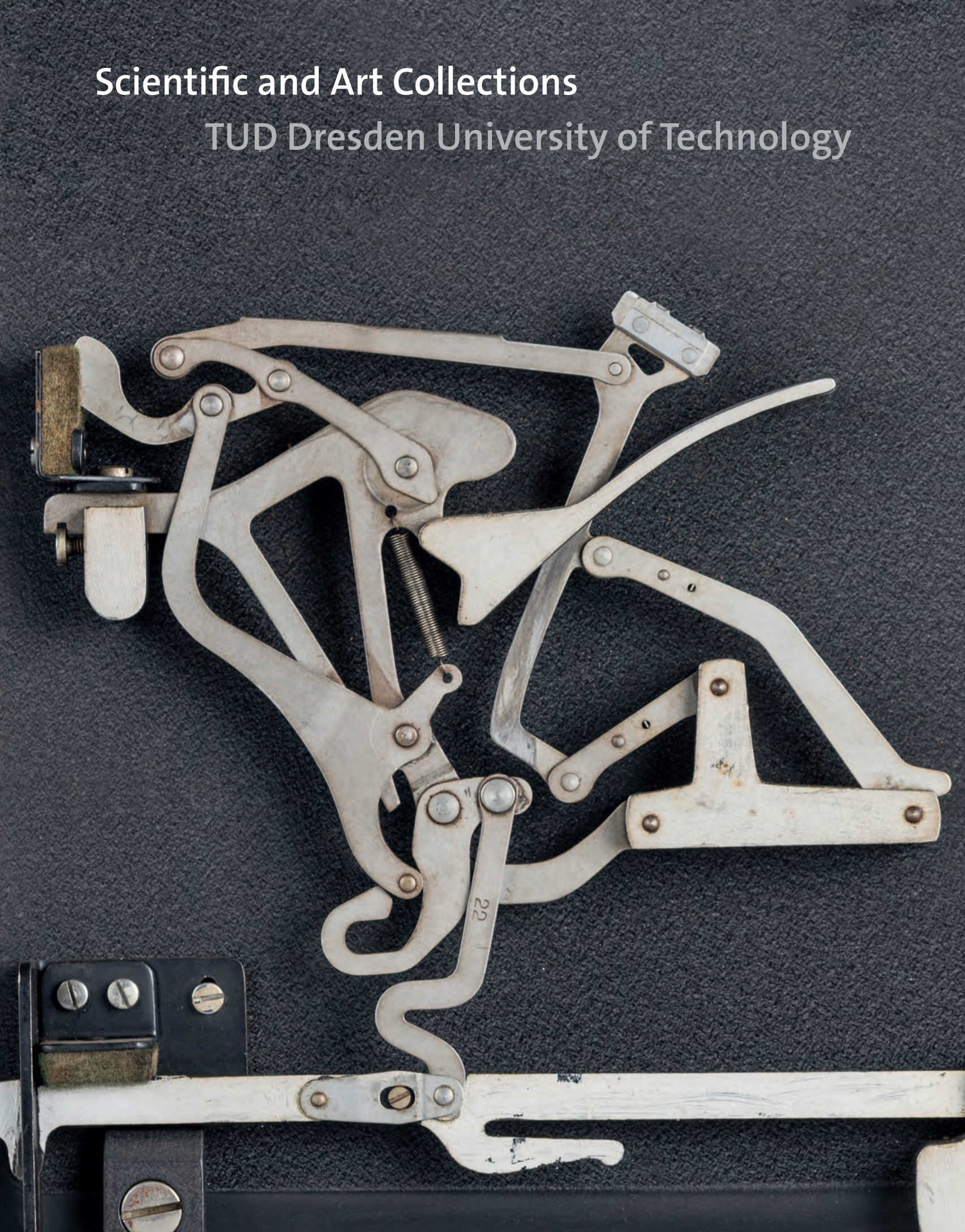
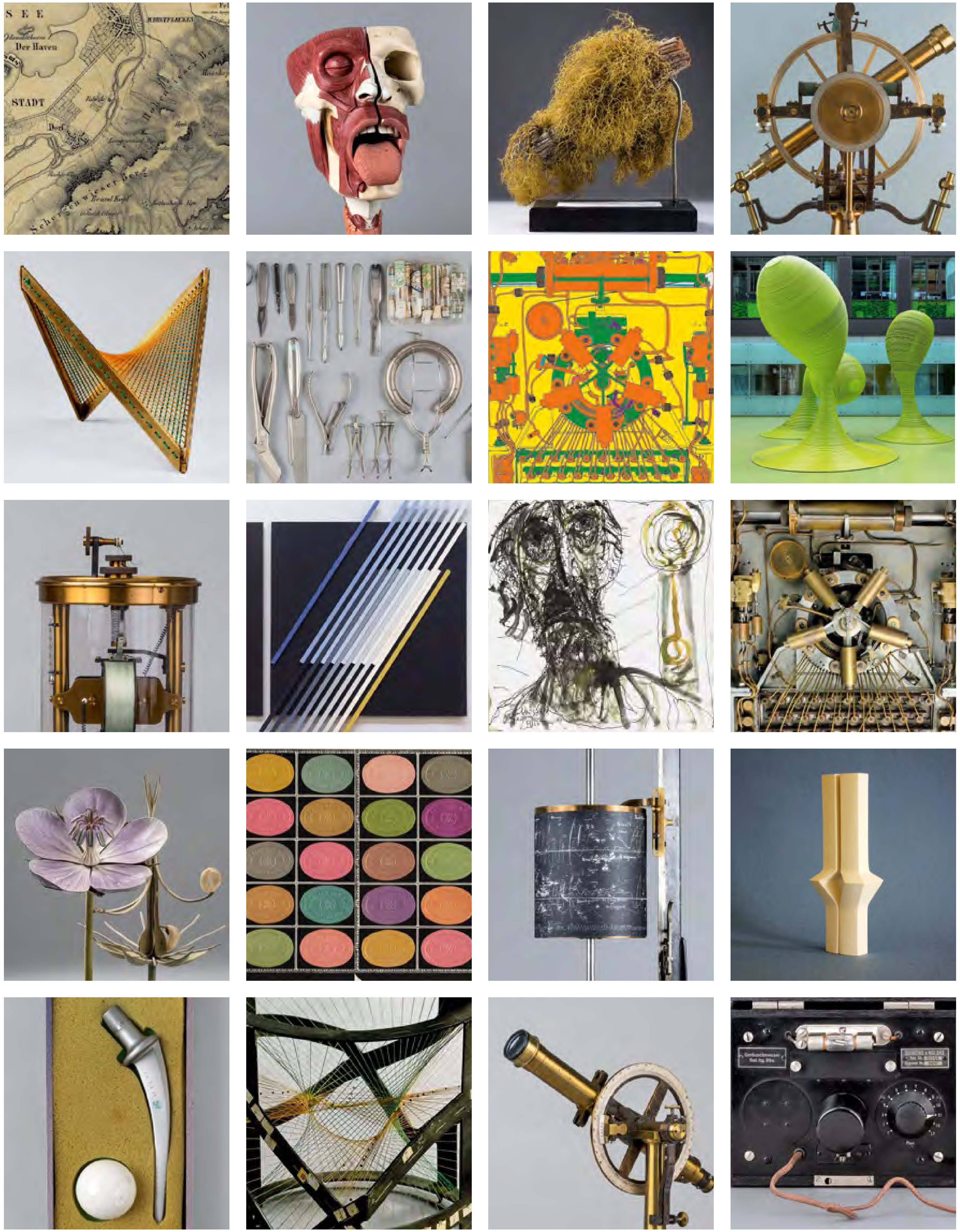
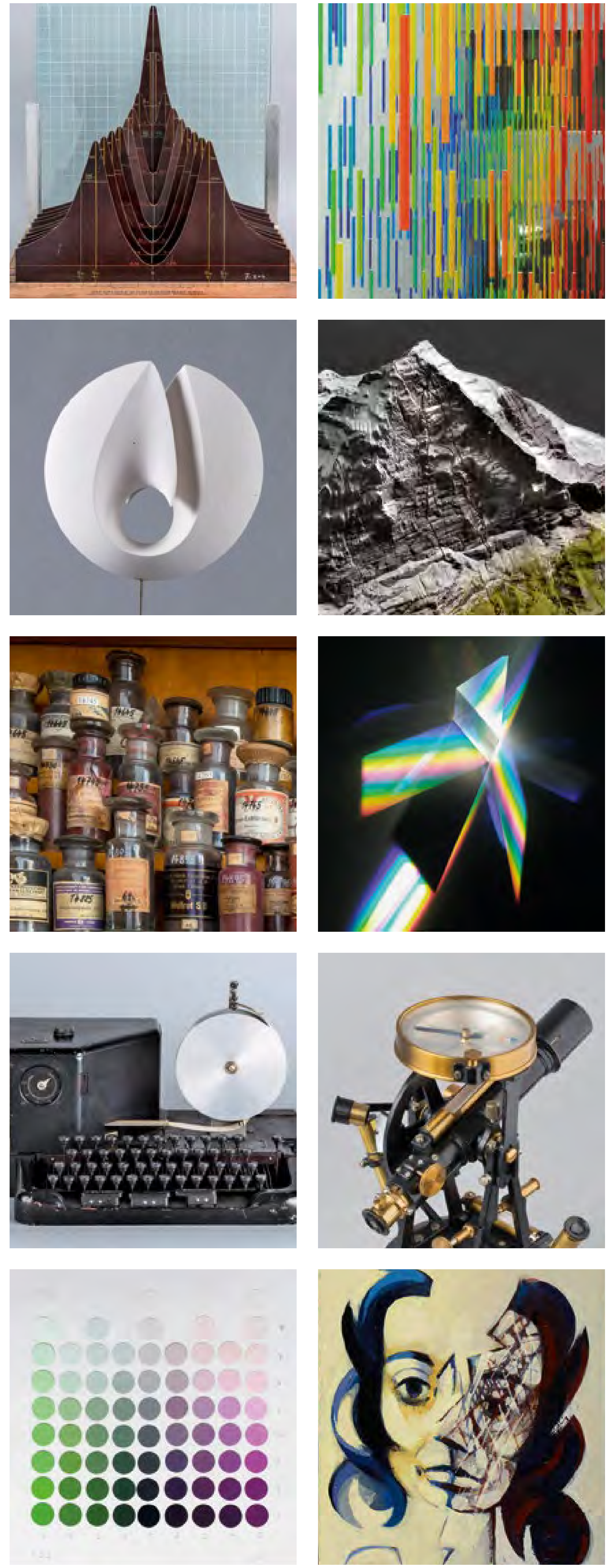
Scientific and Art Collections

TUD Dresden University of Technology







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TUD Dresden University of Technology

Content

Preface

How can we hope to understand a world that has become increasingly digital and global and its material organization has become more and more complex? What challenges arise from rapid technological developments? How can we explain our present, while also reflecting on the future? And what is the role of arts, sciences and engineering in global processes of transformation? As a university, TUD Dresden University of Technology aims to provide answers by discussing, defining, investigating, and researching such issues.

Documenting an almost 200-year history of generating and teaching knowledge, TUD's extensive collections of objects from the natural sciences and engineering as well as its art collection bear testimony to who we are as a university. Exhibits from the early 19th century connect the history of scientific knowledge with current research. When objects of the past tell us a story that may give rise to novel research approaches, they even have an influence on future technologies: Thanks to methods of DNA sequencing, genetic changes in plants can now be reconstructed using historical herbarium specimens, whereas experimental equipment for speech synthesis that is decades old inspires new approaches for generating computer voices.

TUD's rich collections are of outstanding value and significance as starting points for multidisciplinary and interdisciplinary collaborations at both the international and local level between engineering, the natural sciences and the humanities. As objects of societal transfer, they serve as interfaces that convey and embed topics relevant to the future both within and beyond scientific communities.

Our Office for Academic Heritage, Scientific and Art Collections plays a central role in preserving the collections, making them accessible, analyzing them and ultimately integrating them into research and art projects. For the first time, by establishing a collection data base and a team of restorers, a permanent basis has been created for consolidating our academic culture of objects.

This volume was first published in 2015, and has now been revised and updated for the new edition. I would like to take this opportunity to express my sincere thanks to all those involved: The authors and Dr. Klaus Mauersberger, who was the project leader for the first edition, the team and leadership of the Office for Academic Heritage, Scientific and Art Collections for their editing and implementation, and the "Sandstein Verlag" for the professional design and production of the volume. My special thanks go to the Association of Friends and Sponsors of TUD (GFF), which once again provided the funding and has demonstrated particular commitment to our collections in recent years in the form of special sponsorship projects. In addition, I would like to thank all those who – mostly alongside their professional activities or on a voluntary basis in retirement – have dedicated themselves to caring for the diverse collections of TUD and making them accessible.

Professor Dr. Ursula M. Staudinger
Rector
TUD Dresden University of Technology

◀ Historical collection cabinet from the field of chemistry in the permanent exhibition of the Office for Academic Heritage (OAH), 2019

KIRSTEN VINCENZ

The collections of TUD Dresden University of Technology – tradition and new perspectives

As home to 40 collections of technical and scientific objects and to the artworks it owns, TUD Dresden University of Technology boasts a large and significant stock of historical and contemporary artefacts from teaching, research and art.

Objects in university collections differ from those in museums as a consequence of the specific nature of their origin, since they do not represent a past epoch that has now been concluded but are – as it were – in flux. They can undergo noticeable changes in meaning, either rapidly or gradually, changing their status within the university as the decades pass. Collections of scientific devices or models, such as those that have been created primarily at technical universities, usually were – and continue to be – purchased or produced for teaching or specific research purposes. These objects are utilized, used up, sometimes exchanged or renewed over the course of decades. They change during and due to the passage of time.

On the one hand, they are therefore – like the scientific contexts that gave rise to them – subject to a constant yet simultaneously discontinuous process of historization: Little by little, the objects emerge from their original contexts in research and teaching and become cultural assets of past research or teaching practice. In this way, they develop into a meaningful part of the academic tradition of the individual subjects as well as of the history of the respective university as a whole. Their potential significance both for future research in the history of science and for the indispensable self-reflection of disciplines or institutions can, however, scarcely be overestimated.

At the same time, scientific collections of objects from the past can provide surprising answers to pressing questions of current research, such as those regarding climate change, evolutionary theory, or biodiversity. In addition to the history-of-science perspective, natural history collections in particular hold specific, latent opportunities which only reveal themselves after sufficient time has passed. New analytical methods can be employed to examine objects such as historical herbaria, drill cores, or seafloor sediments, allowing us to read the information that they have stored for many decades or even millennia. For every university collection, this opens up new – and often unimagined – opportunities to contribute to current research.

"Collecting always precedes science; there is nothing odd about that; for collecting must be before science; but what is odd is that the urge to collect enters our minds when a science is intended to appear, even if we do not yet know what this science will contain."

Adalbert Stifter 1857

At universities, new collections arising from current contexts of research and teaching continue to be created alongside the historical inventories whose potential is being rediscovered. Nowadays, their materiality is shifting more and more into the digital space, raising entirely new questions regarding use, access, and preservation.

By implication, it is a common feature of all scientific collections that they are valuable material witnesses to the development of an academic discipline and are an essential part of scientific practice at the respective university. The heterogeneity of the objects in university collections paints a complex picture. Their status and, as a consequence, their significance for

View into the permanent exhibition of the OAH 2019

the university oscillates between their present and future relevance as objects of inquiry, their worth as historical artefacts, or even as antiquarian treasures. Increasingly, they are being discovered as influential agents of scientific communication. During the past decades, some universities have therefore concluded that objects in academic collections require special protection, care, and scientific processing.

The Office for Academic Heritage, Scientific and Art Collections at TUD – Past and Present

The Office for Academic Heritage, Scientific an Art Collections at TUD is one of the oldest institutions of its kind in Germany. In the context of the University's 150th anniversary celebrations in 1978, numerous objects once again became a focus of attention, primarily as physical witnesses to the University's history. As an immediate consequence, a central Office for Academic Heritage at TUD was established just a year later. Already at that point, a first stocktaking in a newly founded inventory began, containing, in particular, historically significant objects for teaching purposes. This stocktaking continued over the years and was always adapted to the scientific standards of the day.

The first "Regulations regarding the Museum Fund", which stipulate how to handle the assorted collections within the University, were issued in 1987. During the University's restructuring following reunification, the collections enjoyed a sharp increase in interest, particularly as regards their unique historical artefacts. In this context, the Office for Academic Heritage was initially affiliated with the Faculty of Arts, Humanities and Social Science. In 2004, due to its growing significance, it was upgraded to a central unit reporting directly to the University Chancellor. At the same time, the **ALTANA**Gallery in the Görges Building was integrated into the Office for Academic Heritage, followed a little later by the Art Collection, which until 2007 had been administered by an Artistic Advisory Board at the Faculty of Architecture.

A comprehensive collections policy, which recognized the particular value of the academic and cultural heritage for the University, ensuring its survival, came into force for the first time in the shape of the "Preservation of the Scientific and Technical Collections, the Art Collections and the Cultural Monuments of TUD" (Rundschreiben 1/2004). These regulations defined the Office for Academic Heritage's remit regarding guidance, advice and control as well as that of the "safeguarding institutions". This terminology reveals the principle of decentralized collections that is practiced at TUD: The collections remain the responsibility of the different chairs,institutes, faculties or even workshops. The actual institution is responsible for appointing a collection officer and communicating movement and change in the collections. The decision to keep collections with supposedly mere historical value in their original contexts has since repeatedly proven to be the right one, as it allows them to be "reactivated" and used in current research and teaching.

As with the precious works of art in its museums and its exceptional cultural monuments, collections in the Free State of Saxony are governed by the State's Heritage Protection Law. This means they are entitled to the protection of the state and the associated duty of preservation. The regulations concerning collections at TUD can therefore invoke the status of state heritage. Compared to other university collections in Germany, this constitutes a positive exception. The regulations for collections and the principles of collecting have created important fundamentals for an orderly collecting process at TUD, and still serve as an example for similar efforts. For the introduction of these structures that are still in existence today, thanks must go to Klaus Mauersberger, the Director of the Office for Academic Heritage from 1993 to 2015. He also shouldered the responsibility for the first edition of this volume and describes the historical development of the collections in this new edition.

New strategic orientation of the Office for Academic Heritage from 2016

The core tasks of the Office for Academic Heritage can be divided into three main areas: Preservation and use of the University collections, documentation and reflection regarding topics concerning the University and the history of its collections, as well as maintaining the pieces of art in University ownership and organizing exhibitions. Since 2016, under new leadership and a new team, it has been possible to plan and successfully implement a number of innovations for the University gallery and the art holdings, as well as in the area of collection maintenance.

A primary goal of the new strategic orientation was to make greater use of the collections of technical and scientific objects for today's research projects in teaching, and for new and cross-university projects conveying knowledge. It was also a priority to make them more visible inside the University and beyond, both throughout Germany and internationally. Back in 2011, the German Science and Humanities Council formulated its "Recommendations on Scientific Collections as Research Infrastructures" (German Science and Humanities Council 2011), creating a crucial basis for re-evaluating university collections and also as a result, for the orientation of the Dresden Office for Academic Heritage. Building on the existing structures, greater emphasis was given to previously unused potentials of the collections as bearers of meaning in scientific practice, as a material source of research, but also as an object of artistic examination.

"Scientific collections should be seen as essential research infrastructures whose preservation, upkeep and usability for research is not a dispensable ancillary service but a core task for the institutions which support them. The universities in particular need to embrace this view: even if universities are not museums, in their capacity as organisational centres of science and key sites for knowledge production and knowledge transfer, they are substantially dependent on collections as infrastructure."

German Science and Humanities Council 2011, p. 45

A prerequisite for documenting and taking stock of the objects in the collections was a modern database, which was introduced in 2019, replacing existing inventories. From the end of 2020, it was possible for the first time to implement urgently needed restoration measures and continuous monitoring of the inventory by hiring more staff for the Office for Academic Heritage. The development of a digital and conservational infrastructure will ensure the future preservation and usability of the collections.

The creation of the Office for Academic Heritage's new Scientific Advisory Board in 2015 constituted a far-reaching structural change. The foremost task of the Advisory Board is to

◀ **Forest Zoological Collection** (around 1860) in the main building of the Academy of Forestry in Tharandt

KLAUS MAUERSBERGER

The historical development of the collections at the TUD Dresden University of Technology

The guiding principles of polytechnic education, as developed at the École Polytechnique in Paris from 1794, aimed at practical application and democratization. Accordingly, great value was attached to the practical experience of technology. At that time, it was possible to acquire these primarily through drawing exercises, demonstrations and experiments, as well as through geometric methods. In order to synthesize new technical means, it was supremely important to be able to determine from a drawing those connections that were both constructive and related to manufacturing technology. Therefore, the educational goals at the emerging polytechnic schools involved training spatial powers of imagination, conveying design thinking and encouraging precision skills. Such precision and reproducibility were required by the developing mechanized production in factories.

Mechanical engineering was, then, paramount in engineering endeavors. The great demand for engines and work machines gave rise to a flood of original inventions for transforming movement and force, and also led to the publication of entire catalogs of elementary mechanisms. These basic ideas on construction, unsurpassable in their diversity and objectified as models, promoted the creative drafting of new variations and combinations when it came to training practical mechanics and mechanical engineers.

At the Technical School* in Dresden founded in 1828, models and other visual aids were also incorporated into teaching at an early stage, partly to make up for the lack of suitable textbooks. From the beginning, the pupils were trained in the practical handling of machines, instruments and tools. Instruction sometimes took place in workshops and factories, comparable to today's internships. During the founding years, the use of the Royal Model Chamber – the remaining stock of which later formed part of the Mathematisch-Physikalischer Salon, Dresden's collection of mathematical and scientific instruments in the Zwinger Building – was also subject to ministerial regulation.

The special technical collections, which were primarily established at the polytechnic schools, thus represent the process of scientification of technology and industry. In addition to raw materials, material and product samples, devices, measuring instruments and entire machines, the collections mainly contained presentation sheets and models. In addition to the drawn templates used for technical instruction, the exceptional didactic value of the models should be emphasized. One of the earliest collections in Dresden, the "Machine and Model Cabinet", was aimed at the training in mechanical engineering, whereby the mechanism and gear models can be attributed to the constructive branch of scientific mechanical engineering. The basic stock of today's Collection of Mechanism and Gear

* Since its foundation in 1828, the Technical School (Technische Bildungsanstalt) has undergone a series of name changes that reflect its constantly rising status and significance. In 1851, the Technical School (Technische Bildungsanstalt) became the Royal Polytechnic School (Königliche Polytechnische Schule). Since 1871 the name Polytechnic (Polytechnikum) was used, officially introduced as Royal Polytechnical College of Dresden (Königliches Polytechnicum zu Dresden) in 1878. In 1890, the College was given a university constitution and the name Royal Saxon Technical College (Kgl. Technische Hochschule Dresden/TH Dresden). Finally, the renaming to TUD Dresden University of Technology followed in 1961.

Gear model after Johann Andreas Schubert (1833)
In 1830, Johann Andreas Schubert took over the teaching of Constructive Geometry and Mechanics. According to his wishes, Johann Gottlieb Rehme, the model maker of the Royal Model Chamber, produced a series of models and thus laid the foundation of the Collection of Mechanism and Gear Models. The models no longer depicted entire machines, as had been customary until then, but only individual mechanisms. In this model, three variants for translating a circular motion into a linear motion are shown. (Photo: Franz Zadnicek, Dresden)

Tableau with gray cast iron parts (around 1870)
formed on an insert molding machine
Mechanical-Technological Collection

Models goes back to the early years of the educational institution and is linked to the name of Johann Andreas Schubert, who was probably the most universal of technical scholars in Saxony at that time.

From 1850, following the appointment of Julius Ambrosius Hülsse as Director of the Polytechnical School, the technology profile of mechanical engineering education became increasingly important. It is therefore not surprising that what are arguably the oldest technological material witnesses were gathered together in the Mechanical-Technological Collection. The collection, which was founded by Hülsse, underscores the great significance of the subject of mechanical technology as an intermediary for hands-on training. In order to demonstrate essential production areas and common processing procedures, this collection of teaching materials draws mainly on raw materials, semi-finished products, tools and finished products from the metal, wood and textile processing industries, which were often arranged systematically on educational charts and tableaus.

A specific collection of geodetic instruments was assembled by August Nagel and has been continuously expanded since 1852. Today, the Collection of Astronomic-Geodetic Instruments contains some 150 historically significant instruments. Among them is one of the most valuable museum objects owned by TUD Dresden University of Technology: the Repsold Universal Instrument dating back to 1863. It is a testament to Nagel's farsightedness, but also to that of the school authorities, that they acquired such an instrument in preparation for the triangulation and cartographic representation of the Kingdom of Saxony carried out between 1867 and 1878.

The roots of the collections of mathematical models, physical and chemical apparatuses, and of the mineralogical and geological collections also date back to the foundation phase of TUD. Parts of the latter collection are still used for teaching purposes today. The core of the Botanical Collection with its valuable herbaria (The Herbarium Dresdense – international abbreviation DR) was transferred from the Natural History Museum in the Zwinger to the

Polytechnical School in 1875. The Forestry Collections in Tharandt, on the other hand, house a wealth of instructive visual aids and reference materials, such as beetles, snails, butterflies, mosses, lichens, woods, forestry equipment and measuring instruments. However, the Academy of Forestry in Tharandt with its extensive collections was not affiliated to the Technical College until 1929.

Thanks to the prospering "young industries" and their proximity to science, the spectrum of collections grew noticeably at the end of the 19th century. The increasing scientific collaboration with renowned companies also contributed significantly to the expansion of the experimental basis and the collection-related visual aids. One of the collections created during this period was the Chemistry Department's Dye Collection. The comprehensive collection of dye samples documents impressively the worldwide development of dye chemistry and the dye industry. It is still used today to identify and compare dye samples. The electrotechnical collections also have their origins in these years. A particularly high-caliber collection is the "Historical Didactic Museum of Photography" (part of today's Hermann Krone Collection), established by Hermann Krone and donated to the Technical College on the occasion of his retirement in 1907. The cultural and historical significance of numerous photographs, daguerreotypes and instruction charts handed over by this pioneer of scientific photography from Saxony extends far beyond the University.

One particular feature of the institutionalization of Dresden's collections of didactic and museum objects deserves to be emphasized: From the beginning, due to their evident specialist skills, professors at the Polytechnical College and its successor, the Technical College were also entrusted more and more with the supervision of the important scientific and technical collections as well as with the museums in the city of Dresden. It is in this personal union that the exemplary sample collection of architecture set up by Hermann Hettner and Cornelius Gurlitt also had its origins. This collection was used both as a source and as comparative material for studies in art history, architecture and construction technology.

Mechanical-Technological Collection
In 1905, the Mechanical-Technological Collection was reestablished in the attic of the newly constructed College Building (now the Zeuner Building) of the Mechanical Department.

LUTZ GRAEFE

The Collection of Astronomic-Geodetic Instruments

The well-known observatory tower of the Beyer Building, the landmark of the TUD Dresden University of Technology, houses a selection of the most notable objects belonging to the collection of historical instruments from the fields of astronomy and geodesy. Several display cabinets present to the interested visitor such instruments as theodolites, levels, a telescopic alidade, sextants, chronometers and meridian circles.*

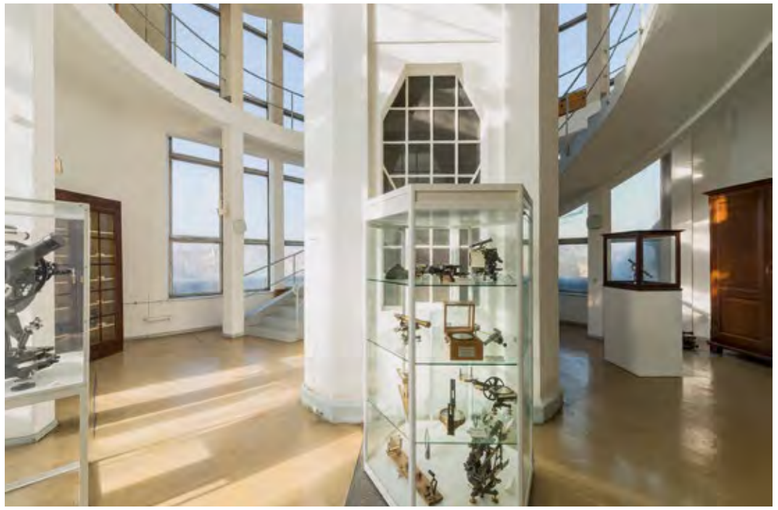
The Collection has its origins in the stock of devices belonging to the Geodetic Institute of the former Royal Polytechnical College and its later incarnation, the Technical College of Dresden. This means that most of the exhibited instruments were actually previously used in teaching. At the Technical School founded in 1828, Wilhelm Gotthelf Lohrmann gave geodetic lectures and conducted exercises already during the first years of the institution's existence. Technological development, especially in the booming railway industry in Saxony, made the training of experts with skills in geodesy a matter of urgency. Lohrmann, who had already been put in charge of the valuable historical collections of the Mathematisch-Physikalischer Salon in the Dresden Zwinger in 1827, now also became head of the Technical School. This was initially located in the former garden pavilion on the Brühl Terrace in the centre of the city. Technical training in surveying, which in those days was still quite hands-on, included site surveying and staking out building designs. At that time, the entire training for a surveyor was still very closely linked to civil engineering and architecture.

Following Lohrmann's untimely death in 1840, Johann Andreas Schubert – originally a mechanical engineer – assumed responsibility for significant parts of the lectures in geodesy and astronomy. In order to lighten Schubert's extensive duties, his former student Christian August Nagel took up the position of Schubert's assistant from 1849, and that of a regular teacher (Ordentlicher Lehrer) for geodesy at what had become the Royal Polytechnic School from 1851 (Peschel 1953). In this way, geodesy was elevated to a separate subject for the first time and an independent Geodetic Institute was set up in the new building at Antonsplatz, constructed in 1846. For a while, this new building helped alleviate, at least to some extent, the permanent shortage of space in the former Brühl pavilion and also in the former armory building at the Jüdenhof, which since 1833 had served as the second location of the Technical School. Working conditions for students and teachers were improved, too.

After Nagel, a noted expert in geodesy, had taken up his post, he was able to modernize and expand the stock of instruments comprehensively during his more than 40-year term in office. At his instigation, one of the most significant instruments in today's Collection – the Repsold Universal Instrument – was acquired for the campaigns of the Central European Arc Measurement and the Royal Saxon Triangulation. Archival records from the Saxon State Archives (SächsStA) show that about 200 to 250 thalers were allocated for the procurement of a "geodetic apparatus" in 1859. After plans for using the universal instrument had been

◀ **Large universal instrument by Pistor & Martins** (1862)
It is one of the most important exhibits in the Collection. Nagel used it for the Central European Arc Measurement, in addition to the Repsold Instrument.

* Due to the renovation of the Beyer Building, the observatory is expected to be accessible again in 2024.



"Lohrmann observatory" in the tower of the Beyer Building
View of the exhibition, today presenting a cross-section of the most important exhibits of the Collection. As part of a guided tour, visitors can also view the large refracting telescope in the dome.

By decree of the Royal High Minister of the Interior of 10th September, 1861, the most respectfully signed Directorate was authorized to order a large theodolite, universal instrument, to carry out major trigonometric measurements, with the remark that the total cost should be indicated when the time comes.

The instrument mentioned has been commissioned by Prof. Nagel from the famous A. u. G. Repsold Company in Hamburg and has arrived here in good condition.

From a letter by Julius Ambrosius Hülsse, Director of the Polytechnical School, to the Ministry of the Interior (SächsStA 15100, p. 34).

On the platform of the roof of the rear transversal building, a number of strong pedestals for geodetic purposes have been built, and in the middle of the platform (above one of the pedestals) a small astronomical observatory with a rotating housing.

Festschrift 1875

approved and the Repsold Company in Hamburg had been commissioned for its manufacture, the costs in 1861 amounted to the impressive sum of 1,000 Reichstaler (SächsStA 15096 and 15098). Despite the high purchase price, the Directorate of the Polytechnical School was authorized by the Ministry of the Interior on September 10, 1861, to acquire this large instrument.

Nagel was one of three Saxon commissioners for the large-scale arc measurement campaign, alongside professors Julius Weisbach (Freiberg) and Carl Christian Bruhns (Leipzig). Their task was to create for the Kingdom of Saxony a trigonometric network of the first order, consisting of a total of 36 measuring points (within the Central European Arc Measurement). This network was further consolidated by means of an additional 122 measuring points of second order. Nagel was responsible for the trigonometric survey and for placing survey markers at the measuring points. Quite a few of "Nagel's pillars", created under his direction, still exist today and are monuments to Saxony's surveying history. These pillars were used to position the instruments during the measuring process. Nagel's survey pillars on the Borsberg, Lilienstein, Gohlig and Wilisch mountains are representative examples in the area around Dresden.

In 1875, in the midst of Nagel's intensive work on the land survey, the Polytechnic – as it was then called – moved into the new building on what was at that time Bismarckplatz, roughly on the site of today's University of Applied Sciences. The new premises did justice to the increased number of students while also providing improved and more up-to-date accommodation for the Geodetic Institute. The rooms for the assistants and the storage rooms for the geodetic collections were situated in the west section of the building on the second floor (facing today's Fritz-Löffler-Straße), with the geodesy lecture hall and, next to it, Professor Nagel's office occupying the northwestern corner of the building. It was also possible to include observation pillars for geodetic measurement exercises on the roof of the southern wing of the building. In total, there were seven pillars on the southern roof area, the middle one of which was equipped with a small rotatable dome. This was where the students' geodetic and astronomical measurement exercises took place. For almost four decades, the polytechnic building near the main railway station, which was built at a later date, became the seat of the Geodetic Institute. Even if the new building could not entirely fulfill all the

needs of a geodetic teaching institution, it was a significant improvement compared to the old location at Antonsplatz.

In 1888, in addition to his duties as a professor, Nagel was also entrusted with running the Mathematisch-Physikalischer Salon in the Zwinger, a dual responsibility that had already been shouldered by Lohrmann and that was to continue until the end of the 1930s. After a busy working life, he retired in 1893. His activities in land surveying and the firm establishment of geodesy in the technical sciences remain Nagel's most outstanding achievements. In 1890, still during Nagel's tenure, the Polytechnic was granted the status of a Technical College. Space in the building at Bismarckplatz soon became too confined for the constantly developing and growing institution. It was then, at the beginning of the 20th century, that the first new buildings were erected on the present campus area in Dresden's Südvorstadt.

In 1913, during the tenure of Nagel's successor, Professor Bernhard Pattenhausen, the Geodetic Institute moved into new, more modern premises on the second floor of the newly-erected civil engineering building, today's Beyer Building. This meant that the building – designed by architect Martin Dülfer – with its distinctive 40 meter-high observatory tower also became the new home of the instrument collection. Facing in the direction of today's Fritz-Foerster-Platz, room 155 was earmarked as the geodesy collection room. Here, the valuable instruments were kept in purpose-built display cabinets, three of which have been preserved in their original condition to this day. The collection room also had direct access to the neighboring lecture theatre (room 154), where geodesy lectures were held at the time (Pattenhausen 1914). The connecting door still exists today, although it is no longer in use. The former collection site, room 155, is now divided into several small rooms that are used as offices.

Unfortunately, the new institute building remained unfinished. An entire stage of construction along Bergstraße was not completed. Also, the location of the building in the middle of a built-up area constituted only a compromise solution as far as astronomical and geodetic observations were concerned. Pattenhausen's wish for an institute building on the ridge to the south of the campus was not granted. Nevertheless, the new premises again meant a considerable improvement in working conditions and provided modern and spacious accommodation for the instrument collection. A number of modern instruments

Wilhelm Gotthelf Lohrmann (1796–1840), painting by Johann Carl Rößler, around 1830 (TUD Art Collection)
The geodesist and astronomer was co-founder and first head of the Technical School and senior inspector of the Mathematisch Physikalischer Salon.

Christian August Nagel (1821–1903) at the Repsold Universal Instrument; painting by an unknown artist, undated (private collection)
Nagel worked at the Geodetic Institute for more than four decades and once and for all developed geodesy into a modern engineering science.

MARINA LIENERT · CARIS-PETRA HEIDEL

The Medical-Historical Collection

The origins of the Collection

Exhibits collected by the Duke of Weissenfels provided the basic stock for a larger collection of the Collegium Medico-Chirurgicum in Dresden. This was the first Saxon school of surgery, opening in 1748. It was succeeded by the Provisional Teaching Institute of Medicine and Surgery (1814/15) and the Surgical-Medical Academy (1815 to 1864). These institutions also made use of comprehensive collections in their training of military doctors, surgeons and medical practitioners. Unfortunately, none of these exhibits made it into the possession of the indirect successor institution, the Medical Academy "Carl Gustav Carus", founded 90 years after the Surgical-Medical Academy closed. However, a physician interested in medical history began acquiring new objects for teaching purposes. Heinrich Fritz, head of the X-ray and Radium Institute of the Dresden-Johannstadt Hospital from 1948, then Professor of Radiology and Radiotherapeutics at the Medical Academy "Carl Gustav Carus" and Director of the Radiology Clinic, collected more than 20 different X-ray tubes, documenting the development of the relatively new discipline. They were on display in a purpose-built cabinet and were used in the training of medical students and medical technical assistants. Nevertheless, there seem to have been no systematic efforts at the new institution to collect material witnesses to medical history, despite the efforts of Heinz Egon Kleine-Natrop, a proven expert and promoter of Dresden's medical history at the Medical Academy "Carl Gustav Carus". Kleine-Natrop was the first Director of the Dermatological Clinic and full Professor of Dermatology from 1957. This lack of system when it came to acquiring historical exhibits was perhaps due to the proximity of two important institutions, both of which had been founded before World War I and already owned extensive medical history collections: the Karl Sudhoff Institute for the History of Medicine and the Natural Sciences in Leipzig and the "Deutsches Hygiene-Museum" in Dresden.

In 1978, the introduction of history of medicine as a compulsory subject at all medical higher education institutions in the GDR led to the establishment of an independent department for the history of medicine at the Medical Academy "Carl Gustav Carus", headed by Günter Heidel. Heidel was a lecturer who had written his habilitation on the subject, and when the department was elevated to the status of Institute in 1990, he became the first Chair of the History of Medicine at the Medical Academy "Carl Gustav Carus". Establishing this discipline in teaching and research was the primary goal of the Chair. It explains why simultaneously developing a medical history collection of substance was neither planned nor possible, due to a lack of staff and funding. However, as far as the limited means allowed, material witnesses relevant to medical history were acquired second-hand, a practice that continues to this day.

In 1746, Count von Hennike took possession of the Duchy of Weißenfels in the name of the King of Poland and Elector of Saxony. He found several anatomical specimens in the duke's collections and sent them to Dresden to be used in training surgeons.

Seiler 1820, p. 439–440

Although there are more glorious causes for the foundation of high schools and universities than secular need, there can hardly be a more cogent, let alone a more humane one for a medical school than that its establishment is necessary in the strict sense of the word.

Kleine-Natrop 1964, p. X

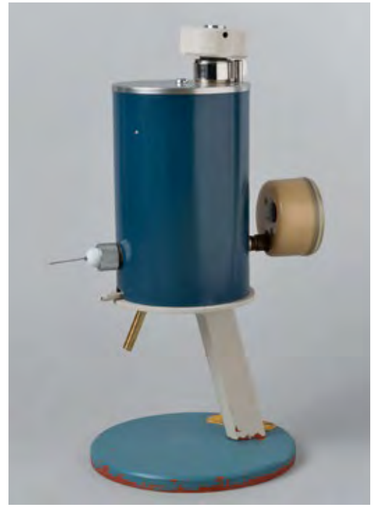
◀ **Treadle drill and dentist's chair,** circa 1890
The treadle drill was supposedly used by a dentist in Dresden as late as the 1960s.

Coffee cup with a view of the Royal Surgical-Medical Academy in Dresden, circa 1830 to 1840
The hand-painted porcelain cup was made as a precious souvenir and highlights the Surgical-Medical Academy as a tourist attraction in Dresden.

2010 saw the purchase of a very special item: a coffee cup that must have been made around 1830 to 1840. The outside is decorated with a rectangular cartouche framed in strict classicist style. It shows a finely painted polychrome view of the Royal Surgical-Medical Academy in Dresden, based on a print by Johann Friedrich Schröter. The piece was produced as a souvenir and depicts the Surgical-Medical Academy as a tourist attraction, lending the item its unique value. This image was certainly not chosen solely for the architectural quality of the "Kurländer Palais" and "Oberzeugwärterhaus". After all, Dresden had an abundance of buildings that were equally worth depicting. It was due to the Academy being unique in Saxony and offering an education of high renown that made it a place of interest in Dresden.

Systematic collecting activities regarding the history of the Medical Academy "Carl Gustav Carus" and Dresden's medical history

Extensive renovation and reconstruction measures were undertaken after German reunification, culminating in the integration of the Medical Academy "Carl Gustav Carus" into TUD Dresden University of Technology as the Faculty of Medicine Carl Gustav Carus in 1993. Back then, cellars and attics of the clinics and institutes still harbored a plethora of technological devices from medicine and nursing, along with instruments and furniture from bygone decades, which were now to be discarded. The Institute for the History of Medicine was asked if it could store these objects in its building. The staff of the Institute – headed from 1992 by Albrecht Scholz, initially on a provisional basis and then as holder of the Chair of the History of Medicine from 1996 to 2005 – assumed responsibility for safeguarding and cataloguing these artefacts. Repeatedly, they appealed to the clinics and institutes to offer these witnesses to medical and technical development and to standards of the GDR era to their Institute before disposing of them. The collecting activities became more systematic and resulted in an inventory explicitly designed as a medical history collection that documents and illustrates the history of the Medical Academy "Carl Gustav Carus" and its preceding institutions. From 2000 to 2018, Peter Schneider supervised the Collection with great dedication and wide-ranging expertise. From 2019 to 2021, Jörg W. Schneider devoted himself to the comprehensive tasks involved in maintaining, scientifically recording and exhibiting the historical objects.



Total hip joint prosthesis (two-piece, with press fitting) with transport case, circa. 1980
This prosthesis represented an early variant of hip joint replacement.

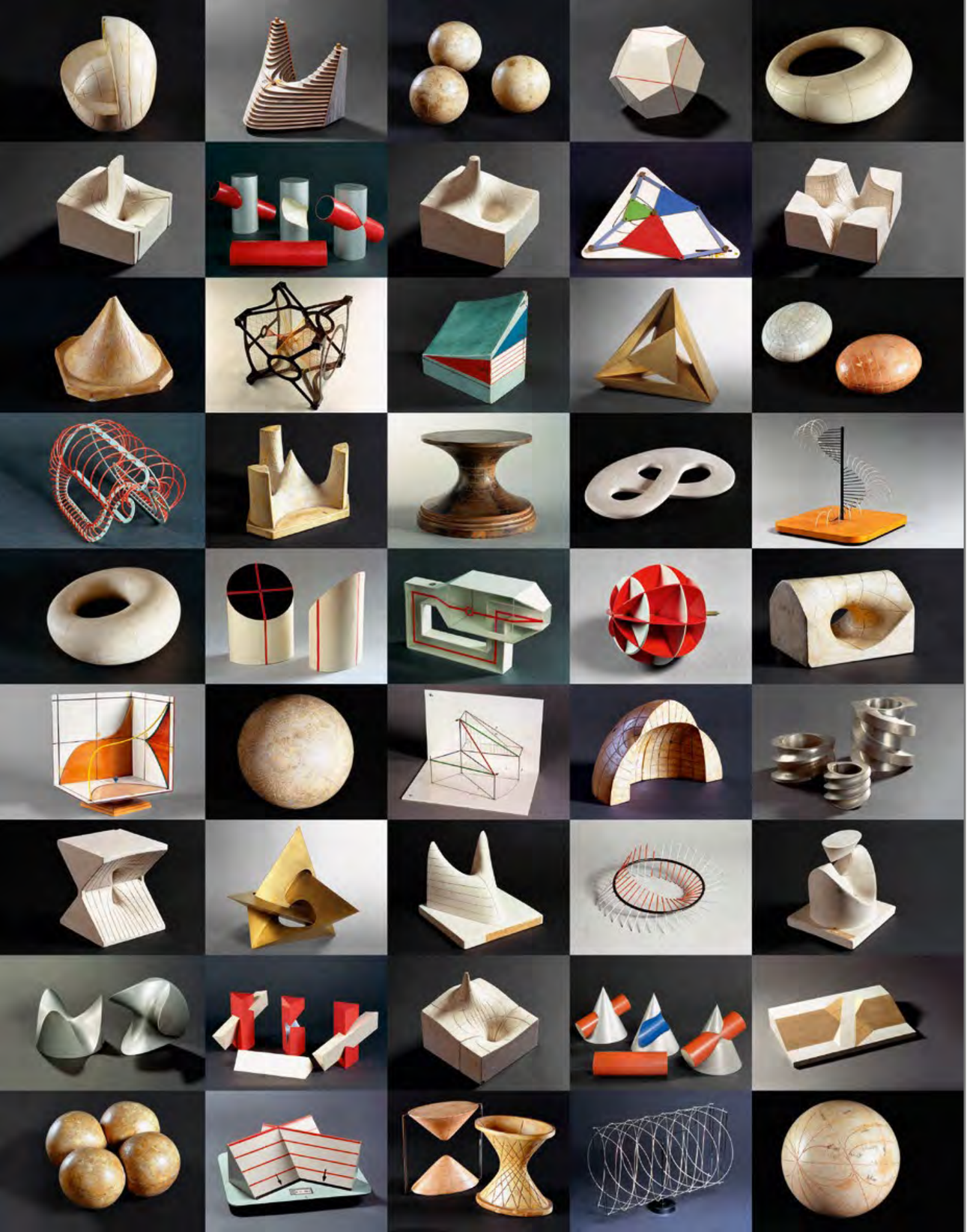
Apparatus for cryotherapy in dermatology
It was developed by the Dermatological Clinic of the Dresden Medical Academy in the 1980s and was also used there.

In 2000, the Collection comprised some 300 objects. 2001 to 2004 was a particularly valuable period, with the Institute accepting numerous medical devices and equipment, including hospital furnishings from the University Hospital and the Faculty of Medicine. For example, the Surgical Clinic handed over a total of 219 objects of all kinds: rib shears, vascular staplers, abdominal wall holders and intestinal clamps.

Technical devices and instruments for medical diagnostics and therapy, specifically developed at the Medical Academy "Carl Gustav Carus", are an exclusive feature and the centerpiece of the collection. As evidence of the innovative research in the different specialist fields of medicine and its application in high-quality medical care, these objects allow a historical evaluation and illustration of the achievements of the Dresden institution. With this in mind, it has been possible to garner objects from medical technology that had been developed primarily during research into cryomedicine, endoscopy, electrotherapy, vascular surgery, endoprosthetics (the artificial replacement of joints) and implant medicine. What is more, the Institute now incorporated items donated by private individuals, mostly physicians or their heirs, into the collection. In this way, the inventory was not only supplemented with instruments and devices from private practices, but specifically with objects from former polyclinics run by East Germany's state-owned firms with a focus on the field of occupational medicine. In 2002 and 2003 alone, some 220 individual items were donated.

Of particular value are complete sets of instruments and devices. These include a set from the estate of the late Oschatz physician Leopold Wilhelm Lohmann, which was donated to the Institute in 2006. A total of 48 instruments and other objects, such as the examination case, provide insights into the everyday life of a general practitioner – who also made house calls in the surrounding villages – in the first half of the 20th century. Most of the objects originate from the time before World War I, with only a few dating back to around 1930. Diagnostic instruments such as a pocket set for laryngeal examinations or an electric hand-held ophthalmoscope are among the items, as are a chloroform anaesthesia mask, a metal bone saw, obstetrical forceps, and universal dental forceps.

In 2003, the niece of Kurt Warnekros, Director of the Dresden State Women's Clinic from 1925 to 1949, transferred ownership of her uncle's written documents to the Institute. She also handed over the medical bag used by Warnekros when he was called to consultations, operations and deliveries in France, Sweden, Italy, Greece and Romania, or within Germany.



DANIEL LORDICK

The Collection of Mathematical Models

The ambiguous concept of what constitutes a mathematical model

When scientists today talk of a mathematical model, they usually do not refer to objects such as those presented in this Collection, but to a formalized description – employing mathematical means – of a sub-problem from the world we experience. The more precisely an event is "modeled," the better it can be predicted. Accurate weather forecasts, analyses of financial markets and the characterization of complicated processes from physics, chemistry and biology become possible when the power of computers is harnessed. Despite these obvious successes in almost all areas of life, despite their key role in advanced technology, and despite many attempts at mediation, mathematicians and the rest of society remain thoroughly divided: Their formalistic science is often regarded as incomprehensible and remote, not least because of its highly condensed language.

By way of contrast, the Collection of Mathematical Models offers a distinctly sensual treasure, making the inner beauty and elegance of formulae and abstract structures tangible even to the layperson. These material models are also the actual work of mathematicians and serve as a means of communicating mathematical content, alongside formulae, texts and graphics. In the recent past, the immediate persuasive power of the material models in conveying knowledge has been the starting point for numerous projects that have taken the Dresden Collection to new heights beyond the boundaries of mathematics. The models have been on display in various exhibitions, with some now on loan to Saxon museums; they serve as the subject matter of artistic works and, last but not least, have been researched in a pilot project of the German Research Foundation (DFG). At the same time, however, the aesthetic appeal of the objects camouflages the remarkable conflicts that have contributed to the very eventful history of the Collection during its inner-mathematical push and pull between reference to reality and abstraction.

Whereas Galileo Galilei still proclaimed that the universe was written in the language of mathematics, Albert Einstein already viewed the interplay between science and reality in a much more differentiated way. Even the title of the oldest specialist journal still in publication, the "Journal für die reine und angewandte Mathematik", founded in 1826, describes the polarity according to which pure mathematics is regarded as belonging to the humanities, while everything that emerges from this ivory tower and moves towards application and "Anschauung" is implicitly devalued and classified as "impure". So, it may seem like a contradiction that the models of the 19th century largely originate from pure mathematics.

An obvious limitation of material models consists in their inevitable attachment to the three-dimensional visual space. Small wonder, then, that material models are rather insignificant for current mathematical research, dealing as it does with higher-dimensional structures. As a direct form of depiction, objects are suitable only for a small section of mathe-

◀ Objects from the Collection of Mathematical Models.

As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.

Albert Einstein in his lecture on "Geometry and Experience" (1921)

Movable model of a hyperbolic paraboloid
Presumably made around 1849 under the guidance of Théodore Olivier in Paris. Brass and threads

matical topics, in particular for those related to engineering geometry. Here, they are still popular as didactic and visual aids, which explains the decision to house the Collection at the Institute of Geometry.

Models in the early days of the Technical School in Dresden

The original collection of the Technical College of Dresden and the related documents were destroyed during the bombing of Dresden in February 1945. As a consequence, we have little information about its early history. Since World War II, various actors have gradually rebuilt today's collection, partly collating it from bequests. This explains its somewhat "patchy" nature compared to other universities, such as Göttingen, Tokyo or Boston, while at the same time it contains numerous recent models. Despite the devastating caesura of 1945, some of the Dresden Collection's unique specimens of historic value from the 19th century have been preserved. The models therefore have a particular significance for the history of science that goes well beyond their function as a collection of teaching aids.

When evaluating the pertinence of mathematical models in the early days of the Technical School in Dresden, the first thing to consider are its antecedents. The most prominent of these was the École Polytechnique in Paris, founded in 1794, which served as a prototype for the polytechnic schools in Germany. In Paris, one of the founding fathers was Gaspard Monge, whose groundbreaking work *Géométrie descriptive* standardized the use of engineering drawing in the technical subjects. This explains why scientifically correct illustration based on geometry – known as descriptive geometry – has been a core element of teaching in Dresden from the very beginning.

The success of the Technical School in Dresden resulted from the combination of scientific mechanical engineering based on the French model with the English principle of practical trial. Inspired by the Berlin pioneer Christian Beuth, models and English machines were procured that served as templates for replicas. These were also used for the purposes of modeling as well as machine and freehand drawing. The existence of purely mathematical models, however, cannot be verified for the early years. It is noteworthy, though, that Wilhelm Gotthelf Lohrmann, the first head of the Technical School, was also chief inspector of the Mathematisch-Physikalischer Salon in the Zwinger. In this respect, there is a strong personal connection between the first location of the School, a pavilion on the Brühl Terrace, to a collection of mathematical instruments that is unique worldwide.

Arriving in Dresden in early 1849, the first mathematical models were a constituent of descriptive geometry and came from the French mathematician Théodore Olivier, who was a

Steiner's Roman surface with main tangent curves
Plaster model of a fourth order surface after Kummer, Martin Schilling publishing house
Series IX 3, 1883

student of Monge. With the help of taut threads, the models represent ruled surfaces, that is: curved surfaces created by the movement of straight lines. From 1839, Olivier initially had these surfaces – of utmost interest to civil engineering – made for the Conservatoire des arts et métiers in Paris. Monge, too, had previously depicted ruled surfaces by means of taut threads. However, the special feature of Olivier's constructions is that the models are movable, which means they represent more accurately the spectrum of possible cases – for example, intersection phenomena. Characteristic of Olivier's creations are brass frames with mechanically complex joints and, in some models, lead weights for automatically retightening the threads (Cf. the collection at Union College). In today's collection, there is only one model left – a hyperbolic paraboloid – that due to its construction and materiality can be traced back to the delivery of those first thirteen models.

The heyday of mathematical models

The heyday of mathematical models in the second half of the 19th century is closely linked to research in the field of algebraic surfaces (Fischer 1986). One of the first mathematicians to be mentioned here is Ernst Eduard Kummer. At the mathematical seminar of the University of Berlin between 1862 and 1872, he constructed nine models of fourth order surfaces, including Steiner's Roman surface. The models were still praised twenty years later for being "among the most beautiful and elegant that have been produced up to now" (Schilling 1911, p. 20).

The most influential protagonists in the rise of mathematical models, however, were Felix Klein and Alexander von Brill. Both were students of Kummer and were appointed to the Technical College in Munich in 1875. Their teaching, which was entirely focused on "Anschauung", led them to set up a modeling cabinet. In the following years, with the support of a lathe operator and a plaster molder, and using arithmetic and drawing extensively, their students constructed around 100 mathematical models. However, this was not just indulging the "luxury" (Brill 1889) of having teaching models in engineering training; the models were intended to promote specialized studies in geometry.

The study of the shape relations, including of structures that are otherwise well known to the geodesist prompts new and often momentous questions.

Alexander von Brill 1889

The mathematical models, inasmuch as they represented surfaces of revolution or generalized helicoids, were initially made of wood. For the other models, planar cuts were made into zinc sheets and then soldered together to form a framework. The final form was created in several steps by filling the zinc framework with a special molding mass and by subsequent smoothing. Finally, plaster casts were made from the master models and lines relevant to the design were applied to them. Only such plaster casts were intended for distribution. In this respect, it is remarkable that some wooden models still exist in Dresden. These are very

ECKHARD BENDIN

The Color Research & Theory Collection

Color as multidiscipline

There is barely any other aspect of our lives and our knowledge that has the topicality and complexity of color, reflected and refracted in all fields of scholarship as it is. It is due to these properties that color has long since ceased to be the subject of only one academic discipline, as was the case regarding philosophy centuries ago. Just as light and color are connected to all areas of life, nature, technology, science, art, culture and education, recent analysis shows that the path of color theory initially led through the most differentiated investigations in many individual disciplines. It then continued on towards an increasingly multidisciplinary field of knowledge that has become almost boundless (Welsch/Liebmann 2003; Kuehni/Schwarz 2007).

Today, an interdisciplinary color theory which has established itself as a modern science examining the interrelationships of light and color, seems more necessary than ever. This is especially true since in the past, all endeavors of individual disciplines quickly reached their limits and were being challenged to extend them. An impressive example was the increasing shift of philosophy towards the natural sciences in the 19th century. This was particularly apparent as regards physiology, which in Leipzig, led to the emergence of psychophysics, experimental aesthetics and experimental psychology. The history of the impact of Goethe's theory of colors also bears witness to how necessary the holistic overview of essential facts appears to be. Time and again, eminent natural scientists have turned to color and taken up positions regarding the subject. Among them are Nobel Prize winners such as Wilhelm Ostwald, Max Born, Erwin Schrödinger, and Werner Heisenberg, who, in a lecture on the theory of color as propounded by Goethe and Newton, challenged scientists – in the light of modern physics – by pointing out to them the necessity of transcending boundaries and establishing and defending fresh connections, in the interest of life and communication.

Today, among the largely subject-specific University collections, an interdisciplinary collection that transcends boundaries is something of a rarity. The Color Research & Theory Collection can therefore be seen as something special. Unlike other collections, it strives for a multidisciplinary connection of teaching and research content. This, however, is only natural, because color – this ancient field of experience and knowledge – can no longer be dealt with by just one discipline. Color is an elementary, sensual, morally perceptible and biologically and culturally effective phenomenon. As such, it is generated by nature through the interplay of light and matter and therefore in the first instance, linked to physics, chemistry and biology. In short, it cannot exist without them. Color theory, by contrast, as a comprehensive science of color and what it conveys has always been a fundamental concern of the humanities, social sciences, engineering, and artistic disciplines. Color was integrated into these fields and was the focus of specific subjects. The elementary aesthetic potential of color, however, attracted

◀ **Zeugner's "Renewed Baumann-Prase Chart"**
Leipzig 1989/90
Six of the twelve sectional planes of his draft of a "Renewed Baumann-Prase Color Chart" with a total of 864 samples, mixed with gyroscopic mixing (Zeugner estate).

Only where science discovers relations to life itself at the utmost limits of its previous way of research, will its meaning become comprehensible.

Heisenberg 1941

For how difficult it is to isolate the theory of colors, which only permeates through everywhere, from the rest of knowledge and yet to hold them together again, will be palpable to anyone with insight.

Goethe 1810, Vol. 2, Introduction, p. XI.

It was inevitable that in connection with colors technical and artistic questions occupied me at the same time...and the increasing realization that nothing is inaccessible to science forced me to set my sights on the science of art.

Ostwald 1927, p. 407

the highest level of attention in the complexity of architecture, art, and design. Here, it was widely used and reflected upon as a visual event and a creative medium. In today's world of media, the use and significance of the media of light and color have attained a remarkable degree of breadth and diversity. Just think of the multitude of new disciplines and professions in media and communication design. These disciplines and professions can no longer do without basic insights such as those provided by a multidisciplinary color theory.

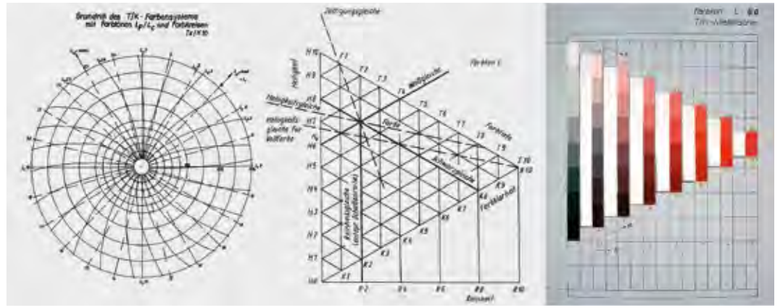
Goethe already referred to the difficulties of a holistic overview in the introduction to the historical part of his Theory of Colors. In it, he complains about the difficulties involved in isolating the theory of colors, which permeates everything, from other knowledge, while still holding it together. He identifies the challenge that science must necessarily be thought of as art if we expect any kind of wholeness from it. However, in this manner he also points the way: "In order to...approach such a demand, ...one must not exclude any of the human powers in scientific activity. The abysses of intuition, a sure vision of the present, mathematical depth, physical accuracy, height of reason, sharpness of intellect, an agile yearning imagination, loving delight in the sensual, nothing can be dispensed with." (Goethe 1810, vol. 2, p. 119 f). A good 100 years later, Ostwald – looking back on decades of color research and the awareness he gained in the process that he was inevitably and simultaneously being confronted with artistic questions – also invoked the possibilities and opportunities of a growing integration of science and art.

From the Color Forum to the Collection

It is therefore not surprising that the idea for the Collection evolved from a specialist discipline such as architecture, with its focus on life's complexities, and also from an interdisciplinary tradition of thought. Since its foundation in 1992, the Dresden Color Forum (Dresdner Farbenforum), an interdisciplinary conference and publication series at the Institute of Foundations of Design and Architectural Delineation at TUD Dresden University of Technology, has taken on a wide variety of overarching subjects in a series of conferences and exhibitions, connecting various experts and interested parties through knowledge exchange and personal encounters. For the first time after a 30-year hiatus, the Forum brought together color scientists and designers from East and West as well as from several European countries at a conference in East Germany. The first meeting was followed by further conferences every two years, including the symposium "On the Significance and Impact of Wilhelm Ostwald's Theory of Color". This event was held in 2003 in Großbothen near Leipzig in cooperation with the Wilhelm Ostwald Society to commemorate the 150th birthday of the Saxon Nobel Prize winner and color researcher. In the publication series Dresdner Farbenforum, six conference volumes were published between 1992 and 2003, with 94 papers by 75 authors, including the documentation on the Ostwald Symposium 2003 (Bendin 1996–2001; Bendin 2003).

Since 2001, the Dresden Color Forum has increasingly devoted itself to a concern that had been insufficiently documented and reappraised in the past: The specificity and history of the development of color theory in Central Germany. It was essentially shaped by natural scientists and humanists, artisans, entrepreneurs, architects, artists and educators. Among them were well-known protagonists such as Goethe, Runge, Schopenhauer, Hering, Ostwald and Itten. However, as industrialization progressed, many lesser-known personages in the field of color theory also contributed significantly to the development of Central Germany into a melting pot of modern color theory until the middle of the 20th century. They include:

- the chemists Stöckhardt, Möhlau, Krais, Ristenpart and König
- the physicists Ulbricht, Klughardt, Richter and Buchwald
- the physical chemists Ritter, Seebeck, Luther and Goldberg
- the printing technicians Gleitsmann, Förster and Neugebauer
- the mineralogists/crystallographers Goldschmidt and Rösch
- the physiologists Purkinje, Fechner, Wundt and Matthaei



Adam's color chart according to TGL 21579, Dresden 1966
Manfred Adam's design of the TGL* color chart as an aesthetic-technical system. L/T/K was first presented at the International Color Conference Interfarbe 1966 at the Deutsches Hygiene-Museum Dresden and was intended to serve for the production of "made to measure" color samples.
* technical standards in the former GDR, 1955–1990

Ostwald's double cone from 1923
True to original reproduction of Ostwald's double cone with 2,520 patterns using the original color spreads: 24 triangles of the same color with 105 derivatives of the same tone each. Execution Fritz Rausendorf, Leisnig 1965 (estate Streller and Rausendorf/gift Hönle)

Prases color fan "Le clef de l'harmonie de couleurs", Aue 1935
The unique 24-part color fan, designed and realized by Otto Prase in 1922, and awarded several prizes at trade fairs – toned down in eight stages to a total of 408 tonally identical derivatives – went into mass production after Prase left Baumann's company in the mid-1930s. (Prase estate)

- the psychologists Müller, Kirschmann, Weissenborn, Krüger and Bühler
- the color card manufacturers Baumann and Prase
- the architects Semper, Taut and the Luckhardt brothers
- the garden artists Pückler and Petzold
- the artists and "Bauhaus" teachers Kandinsky, Klee and Scheper and
- the "Brücke" artists Kirchner, Heckel and Schmidt-Rottluff.

After the Second World War, too, color experts from Central Germany made extraordinary contributions. Among them were the color metrician Richter, the systematist Adam, the printing technician Hickethier, the color psychologist Frieling, the artists and teachers of vocational training Zeugner and Arnold, the art teachers Streller, Rausendorf and Zitzmann, and the physicians Heller, E. Marrè and M. Marrè.

In 2001, a first exhibition to illustrate a cross-section of contents, connections and lines of development was held, and a series of personalities were presented whose lives and works in Central Germany were closely connected with the theory of color. The same subject was addressed in the special issue "Light and Color" of the Scientific Journal of TUD. The work of Manfred Adam received special recognition on the centenary of his birth. Adam, as a former assistant to Ostwald, continued the latter's work in Großbothen as head of color research, in addition to reestablishing and advancing Ostwald's colorimetric system (Adam 1989/Bendin 2001). Other anniversaries in the ensuing years gave rise to a special examination of the life and work of Wilhelm Ostwald (150th birthday in 2003), Manfred Richter (centenary of his birth in 2005) and Otto Prase (50th anniversary of his death in 2006).

The exhibitions "Interface Color" (Schnittstelle Farbe) and "Resonances – Color as a System" (Resonanzen - Farbe als System"), curated by Eckhard Bendin, the initiator of the Color Forum, provided the initial spark for the development of a collection in which these matters – integrated into the collection concept of the Office for Academic Heritage of TUD – could be preserved and pursued further. The former of the two exhibitions was held in 2003 in the main auditorium (HSZ) of TUD during the 175th anniversary celebrations of the University. The latter, as a commemoration of Ostwald's 150th birthday in the same year, took place in the town hall gallery in Grimma (Bendin 2003, pp. 50–59). On the one hand, there was growing public interest in this still largely unknown concentration of historical developments. On the other, it was crucial to satisfy the interest in teaching and research as sustainably as possible, also in relation to institutions.

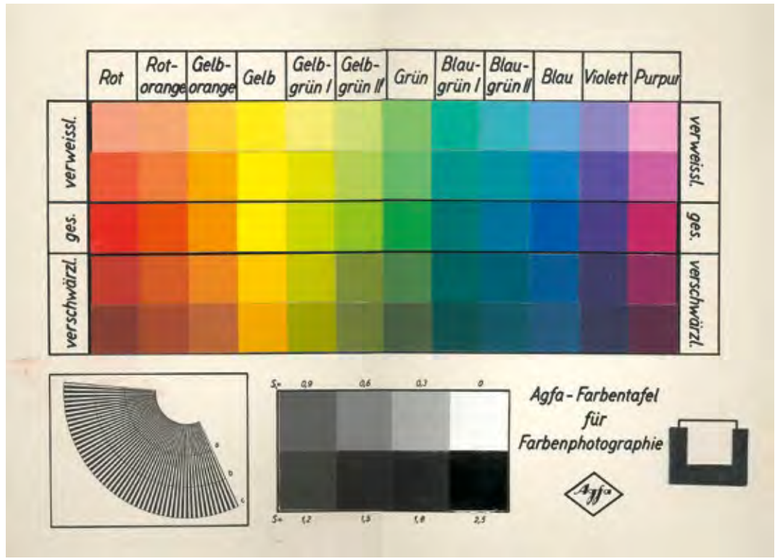
The 6th Color Forum on 28th October 2005 was already dedicated exclusively to this issue after the fundamental decisions taken at the Institute of Foundations of Design and Architectural Delineation of the Faculty of Architecture and at the Office for Academic Heritage in October 2004. The collection initiative was a logical consequence of the Dresden Color Forum, itself the result of a metamorphosis that received fresh input from conference to conference and exhibition to exhibition. The development concept put forward saw the most essential tasks of the innovative Color Research &Theory Collection in preserving and bringing together the surviving contemporary, factual, and personal evidence of historical developments in the multidisciplinary field of color theory in science, education, culture and art in Central Germany. At the same time, it sought to prepare them for teaching and research and to enable their sustainable usage. Regional and local focal points were established for the documentation and scholarly reappraisal of achievements, events, and overarching contexts. Examples of these focal points were the special scientific, pedagogical and artistic lines of development such as the circles of influence around Goethe, Fechner, Hering, Wundt, Ostwald and Baumann/Prase and their successors, as well as local centers such as Jena/Weimar, Leipzig/Großbothen, Dresden and Aue (Bendin 2008). Collection experts from various universities were also involved in the discussion of the development concept.

The interdisciplinary approach also aimed at enhancing the collection's intended function as a networking link between the two historical subject-specific collections regarding the complex of light and color at TUD. These were the Historical Dye Collection at the Institute of Organic Chemistry, the Hermann Krone Collection and the Scientific Photography Collection at the Institute of Applied Physics (formerly the Scientific Photographic Institute), both already long in existence at the time.

An auspicious omen for the new Collection might be that its founding coincided with the 100th birthday of one of the most important German color scientists, a man whose origins and career were closely linked to the Technical College/TUD. Born in Dresden, Manfred Richter – known abroad affectionately as the German "color pope" because of his extraordinary competence – studied physics here and gained his *Diplom* from the Scientific Photographic Institute (Wissenschaftlich Photographisches Institut). His supervisor was Robert Luther. It was there in 1938 that he also received his doctorate for his thesis on the literature regarding Goethe's Theory of Color, under the supervision of August Klughardt. Later, he devoted himself entirely to color research in Berlin. Richter is credited with founding the German Society of Color Science and Application (Deutsche farbwissenschaftliche Gesellschaft), several color standards committees and the commendable journal "Die Farbe" (Bendin 2003 and 2006; Mauersberger 2008).

The theory of color is the science of the colored appearance, which is conveyed to us by the sense of sight, in other words, of the perception of color ... It is precisely this fact that makes it very difficult to establish a universally valid theory of color, and most of the laws that have been discovered so far consist of laws for the color stimulus.

Richter 1940, p. 1



Klughardt's Agfa color plates for color photography, Dresden 1950
One of the color charts for testing color reproduction that were produced under the guidance of August Klughardt with color samples by Baumann-Prase at the Scientific Photographic Institute around 1950 as reference charts for VEB Filmfabrik Agfa Wolfen (chart with eight-part gray series and 12 color tones in 5 saturation levels each).

GWENDOLIN KREMER · MARIA OBENAUS

The Art Collections – living testimony of the University's history

There would be no University art without a campus and the institute buildings. Incorporated in the Office for Academic Heritage, Scientific and Art Collections (OAH) since 2003, the extensive Art Collections of the TUD Dresden University of Technology span many genres and date back to the founding of the Technical School in 1828. They are closely connected to building activities and campus planning, that is to the University buildings at changing locations over two centuries. The majority of these buildings are listed as individual monuments and are under the special protection of the Free State of Saxony.

The campus is a reflection of the University's institutional history and genesis. Historicist institute buildings from the end of the 19th and the beginning of the 20th centuries stand next to edifices built after the Second World War. Since the 1990s, the University campus has been expanded and consolidated as a result of establishing a full-range university and of the strategies for becoming a university of excellence. However, it is not only the University buildings that reveal the history of the institution and how it wished to be seen at the time. These are also communicated through the works held in the Art Collection, the paintings, statuary art, sculptures, drawings, and prints, and through site-specific art, that is art works that form an inseparable part of a building.

Works donated or purchased from the founding year of 1828 up to 1945 are listed under the collective term "Altkunstbesitz". This unites stocks of graphics and portraits that came into the University's possession independent of "planned pictorial acquisition" (Schieferdecker 1996, p. 126). It is characterized by a gradually increasing focus on collecting portraits of University members. This focus is also what connects the "Altkunstbesitz" with works acquired and commissioned from the GDR period to the present day. It is primarily these portraits of staff and students that bear vivid witness to the institution's history and keep alive the memory of the University's development. The subjects of the portraits are depicted with typical professional attributes such as their work materials or in the context of their activities in teaching or studying. In this way, the artworks illustrate the social standing and the functions of the depicted individuals, but also tell of social transformations and representation strategies.

By maintaining this portrait tradition as part of its acquisition policy to this day, the TUD has been able to amass more than 90 portraits among the artworks it possesses. These include busts of outstanding scientists in front of and inside institute buildings (Obenaus 2015, p. 142). A publicly accessible presentation in the shape of a gallery of University portraits of scholars and students is being planned for the Fritz Foerster Building. From 2025, it will provide a permanent overview of this characteristic focus of the Art Collection within a single exhibition.

◀ **Kurt Wünsche and Harry Schulze: "Zur Elektrotechnik"** (*On Electrical Engineering*) (1964), detail, silicate ceramic tiles, Barkhausen Building (BAR), inv. no. KB94600 (Photo: Till Schuster)

In the 1950s and 1960s, several ceramic site specific art works were created at TUD under the aegis of the Artistic Advisory Board. They were conceived in close cooperation between the master potter, university educated sculptor and ceramics engineer Harry Schulze at the Chair of Building Construction of the Department of Architecture and in the workshops of the then Technical College. Reinhold Langner, Kurt Wünsche, Karl-Heinz Adler, Friedrich Kracht were among those artists who were also involved.

Arnd Wittig: "Die Widerstandskämpfer" (Resistance Fighters) (1958), bronze, 220 × 325 × 200 cm, Münchner Platz Dresden Memorial, Münchner Platz 3, inv. no. KB92359 (Photo: Till Schuster)

Among the artworks commemorating the past of the buildings taken over by the University in 1957 as well as the fate of people under political tyranny are two sculptures of outstanding artistic expression: Arnd Wittig created a bronze group sculpture that was erected in 1962 in the former execution yard, today's memorial courtyard. This sculpture references Auguste Rodin's "Citizens of Calais". In the north-eastern courtyard of the site, the figure "Namenlos – Ohne Gesicht, den zu Unrecht Verfolgten nach 1945" (Nameless – Without a Face, dedicated to the Unjustly Persecuted after 1945) by sculptor Wieland Förster has been on display since 1995.

From the 1960s until reunification, the GDR's "Kunst am Bau" program, which ensured that a small percentage of the construction costs were invested in site-related art – hence the English term "Percent for art" – was closely intertwined with changes in the propagated architectural style and the prevailing cultural-political views and directives. At the same time, the investment budget was reduced due to a decline in construction activity. Instead of being able to commission around 70 site-related works of art, as had been the case in the 1950s, the number was only half that from the 1960s. Whereas the focal point had previously been designs for murals and façades, now sculptures were increasingly integrated into the green spaces of the institutes and the dormitory buildings. In view of these tendencies, surprising exceptions are represented by the futuristic façade reliefs depicting "Bau-, Kern- und Astrophysik" (Construction, Nuclear- and Astrophysics, 1967–70), by the artist couple Elfriede and Siegfried Schade on the dormitory buildings at Fritz-Löffler-Strasse 12, alongside the staircase design (1960/63, built over in the 1990s) by the architect and artist Peter Albert in the dormitory on Christianstrasse (today St. Petersburger Straße 25) and the wall frieze "Zur Elektrotechnik" (1964) on C-wing of the Barkhausen Building by Kurt Wünsche and Harry

Klaus Dennhardt: Installation of the "Mast mit zwei Faltungszonen" (*Pole with two folding zones*) by Hermann Glöckner (1982), black-and-white photograph, 29.5 × 42 cm, inv. no. KB03682

In addition to works on paper by the Dresden painter and graphic artist Klaus Dennhardt (* 1941), the collection also includes three documentary photographs of the installation of Hermann Glöckner's "Mast mit zwei Faltungszonen". Dennhardt worked closely with the constructivist in the 1980s.

Schulze. They all stand for the continuation and reinterpretation of "East Modernity" at TUD. It is equally remarkable that under TUD ceramics engineer Harry Schulze, pioneering investigations into building materials and ceramic glazes were commissioned in close cooperation with Dresden artists at the Chair of Building Construction and in the workshops of TUD.

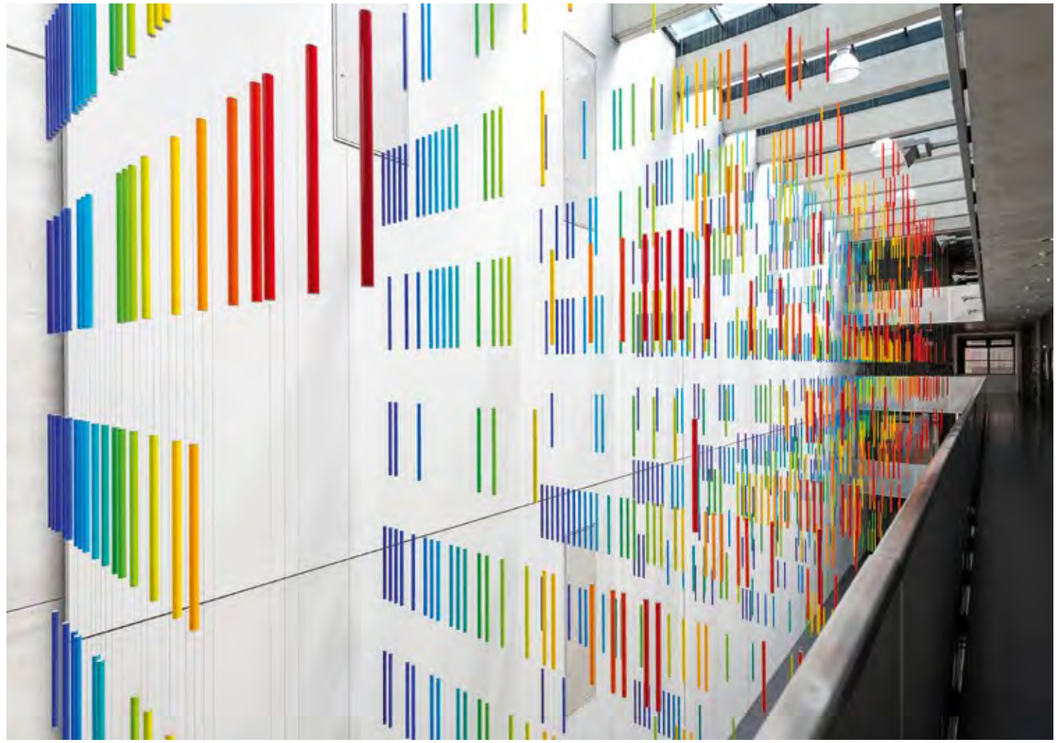
As a rule, however, fewer works were commissioned during these years. In the main, sculptures were purchased, including works by Ludwig Engelhardt, Werner Stötzer, and Theo Balden from the art exhibitions of the GDR. In view of this otherwise customary practice, the decision to place a two-part group of figures by Wieland Förster in front of today's dormitory at St. Petersburger Straße 25 amounts to an almost unique occurrence in the University's procurement of the time.

Not only did the Artistic Advisory Board have lower sums at its disposal from the investment budget, but the Rector's Office also saw less and less need to substantially promote and expand the Art Collections. This also led to a decline in the acquisition of paintings. Instead, a disproportionate number of works on paper – few of them originals – as well as works from portfolios were purchased. Analogous to the commissioning of site-related art, hardly any works by progressive artists found their way into the Collection. Under the architect and artist Jürgen Schieferdecker, who took over the leadership of the Artistic Advisory Board from 1975 to 2003, purchasing and commissioning changed only marginally. Schieferdecker's hands were tied due to structural changes at the University and the financially limited room to maneuver, so that in the 1980s and 1990s he was only able to make selective additions, such as acquisitions from Helge Leiberg, Angela Hampel, Petra Kasten, Veit Hofmann, and other artists of the generation born between 1940 and 1960. Of great success was the installation of the steel sculpture "Mast mit zwei Faltungszonen" (1982) by Hermann Glöckner on Fritz-

Hans Christoph: Untitled (1976), mixed technique with varnish on cardboard, 30 × 42 cm, inv. no. KB4072 (Photo: Tobias Lange)

Thanks to a donation from the estate of the Dresden illustrator and graphic artist Helga Knobloch, an extensive body of works by the Dresden artist Hans Christoph has been added to the Collection. The donation comprises more than 350 works from the period 1930 to 1982 and includes mainly oil paintings as well as gouaches, watercolors, and collages. Christoph developed an independent oeuvre that, after a figurative phase, moved between *action painting* and *informalism* from the 1950s until his death. The extensive donation expands the Collection's focus on abstract and constructivist art in the GDR.

The Art Collections –
living testimony
of the University's
history



Roland Fuhrmann: "Spektral-symphonie der Elemente" (*Spectral Symphony of the Elements*) (2010), 99 elements with 1,433 glass tubes, 70 cm each tube, H: 1,500 cm, W: 335 cm, D: 300 cm, Chemie-Neubau, inv. no. KB94313

"'Spectral fingerprint' is the line spectrum mentioned, typical for each chemical element. The emission lines of No. 1 hydrogen to No. 99 einsteinium float as colored glass tubes in the area and change the logic of this natural law into an impressionistic space painting. Color tones are transformed into a spectral symphony. When crossing, the shift of colors becomes dynamic, the spectral lines mix themselves and new chemical compounds will be created." (Roland Fuhrmann)

Collections of the Faculty of Biology

Botanical Collection including Herbaria
The Herbarium Dresdense (international abbreviation DR) comprises some 500,000 samples of plants, lichens and fungi from all systematic groups and from every continent on earth, although its main focus is on Europe. The Collection consists of the Herbarium Generale with seed plant samples of global origin, the Herbarium Saxonicum, which houses plants from Saxony and adjacent areas, the Cryptogam Herbarium with algae, fungi, lichens and bryophytes, and Oscar Drude's Formation Herbarium. In addition, the Herbarium houses timber cross-sections, seeds, fruits and pollen preparations. A locality index of Saxon plants is also part of the Collection. In 1918, Theodor Wolf's extensive Potentilla Herbarium (the basis for his monograph on the genus Potentilla) was acquired.

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Visits upon request

Paleobotanical Collection
This Collection of approximately 800 specimens of plant fossils was assembled over many years by palaeobotanist Harald Walther, for use in his lectures. In addition to specimens collected by him, especially from the lignite opencast mining areas in eastern Germany and Bohemia, donations from colleagues and private collectors have contributed to a virtually complete documentation – based on selected pieces – of the evolution of these plants.

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Zoological Teaching Collection
This Collection is primarily used for practical training in biology and biotechnology, but is also employed in the teaching of medics and landscape architects. It includes skeletons, wet and dry preparations, molluscs, arachnids and crustaceans, fish, worms, insects and radiolaria as well as permanent preparations, historical cartographic material and plaster models. The Institute of Zoology was re-established in 1994, at which point the Collection was also set up once more. The basic stock consists mainly of specimens returned from Dresden's Museum of Zoology and of objects from the collections of the Institute of Zoology at the University of Bonn and of the "Museum of the Study of Hunt Animals and Ornithology" (Museum für Jagdtier- und Vogelkunde) in the Ore Mountains.

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Sand viper (*Vipera ammodytes*)
Zoological Teaching Collection

Collections of the Faculty of Chemistry and Food Chemistry

Inorganic Chemistry Collection
The teaching Collection currently consists of about 200 appliances and more than 1,000 chemical substances. It brings together the scientific collections of important researchers from chemical institutes. The origins of the Institute and therefore the oldest items in the Collection can be traced back to Walther Hempel, Professor of Inorganic and Technical Chemistry at the Chemistry Department from 1893 to 1912. Today, special devices such as Hempel's gas burette and the water engine from 1878 are considered valuable material witnesses of the Institute's Collection. In addition, the chemistry collections have been enriched by experimental setups and devices of chemists Fritz Foerster, Arthur Simon and Kurt Schwabe.

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Crystals of ammonium hydrogen phosphate and nickel vitriol
Inorganic Chemistry Collection

Dye Collection
The Dye Collection is one of the most important collections at TUD. It houses more than 1,500 natural dyes from plant and animal sources and over 20,000 trade samples of synthetic dyes from more than 80 producers, arranged according to their chemical structures. Additionally, it contains more than 3,000 color sample charts and numerous staining patterns. The oldest color samples date back to around 1830, while other samples stem from the Great Exhibition in London in 1851. The Collection also contains an original sample of Mauveine, the first viable coal tar dye produced by W. Perkin in 1856. The Institute's scientific activities can be traced by means of students' final theses, which have been collected since 1890, along with the preparations that were made for them. To this day, the Collection is housed in the rooms it moved into in 1926, next to the chemical dyes laboratory and the historical auditorium.

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Collection of Food Chemistry
This Collection comprises some 100 measurement and distillation devices, used to determine food properties such as density and fat content. There are, for example, viscometers and pycnometers, some of which were constructed at the Institute. Several display cabinets showing food processing and packaging technology are also maintained. The Collection also contains some 250 preparations consisting of plant extracts, resins, fiber materials and salts.

Chair of Food Chemistry
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Visits upon request

- The Collection of Astronomic-Geodetic Instruments
- The Botanical Collection
- The Medical-Historical Collection
- The Dye Collection
- The Collection of Mathematical Models
- The Cartographic Collection
- The “elektron” Collection of Communication Engineering and Precision Technology
- The Historical Acoustic-Phonetic Collection
- The Color Research & Theory Collection
- The Industrial Design Collection
- The Art Collection
- The Collection “Doctors, Patients and Disease in Art”

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