Anatomical Waxes in 18th Century Italy

Santo V. Nicosia, University of South Florida College of Medicine, Tampa, FL

Introduction

Since the antiquities wax has been regarded as prodigious material. Egyptians, Greeks, Etruscans and Romans used it to create religious and commemorative figurines. Plinius the Elder' Natural History treatise described the medical, cosmetic, industrial and religious properties of wax. In 14th century Italy, wax modeling was an established craft that produced large numbers of life-sized statues and votive limbs, organs or parts of organs for churches and the public. In the 15th and 16th centuries, Leonardo da Vinci and Michelangelo Buonarroti began to experiment with the flesh-like properties of wax and created three-dimensional and life-like representations of the human body.

Waxes as Didactic Tools in Medicine

The earliest surviving anatomical wax model specifically produced for medical didactic purposes is the "Anatomical Head" created toward the end of the 17th century by the Sicilian Gaetano Giuliano Zumbo (1656-1701) who worked for Florentine Cosimo III de' Medici and attended what was to become the first school of wax modeling or "*ceroplastica*" at the Institute of Sciences of the University of Bologna (1). This school was founded in 1711 by Luigi Ferdinando Marsigli under the auspices Pope Benedict XIV and was active for over 150 years (2-3). A second and equally eminent school, active for almost a century, was later founded in 1771 by Felice Fontana (1730-1805) at the Florentine Museum of Physics and Natural History, later called "La Specola", under the auspices of the Grand Duke of Tuscany Peter Leopold of Habsburg-Lotharingen whose love for the sciences was inherited by his grandson Leopold II nicknamed "*canapone*" (from *canapa* or hemp) by the locals for his white hair (4). La Specola was the first museum of its kind to admit general public albeit at separate hours for "cleanly clothed" lower class people and "intelligent and well-educated" higher class individuals (4). Its collections included 19 full anatomical male and female wax figures, over 1,400 wax models of human organs and body parts, comparative anatomy and zoological specimens. The greatest Italian wax modelers ("*ceraioli*") worked at these two schools including Ercole Lelli (1702-1766), Giovanni Manzolini (1700-1755) and his wife Anna Morandi (1716-1774), Felice Fontana (1730-1805), Clemente Susini (1757-1814), Giuseppe Astorri (1785-1852), Cesare Bettini (1801-1855), and Luigi Calamai (1800-1851). These and other modelers produced artistic and accurate models that would obviate the need to exhume corpses for medical education and surgical training at several European universities.

Technique of Anatomical Wax Modeling

Little is left of the armamentarium utilized by the Italian wax modelers. The Specola's archives maintain documents that registered the purchase of copper containers to melt wax, modeling tools including iron filaments, marble slabs to flatten the wax, balances, stove tripods, blackboard slabs to sketch and annotate anatomical parts during the autopsy, baskets with handles for transportation of cadavers, wooden boxes to transfer waxes, glass and clay vases to store pigments and other substances that were to be added to the wax (4-5). Because of the lack of effective preservatives, an average of two hundred cadavers was required to make preparations that captured the anatomical details needed to create a full anatomical wax figure! There was a close collaboration between anatomists, who performed careful dissections

following the drawings of anatomical treatises, and the modelers who then produced the waxes. The technique for creating wax specimens probably varied from modeler to modeler but specific details are sketchy due to the secretiveness of the trade. Zumbo's Anatomical Head was gruesomely modeled directly on the decapitated head of an executed citizen from Genoa while later modelers made first a copy of body parts using inexpensive wax or clay. A plaster cast was then created that could be utilized as a template more than once. The definitive wax was the white Smyrna or Venice wax mixed with Chinese or plant waxes, mastic, tallow, turpentine, and fats to increase the melting point and elasticity. Once melted, the wax was mixed with finely ground and pre-filtered pigments of body part-specific color previously dissolved in turpentine. Various layers of wax were then stepwise poured into the plaster cast previously moistened with warm water and soft soap to facilitate the detachment of the cured wax. Smaller models made entirely of wax were built around an inner cavity filled with plaster or clot while larger specimens, such as full figure models and their parts, were built around an inner metal or wooden armory. Using fine brushes or silk threads and freshly prepared waxes of various colors, specialized teams would then create blood vessels, lymphatics, nerves, tendons, fasciae or other needed refinements. Models were finally covered with transparent varnish. Alterations and restorations were done when anatomical reproductions were deemed inaccurate or deteriorated.

Wax Modeling in Bologna

Why anatomical waxes? The answer may be found in a document by Marsigli entitled "Parallels between the University of Bologna and Institutions Abroad" that advocated a drastic revision of the methods to teach anatomy introduced over four centuries earlier by Mondino da Liuzzi (2). However, cadavers were scarce and dissected body parts or organs could not always be well preserved, even with the dry preparations suggested by Valsalva (1666-1723). These preparations did not always faithfully reproduce morphological reality and spatial relationships. Thus, the need to explore other pedagogic modalities lead to the development of anatomical models precisely reproducing the findings in dissected cadavers and made of wax, a long lasting and easy to mold medium. As indicated by Fontana, wax models were meant not just to represent but also to replace anatomical parts and avoid physicians "soiling their own hands". The wax of a horseshoe kidney modeled on a specimen discovered at a "public dissection" was the first demonstration project in 1705 that displayed the artistic and anatomical talents of Lelli in Bologna. As this city was part of the Papal State, Pope Benedict XIV commissioned Lelli the creation of a "wax school of anatomy" and the replacement of all dry specimens in Bologna's Institute of Sciences with wax models, at a cost of 17,000 liras. Lelli took up this charge with enthusiasm by creating a series of eight statues beginning with two intact statues ("Adams and Eve") and continuing with statues deprived of skin integument (so-called "*scorticati*" or skinned) depicting muscular layers of various depth and skeletons with movable parts. Lelli was nominated *motu proprio* by Benedict XIV as keeper and illustrator of the Institute's "Room of Anatomy" for which he even designed elegant wooden cabinets to house the anatomical models.

Anna Morandi was the professional heir to Ettore Lelli and together with her husband Giovanni Manzolini distinguished herself in Italy and Europe as the creator of a rich series of thirty tables with wax models representing the organs of sense, and other work displaying the urogenital apparatus, the cardiovascular system and obstetric anatomy. In 1758, three years after the death of her husband, she was nominated official modeler for the Chair of Anatomy by the Bologna Senate at an annual stipend of 300 liras with a lifetime supplemental stipend derived from

University taxes and was also given the choice to teach either at the University or at home. She received invitations to speak at several European universities and the Royal Society of London and to meet with the Russian Empress Catherine II. Upon her death in 1774, Luigi Galvani referred to "*that extraordinary Lady who set the example for our and foreign men in moulding with equal skillfulness even the most tenuous…the thinnest…and most diaphanous parts, those that would almost escape from the sight…"* (3). Her entire collection of wax models, including wax tables commissioned by Professor Giovanni Antonio Galli (1708-1782) for his domestic school of obstetrics, was purchased by the Academy of Sciences for 3,000 shields (3). Among other modelers in Bologna, one must mention Giuseppe Astorri and Cesare Bettini who produced excellent anatomical and pathological waxes, Giovan Battista Manfredini (1742-1829) who produced several wax models of "internal organs, vessels and nerves in natural size", and Pietro Sandri (1789) who created a wax statue with removable elements to demonstrate the second and third trimesters of pregnancy.

Clemente Susini and the Florentine School

The Italian collection was later enriched by the contributions of other anatomic wax modelers at Florence's La Specola such as Felice Fontana, Luigi Calamai and Clemente Susini whose collective works were admired among others by Goethe, Stendhal and even the Marquis De Sade. Susini produced there an Anatomical Venus, the so-called "*Venerina*", and other waxworks including the lymphatic system and the "organ of hearing and balance". Susini's fame was sealed through the commission by the Austrian Emperor Joseph II, Peter Leopold's brother, for a complete collection of anatomical wax models in Vienna. At the agreed cost of over 30,000 florins, work begun at the house of Felice Fontana resulting in the production of more than 800 specimens delivered in 1786 to the Josephinum's Museum in Vienna after a perilous voyage by mules over the Italian Alps (4). Susini produced over 2,000 models and, through an extensive use of prototype molds, several copies of the same model. For instance, Bologna's "*Venerina*" is reclining and modeled onto a natural skeleton while the Florentine's "*Venerina*" is reinforced by iron support. Both models come apart layer by layer to reveal both breasts, the rib cage, successive layers of muscles, heart and lungs, the intestines and other major organs to finally demonstrate a pregnant uterus. Susini's anatomical waxes extended the artistic beauty of Italian waxes while attempting to maintain anatomical reality as he adopted a hedonistic and sensual approach in tune with the Romantic tendency of his time. His dual passion for art and science was reflected by overlapping activities at La Specola and the Fine Arts Academy in Florence where he taught nude drawing.

Pathological Waxes in Bologna and Florence

The development of pathological waxes was a logical outcome of the pedagogic success of their anatomical counterparts. Even with the basic contributions of Morgagni (1682-1771), pathology did not exist as a specific branch of medicine before the 19th century and consequently pathological and anatomical demonstrations, including wax models, shared same professors and institutes. In 1840, this situation changed with the creation of the first Italian Institute of Anatomic Pathology in Florence where several pathological waxes housed since 1824 at the Academy Museum and Santa Maria Nuova Hospital, were transferred (6). Here and at the Bologna's Institute of Anatomic Pathology chaired by the teratologist Cesare Taruffi (1821-1902), collections of waxes were developed representing congenital abnormalities, infectious processes, dermatological disorders, cardiovascular diseases and neoplasms (6-7). Notable

among these waxes were the "man with scabies" (so-called "leper") and a congenital hydrocephalus by Luigi Calamai, a perforated septal aneurysm and a gangrenous bowel, a tibial osteomyelitis by Giuseppe Ricci, a pseudo-hermaphrodite and a *pygopagus* by Cesare Astorri as well as a tuberculous scrofula and a fibrinous pericarditis by Egisto Tortori. Illustrious visitors including Virchow, Meckel, Hodgkin and Dupuytren commented favorably on these collections, which even today could serve for gross demonstration, especially of rare entities, to medical students and pathology residents. Visiting the Taruffi museum in Bologna, Virchow was particularly impressed by the skeletal changes of one if its waxes, the so-called "Bottaro" by Pietro Sandi. Both Taruffi and Virchow failed to associate these changes with acromegaly as this entity would be recognized ten years later!

Conclusions

The contribution of Italian wax modelers to anatomy and pathology is undeniable and is a witness to the Italian genius and to a time when participation in gross demonstrations was a proven tool that effectively complemented lectures and book readings (8). Building on the anatomical discoveries made in the age of scientific Enlightenment, wax models afforded medical students and surgeons comprehension of normal and aberrant processes with a physical immediacy not afforded by fixed organs and tissues as in addition to tridimensionality they offered the dimension of color, an essential element to successful gross diagnosis. Waxes also accomplished their intended purpose through a pleasing artistic rendition of reality even if fragile and unauthentic reproductions of the living. To paraphrase 18th Century Pope Benedict XIV, anatomy and pathology must be appreciated more "with the eyes than with the ears"!

Acknowledgments

I am indebted to Drs. Marta Poggesi and Gabriella Nesi who made my visits to La Specola and the University's Department of Pathology in Florence a very informative experience. I am equally thankful to Professor Alessandro Ruggeri for enthusiastic and encyclopedic assistance during a delightful visit to Bologna's Poggi Museum and the University's Department of Anatomy.

References

1. DeCeglia P. The rotten, the disemboweled woman, the skinned man. JCOM 4:1-7, 2005.
2. Ruggeri A, Bertoli Barsotti AM. The birth of waxwork in Bologna. It J Anat Embryol 102:99-107, 1997.
3. Tega W. Palazzo Poggi Museum: Science and Art. Compositori ed., 2002, pp.58-79.
4. Poggesi M. The wax figure collection in La Specola in Florence. In: Encyclopedia Anatomica. Taschen, Köln, 1999, pp.6-28.
5. Azzaroli ML. La Specola. Olschki ed., 1975, pp. 5-31.
6. Scarani P. Museo di Anatomia Patologica "Cesare Taruffi". In: I Luoghi del Conoscere: I Laboratory Storici e I Musei del'Universitá di Bologna. Banca del Monte ed., 1999, pp. 195-201.
7. Le Cere del Museo dell'Istituto Fiorentino di Anatomia Patologica. Arnaud ed., pp. 9-17.
8. Brandon AS. Artful Italy: The Hidden Treasures. Invisible Cities Press. 2002, pp.134-145.