, BSc(Hons), PhD (Otago), works in the Department of Anatomy at the University of Otago and is a researcher in the university's Brain Health Research Centre. She is investigating the role of binge-like exposure to alcohol during fetal development in acute and long-term changes in the structure and function of the brain.

Figure 1. Brigitte Kammlein, *Art and Anatomy; My Paper in Review* (2014), solar etching dry point.

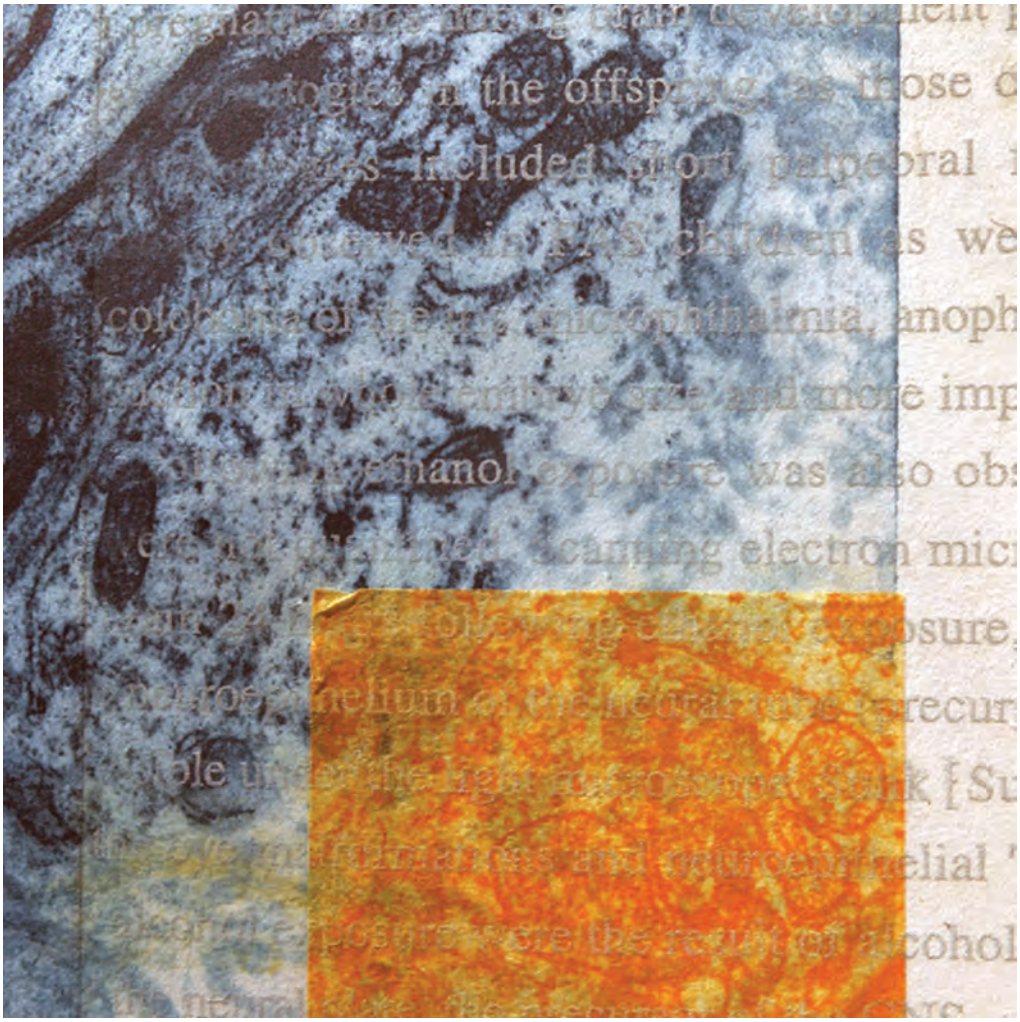

Figure 2. Brigitte Kammlein, *Art and Anatomy: My Paper in Review* (2014), detail, solar etching dry point.

EYE MOVIE

Rebecca Cameron and Chris Button

Chris Button has been using an eye-motion tracking camera to study human movement and how people acquire skill in physical activities. Although recently graduated with a BA Honours in the visual arts, I realised I knew very little about vision and how it works – not just light beams being focused through the retina, but the eye's saccades, cycles and digressions as it scans a scene to build up a picture of the world around us. I sought to apply the eye-motion tracking camera to look at – literally – how I draw. Not such an easy translation of technology; the eye movements while drawing a life model were small and precise, and we struggled to get an accurate enough overlay of model / eye movements / drawing. When A L Yarbus, the Russian pioneer in the field, studied the eye patterns of people looking at paintings he'd used a terrifying-sounding contact lens device to get precise information, not the optical tracking we were using here. The works exhibited were drawings from the sessions with the eye camera, alongside video footage of the eye as I drew. The eye scans and flicks, a curious creature, never still as it follows the contours and shadows of the visual field.

BECKY CAMERON

I conduct research on motor learning and sports performance. I am interested in how humans learn to perceive their environment and coordinate their actions. I use the theoretical framework of ecological dynamics to explain how movement patterns emerge and dissolve under the influence of a range of constraints. With an emphasis on applied research, I have worked with Water Safety New Zealand to provide advice to the general public with the aim of reducing drowning risk. In a recent study, I explored how skilled climbers adapt their visual scanning behaviour in different practice environments.

CHRIS BUTTON

Based in Dunedin, **Becky Cameron** holds an MA in art conservation, and in 2013 completed a Bachelor of Visual Arts with Honours at the Dunedin School of Art. She has been exhibiting since 2008, and her most recent project, "Te Ao Huri Huri / The Turning World," was shown as a part of the Dunedin Matariki Festival in July 2014. Cameron's practice explores landscape, memory, belonging and home.

Chris Button, BSc(Hons) PhD(MMU), has worked at the School of Physical Education, University of Otago, since 2003. Previous roles have included being director of the Human Performance Centre and co-director of Land Information New Zealand (LINZ). As well as carrying out teaching and research, Chris has provided consultancy services to several sports, providing advice on biomechanics and skill acquisition to Snowsports NZ, Netball NZ, NZ Football, and Motorsport NZ, among others.

Figure 1. Becky Cameron, *Drawing for Eye Movie* (2014), detail, charcoal on paper, 50 x70 cm.

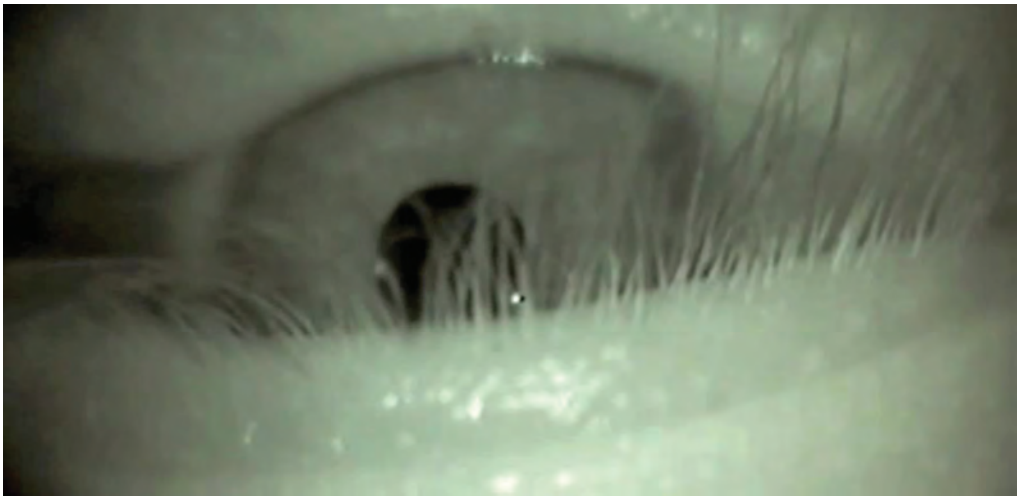

Figure 2. Becky Cameron, *Eye Movie* (2014), video still.

WHY ARE YOU TEARING ME FROM MYSELF?

Sally Shephard and Marcus Collinge

"Why are you tearing me from myself?"

"How are we to understand creation if the artist's selfhood is contained in his unaltered skin rather than within some central core of being that is brought forth in the act of producing art?"

Heather Webb, "Being Marsyas: Dante and Michelangelo as Flayed Poet"

Homo Sapiens. Artistica: "all the rest of the genus in the singularity of its appearance, which is such as at first view rather to suggest the idea of some production of fancy than of any real existence."

G. Shaw, *General Zoology*, 1804

My recent art practice has been informed by the transformation and change in materials. I have been exploring the possibilities of materials in the process of decay, evaporation and absorption, the self-made object, and time-based installations.

In this collaboration, I worked with Marcus Collinge and became interested in both the preservation and display of tissue. The two of us relate to both science and art, as I have a background in musculoskeletal medicine and Marcus is an artist as well as a technician.

My piece also reflects my interest in the classical story of Marsyas, the power relationships between young and old and the somewhat artificial division between scientific and creative thinking.

SALLY SHEPHARD

I work within the Anatomy Department as a specialist technician, maintaining the existing collections and developing new research and teaching material. I am inspired by the efforts and varied approaches of all who have come before me, and the richness and variety of presentation methods as well as the vast talents of those working in the field today.

Taking the best of the past and combining contemporary advances in materials, technology and understanding gives us a tremendously broad range of ways to exhibit anatomical detail and to pass on the knowledge and lessons direct observation can give. I would like to think that I assisted the intention of this exhibition by demonstrating the many ways in which anatomical subject matter can be presented and displayed, and has been in the past.

MARCUS COLLINGE

Sally Shephard is a practising artist who is currently also enrolled for the Master of Fine Arts degree in the Dunedin School of Art.

Marcus Collinge works in the Anatomy Department at the University of Otago. Marcus began his working life as a carpenter, ran a vegetarian cafe and worked in print before heading to art school in Christchurch in the early 1990s. Concentrating on human anatomy, he majored in printmaking and sculpture. As a practising artist, he sold his work to design stores and through galleries in New Zealand, Australia and the UK. He studied digital multimedia at AUT, but preferred working with atoms rather than bytes. Marcus joined the Otago University Anatomy Department in 2012 as an anatomy technician where he works as a museum preparator, potter of wet specimens, skeletonisor, plastinator, and renderer of anatomical models and research prototypes. He now enjoys calling Dunedin home.

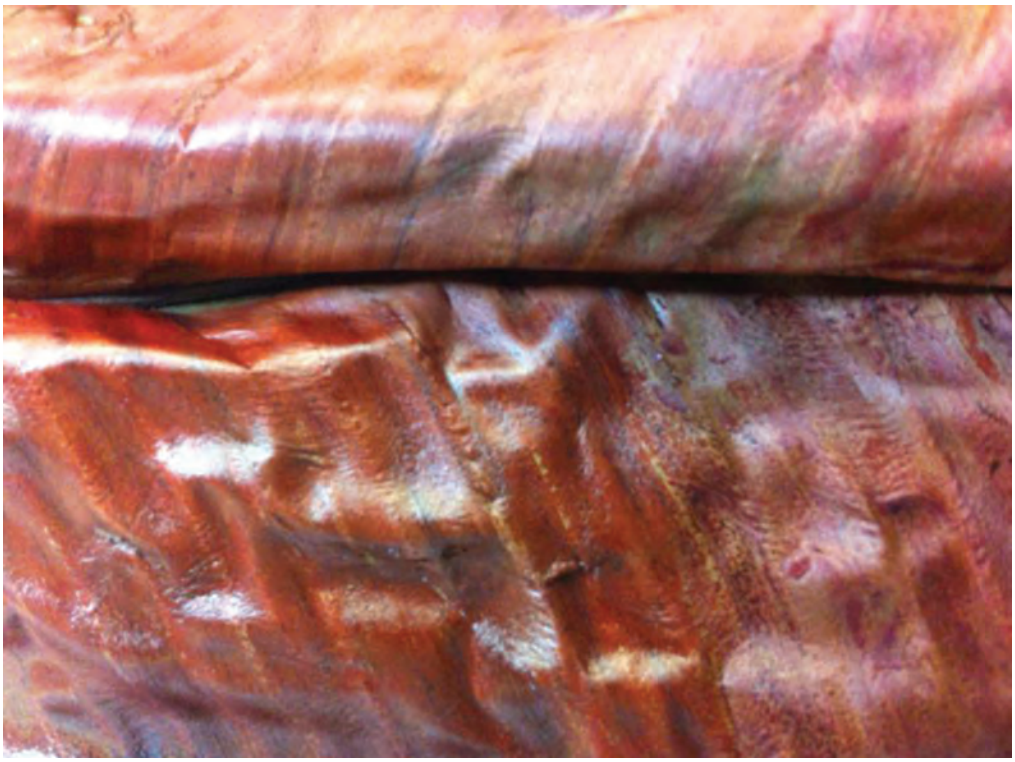

Figure 1. Sally Shephard, *Why are you tearing me from myself?* (2014).

FOUR HEADS

Holly Aitchison and Louisa Baillie

Several years ago I attended a workshop at the Dunedin Public Art Gallery where participants learned about the anatomy of the face by assembling clay muscles onto a plaster skull. It was extremely interesting and a lot of fun, and was run by Louisa Baillie.

When we began this project I recognised Louisa's name, remembered what she was studying, how fascinating her workshop had been and made contact. She supplied me with a series of screenshots taken from scans of two skulls that could be rotated and viewed in any position and could be seen as bone and solid skin or as bone with the skin as a transparent wraparound. As I watched those skulls rotating on her computer screen, I was mesmerised!

Louisa was then kind enough to introduce me to the staff at the Anatomy Department Museum at the University of Otago where I would spend the next few months drawing from the items housed there and learning about facial anatomy. From these studies and images I composed this piece.

HOLLY AITCHISON

My research is to do with forensic craniofacial reconstruction – putting faces back on skulls. In particular, I have been investigating how depth of facial soft tissue is predicted. My focus is on how to improve the accuracy of prediction, as there is at present considerable error in how this is done. I have had access to cone beam computed tomography images of heads from living adults, viewed in 3D on digital software. They give impressive detail of the skull and skin surface of each head and are visually stunning. I can colour the different tissues, make the skin opaque or transparent, spin the heads around, and view them from any angle or magnification. Seeing these layers of skin and bone gave me the impetus for collaborating with artists for this exhibition.

LOUISA BAILLIE

Holly Aitchison is an autodidactic artist who lives and works in Dunedin teaching art to people with special needs. She is a graduate of the Dunedin School of Art.

Louisa Baillie works in the Department of Anatomy, University of Otago. Louisa's primary interest is the anatomy of the human form. She studied health sciences at the University of Otago and fine arts at the Dunedin School of Art. During the 1990s she lectured in sculpture, drawing and design, while also curating and collaborating on community projects. In 2012 Louisa curated a show, "Place," an exhibition of 12 portrait busts of Otago identities that she produced, and supported with prints and text by Otago artists that portrayed the Otago region. Since 2012, Louisa has been a full-time doctoral research student in Otago University's Anatomy Department. Her study is focused on the face, with the aim of improving the accuracy of a forensic facial approximation.

FOUR HEADS BY HOLLY AITCHISON

Alexander Noble Dust

Holly Aitchison recalls staring for hours at her parents' copy of Jean Michel Jarre's Oxygene LP, with its cover image of an ancient hominid skull positioned inside the earth. From a broad palette of just such cultural ephemera grew an obsession with what lies beneath. Coming of age in a bogan culture – in her case, the Southland punk/heavy-metal scene – that sets great store on such imagery, she soon moved onto examining anatomy in the starkest possible light. Although admiring the anatomical art of Vesalius and Bourgery, her earliest large works drew on more prosaic textbook sources, like B Waterhouse Hawkins' *Artistic Anatomy of the Dog and Deer* and especially, Stephen G Gilbert's *Pictorial Anatomy of the Cat.* Her native tendencies towards the graphic, honed in a regular practice of tattooing and cartooning, saw the paint in these works pressed into the service of a rigorously descriptive muse – an attempt to make the personality of bare bones palpable.

Even in her subsequent series *Deceased Estate* (2012-ongoing), which depicts the detritus fetish of her local auction house (see Fig.2, Reál Politik, 2013) she seems to find pleasure in minutely describing the ruin of previously loved items, as if the remains of a Victorian toy or a rusty ironmonger's compass could describe the structure of a vanished life. The invitation to contribute to the "Art and Anatomy" exhibition coincided with this more painterly work, and her attempts to marry it with a graphic impetus.

Louisa Baillie, the scientific contributor in this collaboration, handed in her doctoral thesis on Forensic Craniofacial Reconstruction – the rendering of virtual or clay 'flesh' onto skulls, reclaiming faces lost to the worms – on the day the exhibition opened. The skull at top right of *Four Heads* (see Fig.1, *Four Heads* , 2014) is a CBCT image taken straight from Baillie's work, complete with green tracking dots that show depth values. The 'painting' Baillie had done with this state-of-the-art software inspired her to give an artistic collaboration a try. After preliminary discussions, Aitchison put in solid hours at the university's Anatomy Museum, familiarising herself with the history and finer points of this scientific art. A sideline series of drawings, *Meetings,* materialised during these sessions.

Four Heads came out of an early sketch, working with a model and closely referencing anatomical models and texts. Aitchison says she was inspired by the philosophical notion of the Five Bodies – the notion that we deal with five separate ways of perceiving the human body, for which we often have radically differing and even incompatible modes of intercourse. They range from the Erased Body – where we infer a personage, despite the lack of any physical presence – to the Masked, Clothed and Naked Bodies, finishing with the Opened Body – the state with which anatomy is obviously concerned. The Five Bodies thesis holds that we struggle to harmonise the extremities of these perceptions, and that the shifting social conventions around each state force us into disclosing visceral utterances that betray our true – possibly innate; or at least deeply etched – moral and perceptual qualities. It was from such considerations that Aitchison approached *Four Heads*. The rotation of the heads suggests the turning of our attention from one state to the next; and, faintly seen in the background, there is a tangle of sinewy shadows that might be simple striations of paint, shrewdly evoking that eerie sense of the Erased that we can't seem to shake.

But, as Aitchison says, in painting there is mind, there is instinct, and there is the hand. This latest work on the glassy surface of hardboard represents her attempt to refine certain Old Master fine glazing techniques within the compass of her particular graphic strengths. Skillfully performed, classical glazing seeks to deal with light in as painstaking a manner as a surgeon must deal with tissue. The training of the hand in order to subtly break down

light into facets that remind us of how, and what, we truly see, is agonisingly slow; and it is in just such discipline of technique that art and science might recognise in each other a bond of intent that proceeds from the specific, to the necessarily philosophic.

Figure 1. Holly Aitchison, *Four Heads* (2014), oil on board, 1200 x 1200 mm.

Figure 2. Holly Aitchison, *Real Politik* (2014), oil on canvas, 655 × 520 mm.

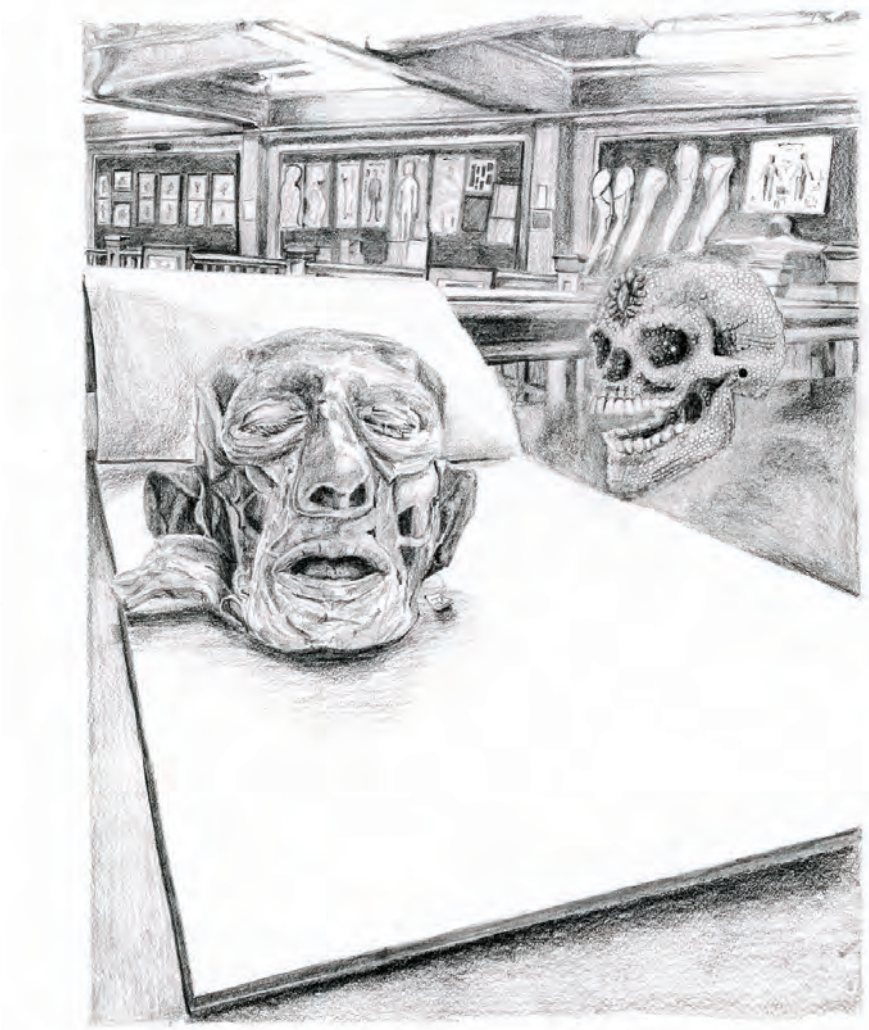

Figure 3. Holly Aitchison, Meetings 1 (Hirst) (2014), graphite drawing, 260 x 200 mm.

I WALK THROUGH MUD TO GET HERE

James Bellaney and Jonathan Shemmell

When talking with Jon Shemmell, whose work involves the rehabilitation of stroke patients who suffer paralysis, I was struck by his admiration for these people who show great perseverance in the face of emotional frustration, learning to once again be capable of simple tasks they easily accomplished prior to their stroke. I thought of them as unsung heroes, whose courage and perseverance inspires us to strive for better things, although their deeds go unheralded. The dark place into which our minds can fall, and that unsettling feeling of inadequacy we know all too well, are set against the romantic image of the human will and our striving to overcome all the obstacles that life places in front of us. Life is a raw canvas.

When I made this work, the strength and perseverance of stroke victims was in the forefront of my mind.

JAMES BELLANEY

The primary goal of my laboratory is to develop methods to improve the ability of our amazing stroke survivors to interact with their world through movement. Given the priority often placed by stroke survivors on regaining arm and hand function, we focus on improving movement in those limb segments. When we suffer a stroke, any resulting impairment of arm and hand movement is caused by the death of many neurons in the brain. People in our lab are developing new techniques to encourage the surviving neurons to take over the functions previously assumed by neurons killed during the stroke.

JONATHAN SHEMMELL

James Bellaney has been exhibiting locally and nationally since completing his BFA at the Dunedin School of Art in 2011. His work includes painting and drawing as well as performance art. He exhibits in galleries, and in artist and community spaces. James was a finalist in the Clifton Art Awards 2012 and the New Zealand National Art Awards in Waikato (2013) and has received commissions for public artworks in Dunedin. He sees himself as an active artist, experimenting with and exploring ideas around the medium of paint, the human condition and the imagination. He is currently working towards an exhibition in Wellington.

Jonathan Shemmell works in the School of Physical Education, Sport and Exercise Sciences at the University of Otago, and is also a researcher in the Sensory Stimulation Project at the university's Brain Health Research Centre. Jon joined the School in 2009. After obtaining a Bachelor's degree in sports coaching in 1997 from Deakin University, Jon completed a Master of Science (1999) and PhD (2004) in motor control and neurophysiology at the University of Queensland. He went on to investigate methods for improving outcomes for stroke survivors during his postdoctoral training in clinical neurophysiology at Boston University and the Rehabilitation Institute of Chicago (2005-08).

Figure 1. James Bellaney, *I walk through mud to get here* (2014), mixed media on canvas, 9 pieces, each 50 x 40 cm.

CONNECTICUT

David Green and Ruth Napper

I am interested in ideas around surface, interiority and the sharp end of our natural curiosity: the complexities that accompany our simple urge to know.

The materials I used were: chromium, molybdenum, vanadium, aluminium, plastic, glass, wood, mirrors, light.

DAVID GREEN

My research areas require an understanding of brain structure at the cellular level. This involves brain tissue being cut into smaller and smaller pieces until finally 90mm thick slices or sections are viewed in the transmission electron microscope. Images from these sections are reassembled into three-dimensional images using computer software. Cutting into biological material to investigate what is inside remains a powerful method of understanding structure and hence function.

RUTH NAPPER

David Green is a lecturer in electronic arts. An acclaimed director, director of photography and visual effects supervisor at RGA graphic film studios in Manhattan, he was represented by Lee Tamahori's Flying Fish Productions in New Zealand where he became known for directing a number of iconic and internationally award-winning television commercials before coming to work at the Dunedin School of Art.

Ruth Napper, BSc(Hons), PhD (Otago), works in the Department of Anatomy at the University of Otago and is a researcher in the university's Brain Health Research Centre. She is investigating the role of binge-like exposure to alcohol during fetal development in acute and long-term changes in the structure and function of the brain.

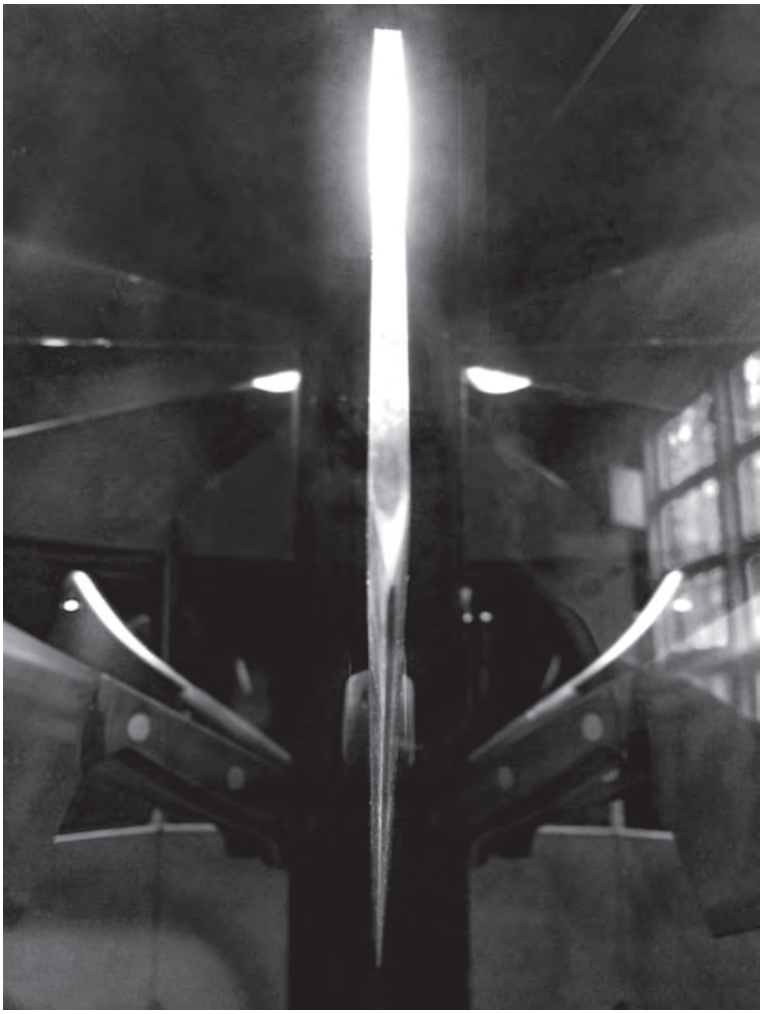

Figure 1. David Green, *Connecticut* (2014), chromium, molybdenum, vanadium, aluminium, plastic, glass, wood, mirrors, light.

BODY OF EVIDENCE

Lynn Taylor, Allan Mitchell and the Scientists

I felt like I was flying over the moon while looking down on slivers of kidney magnified in the electron microscope.

Allan Mitchell introduced me to this micro domain and while under his tutelage, I learned that part of his role is to facilitate the work of scientists in the Anatomy Department. This blended with my impulse to provide creative experiences through art engagement and an interest in how audiences can contribute to an exhibition. The upshot of this was to put out an invitation to scientists involved in the Art and Anatomy project to contribute images to be translated into photopolymer plates and to have a printmaking session printing these.

Evidence of this process was printed as a sketchbook, *Body of Evidence*. This sketchbook was shaped organically in an evolving way with the input of different participants throughout the project. Who is the author? The artist? The scientist? The audience? What happened in the process of collaboratively printing and shaping a sketchbook? Some things I expected and others I did not. People took risks. Although participants recognised the inherent aesthetic appeal of their scientific imagery, some did not feel creative and felt nervous in coming to a printmaking workshop. It seems, however, that all of us like working in something that is not our usual medium and I hope that their printmaking experiences made participants aware that art is about other ways of thinking and what develops out of the process of experimentation.

These prints are markers in thinking that combine anatomical themes with printmaking processes: repetition, rotation, overlay, surface, tone, aquatint, scale and reflection, to name only a few. The parallels between art and anatomical science emerged more strongly than I expected. For example, when printmaking I envisage imagery in mirror image because with the intaglio printing process, the information on the plate prints in reverse. I was excited to hear one researcher describe how she also has to 'flip her mind' when looking at an MRI scan compared with looking at a person; left is right, right is left.

I have stolen some sentences from participants:

> "The essential difference is that I feel a freedom here that I don't feel in science."
>
> "I enjoyed this, as I had no expectations of a result – it was a fun thing to do. The environment is nice to work in as my own [work] environment is sterile out of respect for the human material."
>
> "Is this [the Otakou Press Room] heaven? … I can't quite believe that I got to spend the afternoon doing this."
>
> "It is nice to be part of something communal, to bounce ideas off each other."
>
> "[This printmaking] is a recording of the juxtaposed physicality between the scientific image and the artful."
>
> "There are not enough hours in the day to explore all the ideas that have come all of a sudden."

Lynn Taylor graduated in 1984 with a Bachelor of Education. She then focused her early career on specialist art teaching. In 1998 she graduated with a Bachelor of Fine Arts, followed by a Master of Fine Arts in 2003, from the Dunedin School of Art. These dual streams operated together when she was a lecturer at the Dunedin School of Art and they continue now through her work as a visual arts facilitator, which sees her frequently teaching workshops throughout New Zealand and abroad.

Allan Mitchell works in the Department of Anatomy at the University of Otago and is technical manager for the Otago Centre for Electron Microscopy. Allan provides support for TEM and SEM project planning and training in transmission electron microscopy in the Anatomy Department.

Figure 1. Lynn Taylor, work in progress (2014), printing from the Otakou Press Room at the University of Otago.

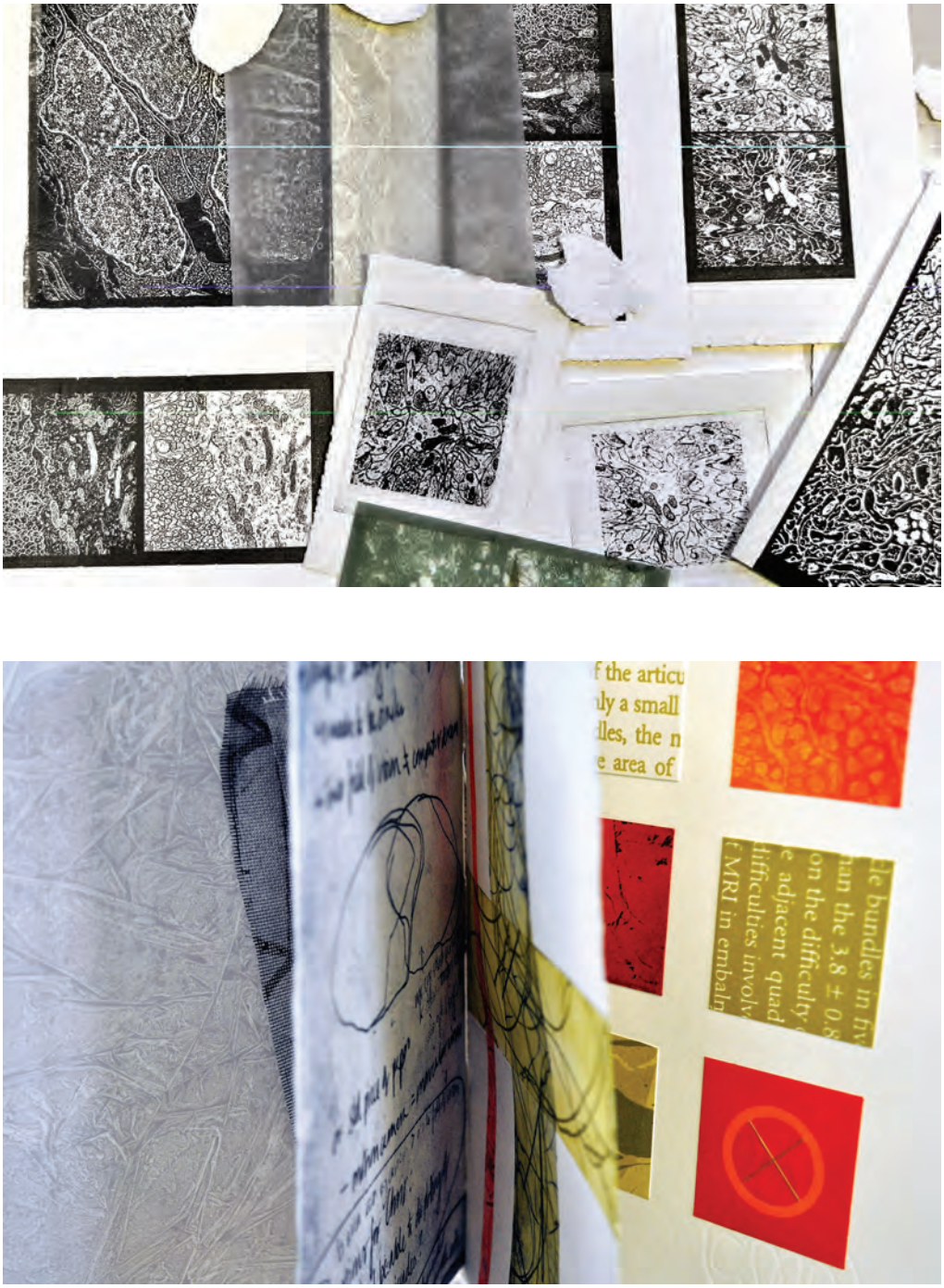

Figure 2–5. Lynn Taylor, Artists' Book (2014), based on the images used by the scientists in their research work.

Figure 6. Lynn Taylor, rubbing table, visitors to the exhibition were invited to make rubbings of the plates which had been set in a table.

CLIFTON SUSPENSION BRIDGE

Emily Hill and Gisela Sole with Chris Sole

The foot is an amazing machine – not far removed from the engineering feats of inventors and designers of our own times. Gisela's work practice as a physiotherapist intrigues me as she investigates the foot as the pivotal point of our body's biomechanics. Her way of seeing it as an engineering masterpiece is fitting, and lends itself to exploration of this aspect of our anatomy from a structural and engineering angle.

In my piece, I have drawn on the modernist transition from functional structures to architectural works considered in terms of aesthetics and form. Isambard Kingdom Brunel's Clifton Suspension Bridge (1836) is a superb example of an engineering masterpiece that has been adopted by the architectural community.

In this work I endeavour to display the aesthetics of form and function and to hint at a changing paradigm that emphasises the foot's strength instead of its previously ill-defined weakness.

Impressed by the architecture of this perfectly designed 'bridge' attached to our body, I draw inspiration from architectural material in my current practice and have incorporated this interest into the present work.

EMILY HILL

Over the past 30 years, the human foot has been considered to be in need of support and control with respect to both children and adults. However, in the light of the development of modern man over millions of years, the anatomy and biomechanics of the foot can be considered well adapted and sufficiently strong to absorb normal forces during daily activity. The mobility of the foot allows us to adapt to the surface we are walking on while providing sensory input to the brain. If we allow the foot to function fully, it provides us with a strong and stable base of support. Our current research explores age-related changes in the barefoot human footprint.

A few months ago we had the opportunity to visit an exhibition of Leonardo da Vinci's creations and inventions. A statement by him was highlighted on a wall at the show: "The human foot is a masterpiece of engineering and a work of art." Despite all the technology, resources and knowledge we now have, we are returning to what da Vinci knew about 500 years ago.

GISELA SOLE

CHRIS SOLE

Emily Hill's artwork is architecturally themed, reflecting her interest in multi-disciplinary approaches to painting and printmaking. She studied painting at the Ilam School of Fine Arts at the University of Canterbury until 2012 and has since been experimenting with textiles and wood and combining printmaking techniques with her painting practice. Emily's work is influenced by Art Nouveau, Bauhaus and Russian Constructivism and she takes an ongoing delight in abstraction. She is currently painting on canvases, printing on timber and exploring ways of combining two modes of representation.

Chris and Gisela Sole are both physiotherapists. After graduating from the University of Stellenbosch, South Africa, Gisela Sole worked in hospitals and private practices for a number of years. She returned to university to complete a postgraduate Honours degree in exercise science in Cape Town, where she was offered a lecturing post in the Department of Physiotherapy. The family moved to Dunedin in 2001 after she accepted a position as a lecturer at the University of Otago in musculoskeletal and sports physiotherapy. She completed a PhD in 2008, and her current research explores outcomes of knee injuries and risk for post-traumatic osteoarthritis.

Chris Sole worked as a high school mathematics teacher for a number of years, in addition to being an elite middle-distance runner and coach. He retrained as a physiotherapist at the University of Cape Town. With the relocation of the family to Dunedin, he established his own physiotherapy practice and completed a PhD at the University of Otago in 2012, investigating the effects of footwear changes on postural stability and performance.

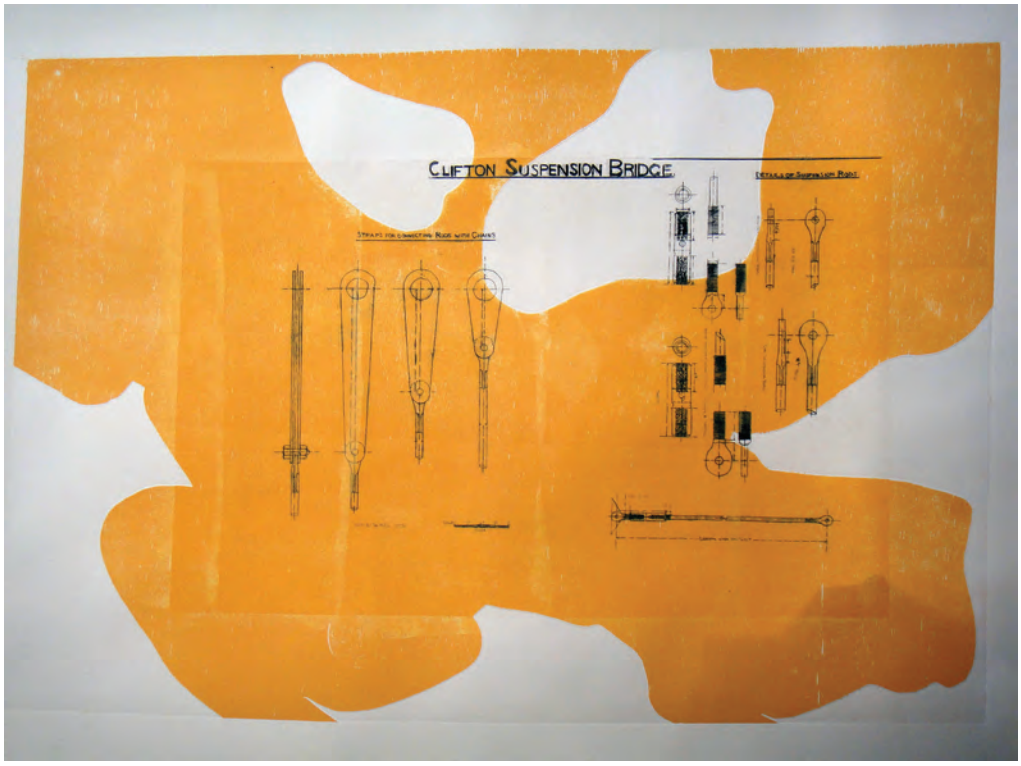

Figure 1. Emily Grace Hill, *Clifton Suspension Bridge* (2014), print.

MAN SAYING 'AHH'

Marcus Collinge and the Anatomy Department

In my role as an anatomy technician in the Otago University Anatomy Department I have the good fortune to spend my working hours fully immersed in the finer points of anatomical preservation and presentation. Facial reconstruction is normally associated with the forensic arts, missing persons and identifying the unnamed, usually pragmatically presented with a placid forward gaze.

During the past four months, I have been working on a facial reconstruction project for the Otago Museum, and consequently have chosen this as a sculptural topic, but with a small twist. I have taken my lead from the works of the eighteenth-century Austrian sculptor Franz Xaver Messerschmidt, exploring the idea of how muscle plays across bone in our everyday facial expression, whether under tension, stress or through deliberate contortion.

MARCUS COLLINGE

Marcus Collinge works in the Anatomy Department at the University of Otago. Marcus began his working life as a carpenter, ran a vegetarian cafe and worked in print before heading to art school in Christchurch in the early 1990s. Concentrating on human anatomy, he majored in printmaking and sculpture. As a practising artist, he sold his work to design stores and through galleries in New Zealand, Australia and the UK. He studied digital multimedia at AUT, but preferred working with atoms rather than bytes. Marcus joined the Otago University Anatomy Department in 2012 as an anatomy technician where he works as a museum preparator, potter of wet specimens, skeletonisor, plastinator, and renderer of anatomical models and research prototypes. He now enjoys calling Dunedin home.

Figure 1. Marcus Collinge, *Man saying "Ahh"* (2014) 400x300x175 (life size).

UNTITLED

Lynnette Taylor and Ruth Napper

It has been a pleasure to participate in the Art and Anatomy Project, which has been an opportunity to share ideas and resources with the scientists and the other artists who have taken part. Ruth Napper generously provided both her time and the raw materials relating to her research work that enabled me to experiment with ideas, techniques and visual effects.

The main challenge for me has been in translating elements of the organic cellular structures of the brain into an organised network of nonrepresentational geometric patterns. Patterns appear in many forms of material culture and are generally thought to function as decorative embellishments. However, non-representational patterns not only decorate, but may also act as visual voices that metaphorically carry particular information about cultural relationships.

The lozenge motif that I have used is based on the specimen support grid holders that house the resin-encased tissue samples which are a vital part of Ruth's research. My purpose in using the single motif in a repeated, overall pattern is to represent the seemingly limitless combinations in the cell structure of the human brain and the ability of brain cells and neural pathways, of brain cells and neural pathways to reorganise and realign in order to maintain functionality when certain types of damage occurs.

LYNNETTE TAYLOR

I was introduced to the use of electron microscopy when I undertook my PhD studies, and in recent years I have returned to this technique to investigate the changes that occur in the neurons of the fetal brain after being exposed to alcohol during development.

My laboratory aims to understand the long-term damage that can result following exposure of the fetal brain to alcohol. We have found that even a single binge-like exposure to ethanol can kill neurons in many different regions of the fetal brain. My group is studying the neurons in the hippocampus – a brain region important in memory and learning – which manage to survive an ethanol insult, to determine how these neurons change in an attempt to maintain normal brain function. We are particularly interested in how these neurons will age.

RUTH NAPPER

Lynnette Taylor is a Dunedin artist whose background in technical graphics strongly influences the content and style of her work. In 2008 she completed a Bachelor of Fine Arts at the Dunedin School of Art, followed by a Master of Fine Arts in 2010. She continues to experiment with materials and modes of production associated with her painting processes.

Ruth Napper, BSc(Hons), PhD (Otago), works in the Department of Anatomy at the University of Otago and is a researcher in the university's Brain Health Research Centre. She is investigating the role of binge-like exposure to alcohol during fetal development in acute and long-term changes in the structure and function of the brain.

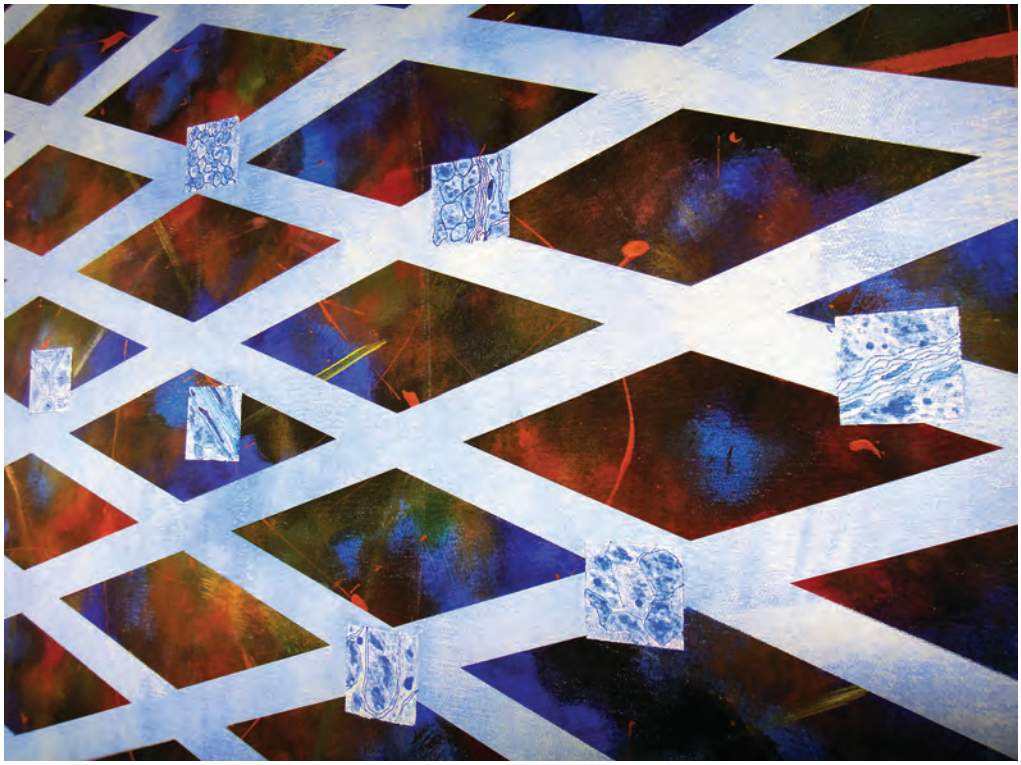

Figure 1. Lynnette Taylor, *untitled* (2014), detail, acrylic on canvas, 105 ×105 cm.

USE IT OR LOSE IT

Robbie McPhee and Stephanie Woodley

Nature dislikes a gap and will use what is at hand to restore the balance, good or bad. Daily movement is vital to the return of positive balance and to assure good health and longevity. In the case of hip pathology or osteoarthritis, when a gap is created due to muscle wasting caused by inactivity or damage, the body may use fat to fill the space. This is not a positive return to balance, potentially weakening the muscle and possibly heightening the chance of recurring injury.

In my piece, young, fit and active people dance across the hillside, while under them a timeline is fed by a system of human vessels, suggesting the link between movement, health and longevity. Older individuals exercise near a landscape composed of fat and graphs that measure the improvement in their physical condition. Still water sits between the timeline and the landscape of graphs and fat, implying a bridge of fitness and movement to strengthen muscles, prevent loss of mobility and improve lifestyle.

ROBBIE MCPHEE

Hip pain is a common condition that affects the health and wellbeing of New Zealanders. It may develop as a result of underlying problems such as osteoarthritis, which affects the hip joint and surrounding soft tissues. The gluteal (buttock) muscles have been a focus of research due to their important role in stabilising the hip and pelvis, particularly during everyday activities such as standing and walking. Assessment of muscle anatomy is possible using magnetic resonance imaging (MRI), a technique that enables calculation of volume and cross-sectional area, both of which are important in determining how much force a muscle is able to produce.

Gluteal muscle atrophy (wasting) or a decrease in muscle mass normally occurs with ageing. However, these changes are also evident in individuals with longstanding hip pain, and in many cases areas of atrophied muscle are replaced with fat. The mechanisms that lead to these changes are not well understood. It is also interesting to consider how the anatomy and function of these muscles may change in response to a programme of specific strengthening exercises in individuals with chronic hip pain.

STEPHANIE WOODLEY

Robbie McPhee is a graphic designer in the Department of Anatomy at the University of Otago.

Stephanie Woodley works in the Department of Anatomy at University of Otago, where her primary area of interest is musculoskeletal anatomy, particularly of the hip and pelvic regions. Stephanie has a professional background in physiotherapy, and endeavours to produce applied research that is relevant to clinical practice. Alongside traditional anatomical methods (including dissection and histology), Stephanie seeks to incorporate clinical studies and modern imaging techniques, such as magnetic resonance imaging and ultrasound, into her research wherever possible. In addition to her research focus, Stephanie teaches in the university's undergraduate and postgraduate physiotherapy programmes, as well as science courses.

Figure 1. Robbie McPhee, *Use it or Lose it* (2014), acrylic on canvas, 795 x 590 mm.

ANATOMY OF THE HEART

Robyn Bardas and Greg Jones

I chose my scientist on the basis of the title of his research project: "Anatomy of the Heart." As part of his teaching at the University of Otago and Dunedin Hospital, Greg builds exquisite plastic casts of animal vascular systems. On his desk and sitting in a cabinet are intricate, delicate, plant-like red casts of the veins, arteries and capillaries of hearts, hands, a finger. It was obvious to me that his functional pedagogic tools could be transfigured into artworks in themselves.

My current research as an MFA candidate explores the concept of 'the Line' as horizontal element. The Line interpolates itself onto or within an existing image to examine multiple, simultaneous narratives, as well as subjectivity. The Line in this work implies horizon, alluding to internal and external states, the physical and spiritual, as well as referring to 'walking the line,' 'drawing the line,' scar, grief, barrier, connection, and the sublime. The casts themselves resemble careful line drawings and, sited within a medical framework, this work begs such questions as ethical lines, communication lines, cardiogram lines and the sanctity of the human body.

ROBYN BARDAS

Vascular corrosion casts are a useful way of demonstrating the blood supply to many organs of the body. Plastic resin is injected into blood vessels and allowed to set hard. The surrounding soft tissue is then dissolved away to reveal the vascular pathways. Here at Otago we use the technique in both teaching and research. The images are both visually appealing and simple to understand, and because of this they increase the level of engagement with the intended audience.

GREG JONES

A resident of Hawea Flat since 1996, **Robyn Bardas** is currently studying towards an MFA at the Dunedin School of Art. Originally from Melbourne, she gained a Bachelor Fine Art (Painting) from RMIT in 1989, and has regularly exhibited in painting, video, performance, theatre, photography and mixed media.

Greg Jones, Bsc, PhD (Otago), is a Research Associate Professor in the School of Medicine at the University of Otago. Dr Jones' research group has a broad range of interests in the field of vascular biology, including population genetics, cardiovascular disease biomarkers, and vascular connective tissue biology. The group's research has a strong clinical emphasis, particularly in the areas of aortic aneurysm, coronary and peripheral arterial disease and varicose veins.

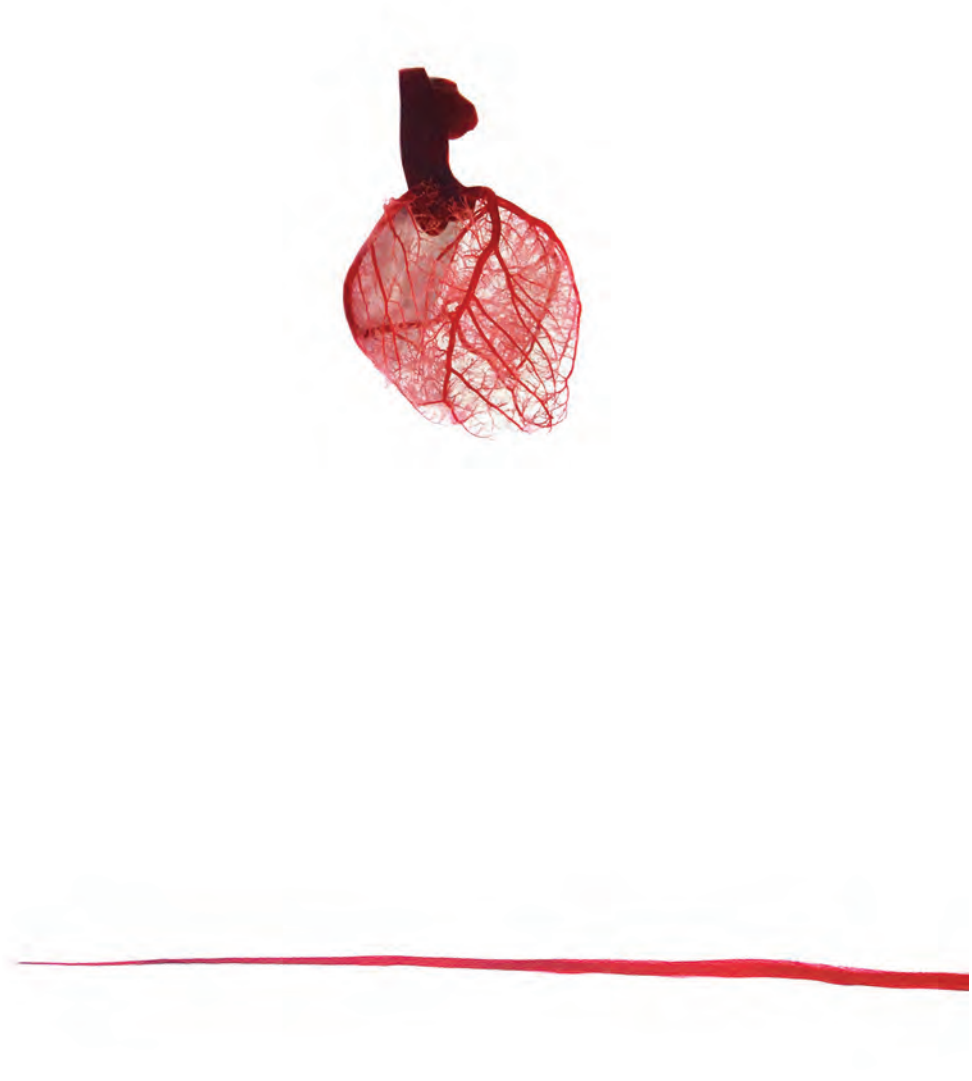

Figure 1. Robyn Bardas, *Anatomy of the Heart* (2014), inkjet print and acrylic on Epson Hot Press 300gm 100% cotton paper, 47 x 65 cm.

MEDIUS and *MINIMUS*

Claire Peters and Natasha Flack

Through my work I explore an inner world of questioning and expression regarding evolution, with a specific focus on genetics, the human body and its environments. Multiple layers of paint accumulate upon the canvas, leaving impressions of their photographic source. Autobiographical in nature, these motifs mix, weave and then evolve into new forms and layers that build up the visual image and become memories that recur while painting.

Collaborating with Natasha was a valuable experience, as she provided me not only with the medical imagery and cellular slides of the gluteus minimus and medius muscles to work from, but also with some useful discussion of the processes and results involved that stayed with me while I constructed the artwork. I was particularly interested that part of her research was still in the initial stages of investigation, with outcomes unknown. I decided to review my own art-making techniques in the light of this, and responded by experimenting with imagery inspired by Natasha's work, combining collage and acrylic paint on canvas.

The two images reproduced here form a diptych.

CLAIRE PETERS

My PhD focused on the anatomy of three muscles on the outside of the hip: the gluteus medius, gluteus minimus and tensor fascia lata. Muscle volume, length, nerve supply and attachment sites were examined through cadaveric dissection and magnetic resonance imaging. At a cellular level, the different types of muscle cells were stained using a method called immuno-histochemistry, and ratios for the whole muscle were estimated, giving an indication of these muscles' functional capabilities and adding another dimension to the story.

Because I am commonly asked "But don't we know everything about the muscles of the human body already?" I was excited to work with Claire Peters and learn her thoughts. Claire was particularly interested in the fact that existing data are deficient and, although my work constitutes the most comprehensive anatomical investigation to date, there is more to discover.

NATASHA FLACK

Claire Peters lives in Dunedin, New Zealand, and graduated with a BFA from the Dunedin School of Art in 2012.

Natasha Flack is a Postdoctoral Fellow in the Department of Anatomy, University of Otago. Natasha works with Professor Helen Nicholson, whose research area is clinical anatomy and medical education.

Figure 1. Claire Peters, *Medius* (2014), mixed media on canvas, 61 x 61 cm.

Figure 2. Claire Peters, *Minimus* (2014), mixed media on canvas, 61 x 61 cm.

BUS STOP and *EFTPOS*

Simone Montgomery and Ruth Napper

The tactility and the interactive capacity of a piece of art to impart a message is important to me. I find that the repurposing of an everyday object – for example, a beanie – can impress on a viewer a new perspective. This work explores the association of hats and humour to impart a serious message.

In particular, this piece embodies my interest in the effect of alcohol on the developing adolescent brain: alcohol alters the function of the chemical transmitters in neurons and this can cause irreversible damage. This work is interactive. You are welcome to put it on and try to complete some everyday activities.

Enjoy.

SIMONE MONTGOMERY

One of my research interests is the effect of the alcohol on the adolescent brain. The brain is undergoing continual growth and remodelling during adolescence, from around age 11 to 25. This involves a reduction in the grey matter that contains the nerve cell bodies and the stabilization of the connections between nerve cells. The Dunedin Multidisciplinary Study has shown that alcohol and drug consumption prior to the age of 15 significantly increases the chance of negative life outcomes in the mid-thirties. My laboratory has developed an animal model to study the cellular changes that occur with repeated binge exposure to alcohol during adolescence in the hope of understanding the long-term brain changes that occur as a result of adolescent alcohol exposure.

RUTH NAPPER

Simone Montgomery (Waitaha, Ngati Mamoe and Kai Tahu) has an MFA from the Dunedin School of Art and recently won the Award of Excellence at the Hokonui Fashion Awards. She says: "As a maker, textiles really excite me; in thinking about a body of work, I am challenging my and others' perceptions about experience. I am aiming to engage the viewer in a story. I am very interested in using mundane textiles in unusual ways. Sustainable art practice is very important to me."

Ruth Napper, BSc(Hons), PhD (Otago), works in the Department of Anatomy at the University of Otago and is a researcher in the university's Brain Health Research Centre. She is investigating the role of binge-like exposure to alcohol during fetal development in acute and long-term changes in the structure and function of the brain.

Figure 1 and 2. Simone Montgomery, *Bus Stop* and *EFTPOS* (2014).

Figure 3. Installation view of work by Simone Montgommery during Art and Anatomy exhibition, 2013. Photo by David Green.

SHADOW

Rowan Holt and Joanna Montgomery

In this piece, I have used the impermeable material of damp-course strapping to signify the meshing mass that occurs when the protein fragments responsible for Alzheimer's disease combine. Creating this form on a large scale is intended to magnify the importance of the research that Joanna Williams and her team are doing. Making the work in a towering form also reminds us how all of us might live beneath the shadow of Alzheimer's.

ROWAN HOLT

Alzheimer's disease currently afflicts more than 50,000 New Zealanders and this number is set to triple by 2050. Aggregation of a small protein fragment, amyloid-beta, drives the underlying pathological changes. The structure of this molecule changes from largely alpha-helical to being rich in cross-beta sheets in the extracellular aggregates, which are the postmortem hallmarks of Alzheimer's disease. This process occurs years before the characteristic symptoms of memory loss occur. My research aims to identify blood-borne markers that are surrogates of the pathological changes in the brain. This will allow new and existing therapies to be given in the early tractable stages of the disease, providing hope to those diagnosed with Alzheimer's disease.

JOANNA MONTGOMERY

Rowan Holt is a textile artist who lives in Karitane, near Dunedin. She incorporates her art practice into daily life while juggling a young family and a career as a registered art teacher. These domestic themes form a common thread in her work. She also enjoys gardening, horse-riding and playing the violin. Rowan holds an MFA from the Dunedin School of Art.

Associate Professor **Joanna Montgomery** completed her PhD in physiology at the University of Otago. She then performed her postdoctoral research at Stanford University, where her research focus was the plasticity of synapses in the hippocampus. She returned to New Zealand in 2004 where she is principal investigator in the Synaptic Function Research Group in the Department of Physiology and Centre for Brain Research at the University of Auckland. Her research team focusses on understanding the molecular mechanisms that underlie the physiology of excitatory synapses in the brain. Her laboratory combines electrophysiology, molecular biology and imaging techniques to investigate how changes in synapse function could underlie developmental disorders such as autism, and neurodegenerative disorders such as Huntington's disease and hearing changes.

Figure 1. Rowan Holt, *Shadow* (2014), plastic strapping.