

The Otago Medical School Anatomy Museum Collection: Taonga for learning in the 21st Century

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Alumni of The Otago Medical School, and many others, will remember their time in the W.D. Trotter Anatomy Museum. Its rich and diverse collection of now over 3,000 catalogued anatomy specimens and models for learning and research has been amassed by staff over nearly 140 years. Included are wax models by the Ziegler and Tramond studios, 77 authentic painted plaster models by the Leipzig firm of Steger,¹ clastique papier mâché models by Louis Auzoux's factory, as well as many in-house wet and plastinated specimens and models including fiberglass, wax and hand-carved wooden examples.² There are even replicas of classical statues by D Brucciani and Co. of London. The display is enhanced by being housed in an elegant, tall space with a mezzanine floor that borders three sides, and warm aesthetics with wooden framed glass cabinets, rimu stair railings and diffuse natural lighting. Yet this collection is vulnerable to attrition, because of space stress at an institution that has a squeeze on every square metre, and surety of ongoing funding required to maintain it. This vulnerability has been further heightened by the trend at some schools to replace, rather than augment, this type of learning with digital resources. In Britain alone, over the past 30 years, many medical schools have modernised their collections in favour of digital learning methods, and in the process have discarded the old 3D models.³ Therefore, retention of all resources in this

Anatomy Museum for active use in teaching has been against the international trend.

However, the retention of all models including those from the 19th and 20th century is now placing the Museum in an enviable position. Not only are many now appreciated for their artistic merit and irreplaceable value, they are being refocused on as powerful anatomy learning aids that complement and deepen learning experiences from other pedagogy, including digital methods.⁴⁻⁹ Indeed, Drake and Pawlina recently recommended to "remove those anatomical models from the glass cabinets. Take the plastic figures down from shelves, dust them off and teach the students to learn them well".⁴ Reasons why learning from 3D objects is so effective are corroborated by recent research on sensory input from touch and kinesthetics.¹⁰⁻¹²

Dr Louis Auzoux's large (scale 10:1) clastique papier mâché ear model is an iconic and endearing item of this museum's collection. A feature of Auzoux's human anatomy models is that they were designed to be pulled apart, imitating dissection of the organs and structures presented. The very nature of their design therefore means heavy use and handling over an extended period of time. This particular ear model was introduced to the W.D. Trotter museum in the 1880s, and has been continuously used for hands-on teaching ever since (Figure 1).

Figure 1: Professor George Dias showing pathway of 7th cervical nerve to a student.



This ear model continues to be in high demand as its clastic design means pieces can be removed to see deeper structures, the anatomical structures themselves are very detailed, and all can be clearly viewed because of its large scale. Professor George Dias (Head and Neck Lecturer, Otago Medical School) particularly appreciates it when teaching postgraduate surgical and ophthalmology students. He says he always feels guilty handling such a delicate museum piece, but no other images or diagrams from textbooks or digital media quite show the structures he likes to focus on with such clarity and intricate detail. In fact, he says this particular model is the only one he has come across which so clearly demonstrates the branches and pathways of the facial nerves “As a student I struggled to

follow and understand the pathways of the intracranial nerves. It wasn’t until I arrived in the Department in 1995 and laid eyes and hands on this model that I truly understood the pathway of the 7th nerve. It is so beautifully demonstrated on this model” (Figure 2).

The following teaching explanation is by Professor George Dias:

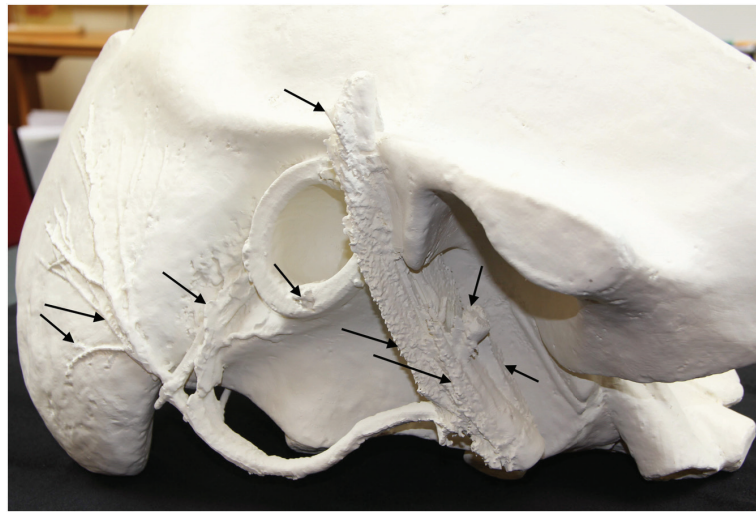
1. 7th nerve, with Nervous Intermedius adjacent, enters the external auditory meatus
2. 7th nerve courses through the facial canal in the petrous region of the facial bone. It is running above the vestibule of the inner ear
3. 7th nerve exits the stylomastoid foramen as a pure motor nerve, having shed all the Nervous Intermedius fibres.

Figure 2: Detail of pathway of 7th cervical nerve.



Dotted lines indicate borders between parts of the clastic model

Figure 3: Arrows indicate interference artefact from wire substructure of vessels in printed reproduction.



In 2015, conscious of the value of this model, Chris Smith (curator, Anatomy Museum) investigated ways of reproducing it to allow the retirement of the original, using the replica in its place for teaching. Reproducing this also afforded an opportunity to trial the potential of scanning and 3D printing for other Museum items (the Auzoux collection alone comprises of 15 pieces, from a 90-year purchase period from the 1880s to 1970s). CT scanning was chosen as the most appropriate approach given the complex 3D nature of the model, including many concave surfaces (undercuts). All eight parts of the clastic ear were CT scanned using a Siemens SOMATOM Emotion CT scanner. The DICOM digital images obtained were then converted to .stl files and printed

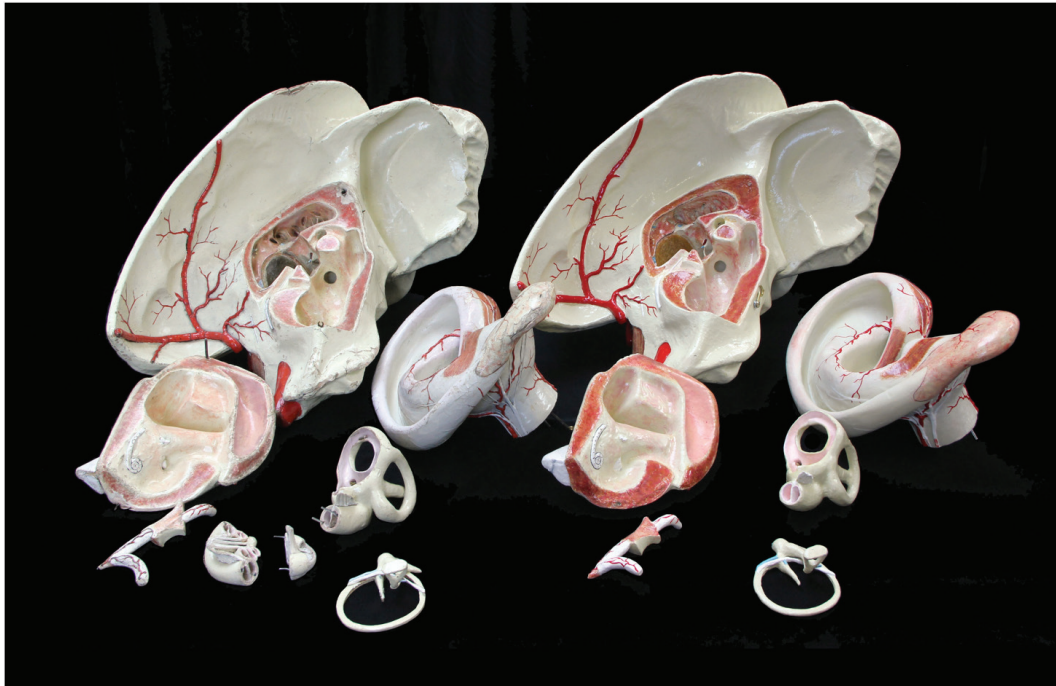
in 1:1 ratio using ABS plastic. The 3D print included internal hollow regions in the large parts, an advantage as their weight to hold was lightened to be approximately the same as the originals. However, what wasn't anticipated was significant surface shape distortion, due to 'noise', or interference, because metal wire within the internal structures interfered with radiation from the CT scanner (Figure 3). This was an unexpected outcome as it had been hoped that the firm outsourced to print the scan files would edit and 'clean up' the files before printing.

One of the structures, the cochlea presented as two parts, was so poorly reproduced that it could not be salvaged by hand sculpting (Figure 4).

Figure 4: Cochlea print (left) next to original cochlea (right).



Figure 5: Original (left) and copy (right) of Auzoux ear.



Dr Louisa Baillie, working as an anatomical scientific artist, salvaged and modified the remaining six structures to become as anatomically similar to the original pieces as possible. This was achieved in the Anatomy Museum workshop, using dentistry grinding burs, razor blades and sandpaper to subtract (carve back) and epoxy filler and Kneadite “green stuff” to add on. Finally, Dr Baillie

hand-sanded pieces to 400 grit smoothness, sprayed them with plastic adhesion promoter, and then intricately painted them using high gloss enamels colour matched to the original model (Figure 5).

She reproduced a tympanic membrane, similar in translucency to the original, using tissue paper, shellac, teased red cotton and a clear plastic spray (Figure 6).

Figure 6: Tympanic membrane, a translucent ochre colour, viewed from the middle ear.

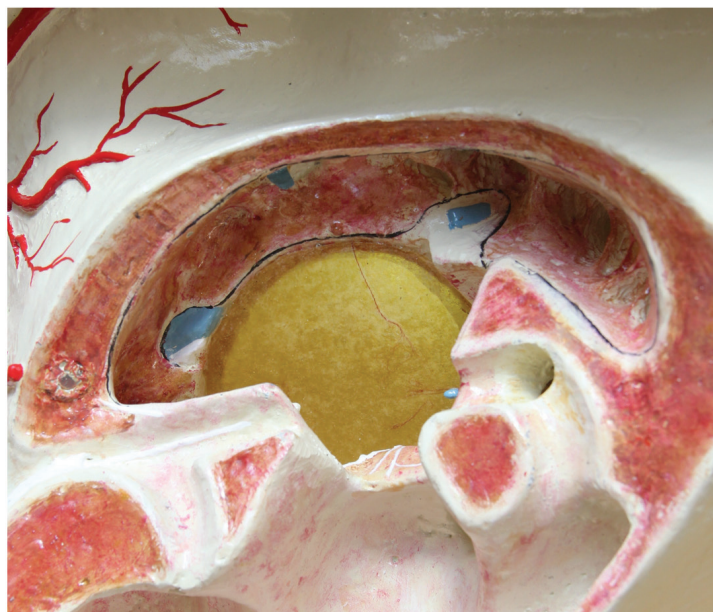
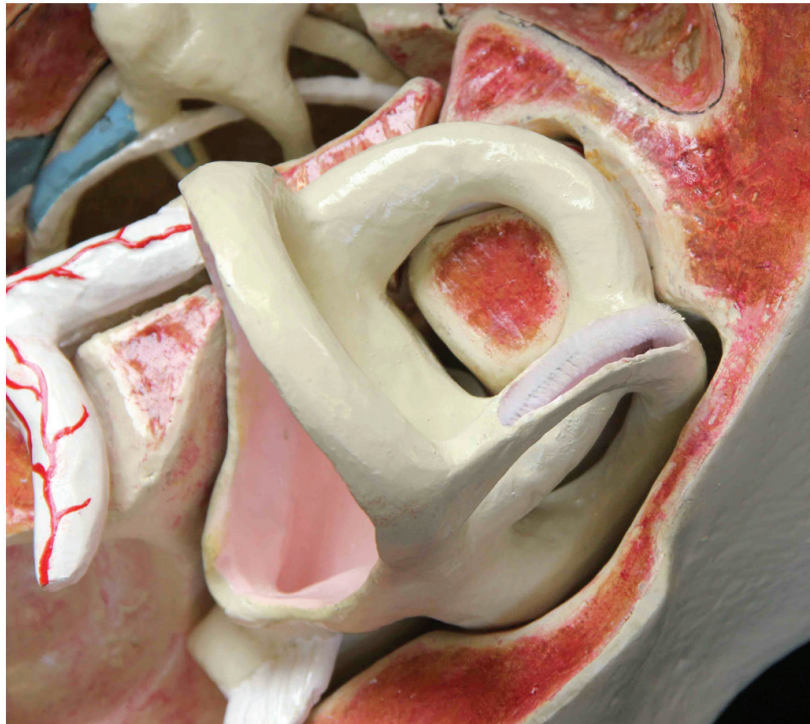


Figure 7: Cilia in the semi-circular canals represented by pipe cleaner.



Additionally, quirky details that showed creative problem solving by Dr Auzoux were also reproduced. These include pipe cleaner to describe the cilia hairs in the semi-circular canals (Figure 7), 0.22 rifle shells as shafts to receive long pins from the external ear part, and the long pins themselves are presented in the same material as the original—No. 8 wire.

While a lengthy and costly process, we hope that this project will provide us with

the expertise, knowledge and network of people to recreate further anatomical taonga in this collection, thus allowing their continued use in teaching. It may be that resources from our enormously popular museum, so carefully collected and cared for by past and present staff, can be reproduced and disseminated beyond in-house use, including back to some of the countries from where they originated, to aid the teaching of new generations of learners.

Competing interests:

Nil.

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