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3/2005 ▶ The Monster of Aramberri ▶ Could There be Life in the Jovian System? ▶ The Stages of "Traditional Enmity" ▶ The Business of Being Princess ▶ New Insights into Fat Metabolism

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In this issue

Is There Water on Jupiter's Moons?

One of the key questions posed by many space missions is: Where else is – or was there once – water to be found in our solar system. Is this fundamental prerequisite for the development of life present on the four Jovian moons, for example? Do Io, Europa, Ganymede and Callisto have large oceans below their surfaces? The information sent back by the Galileo probe was particularly important in the quest to answer this question. For the first time ever, a periodically varying magnetic field was measured, indicating the presence of a salt-water ocean about 100 km below the moon's crust. **Page 8**

War As A Way of Forming Public Opinion

For centuries, the Germans and the French encountered each other primarily on the battlefield. It was thus war that influenced their opinion of each other and the respective image of the other country over the course of many decades. How did these "stages of traditional enmity" develop? **Page 12**

The Enterprising Princess

She had outstanding experience and expertise in agriculture, and used this to bring about an agrarian revolution at the Saxon court in Dresden. Anna von Sachsen, born a Princess of Denmark, was an unusually enterprising Renaissance princess. Not only did she manage about 70 farm estates, but was also an agrarian pioneer. **Page 18**

The Whistle Stop Monster

Aramberri, a picturesque small town in north-eastern Mexico, has – to date – been best known for its unusual variety of cacti. Now it has shot into the international limelight, however, thanks to the discovery of the skeleton of a 50 tonne sea monster (Page 4). Cover: Grousset

Impressum

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In the summer of 2005 Germany's federal and state government leaders approved the "Excellence Initiative", finally putting an end to the political deadlock that had kept the science community holding its breath for well over a year. In January 2004 the then Federal Minister for Education and Research, Edelgard Bulmahn, called for a new start in German science. A competition entitled "Brain up! – Germany's looking for its top universities" was announced. It aimed to find those universities in Germany that were able to successfully compete at an international level and attract the best minds, or had the potential to become an elite centre of learning. This campaign also pointed to the serious problem of the long-term chronic underfunding of the universities and the consequent weakening of German universities as places of research. The president of the Fraunhofer Society, Hans-Jörg Bullinger, compared the situation to the saying "a horse will only jump as high as it has to". In order to increase performance, the bar has to be raised; but at the same time, it shouldn't be forgotten that the means to do so are also required.

It soon became apparent that it was more important to measure the quality of the individual subject areas or departments, rather than measuring the overall performance of a university. After all, even Harvard isn't "number one" in every subject all of the time. In addition to excellence in one's own discipline, peak performance also demands a competitive air.

Over the course of a few months the details of the initiative were drawn up and handed over to science organisations to carry it out: the Deutsche Forschungsgemeinschaft (DFG) and the German Science Council. The funding programme is now based on three pillars: graduate schools, clusters of excellence and institutional strategies designed to optimise the general conditions for university research.

Universities were requested to submit a declaration of intent by 1 August 2005, which, though not binding, would serve to enable peer review panels to be formed in advance. The deadline for submission of draft proposals was 30 September 2005.

In response to the first call for proposals, a total of 319 draft proposals were submitted by 74 universities. These draft proposals were distributed between the three lines of funding as follows: 157 for clusters of excellence, 135 for graduate schools, and 27 for institutional strategies. Twenty international peer review panels, called into being by the DFG, reviewed the 292 draft proposals in the first two lines of funding; the German Science Council reviewed the 27 proposals for institutional strategies.

In January 2006 the Joint Commission, which is made up of members of the DFG's expert commission and the German Science Council's strategic commission, made its initial decisions in the first stage of the proposal process for the Excellence Initiative programme. A total of 36 universities have been invited to submit full proposals for 39 graduate schools, 41 clusters of excellence, and 10 institutional strategies to promote top-level university research. The proposal deadline is 20 April 2006. These proposals will be reviewed over the summer and final funding decisions will be made by the Excellence Initiative Grants Committee on 13 October. Then an announcement will be made as to which of the graduate schools (approximately 20), clusters of excellence (approximately 15), and institutional strategies will receive funding for the five-year period, beginning in November 2006.

What makes these three pillars stand out? Graduate schools are institutions that form an umbrella, under which graduate students are brought together in order to provide the best conditions possible for them to work towards and gain their doctorates. Unlike Research Training Groups, graduate schools are intended to be set apart by their interdisciplinary scientific profile. A graduate school may span several departments, possibly even encompassing the whole university, and may even include local non-university research institutions. A dean of studies and a professional management board will head each graduate school.

Clusters of excellence generally correspond to the DFG Research Centre model. They are based upon outstanding research performance at the proposed location and are not to be mistaken for oversized Collaborative Research Centres. Rather, they should set a particular area of priority, which may also enable the

involvement of non-university research institutions and potentially even universities of applied sciences. The funding provided will be granted to support the establishment of new structures and the required infrastructure, professorships, major instrumentation, etc. International partnerships with other European countries are also a possibility, if this adds value to the cluster.

The third pillar aims to support "institutional strategies to promote top-level research". The main requirement for this line of funding is that at least one graduate school and one excellence cluster are also established under this initiative. Institutional strategies also require a great deal of creativity. They should take into consideration the extent to which the issue of personnel is taken up in the widest sense of the word, in order to make the location attractive for students, researchers and professors, both from Germany and abroad. This may include approaches to research that include a high element of risk, which must ordinarily be funded using the university's own funds. Or, to take a second example, part of this strategy could include instruments to improve the basic conditions for combining family and career, or the conditions for visiting foreign researchers. It would be possible, for instance, to set up institutes of advanced studies for a predetermined period of time, which could include accommodation for students and guests, or new ways of imparting knowledge. It would even be conceivable to consider ways in which science and research could be introduced in schools. A secondary school can even be included as one of the partners in a cluster of excellence. Perhaps the most significant outcome of the whole initiative, from my personal point of view, is that each grant will be accompanied by an additional 20 percent to fund the essential indirect costs that research brings with it. This will, at long last, make it possible to finance projects such as the clusters of excellence without the need to rely exclusively on existing funds, which are often scarce. For those submitting proposals, it will no longer mean making themselves unpopular within their departments, since the indirect costs such as room space and IT equipment will be provided for. Of course, 20 percent doesn't cover all of the indirect costs that accompany research, which are probably nearer 60 percent, but nevertheless it is a good start towards solving this problem. Through this initiative, applicants have the opportunity to utilise the funds in areas where they are needed most or will have the most impact, such as structural or institutional weak points within their institutions.

The second round for the Excellence Initiative programme is due to begin in April 2006 and close in October 2007. The full scope of the programme is envisaged to fund approximately 40 graduate schools, providing an average of € 1 million each year for each graduate school, and 30 clusters of excellence, which will each receive an average of € 6.5 million annually, as well as an as yet undecided number of institutional strategies. A total of € 1.9 billion has been allocated to funding the Excellence Initiative over a five-year period. The DFG and the German Science Council anticipate that this programme will make a significant contribution towards improving the quality of research at German universities, thus boosting their international profile significantly.

Prof. Ernst-Ludwig Winnacker
President of the DFG

Prof. Dr.
Ernst-Ludwig Winnacker

The Excellence Initiative:

High Hopes for Boosting University Research in Germany

The rapid establishment of graduate schools, clusters of excellence and institutional strategies aims to strengthen research in Germany

The Monster of Aramberri

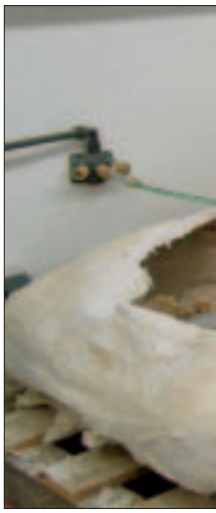
145 million years ago a 50 tonne marine monster prowled the Gulf of Mexico. Its almost complete skeleton is now excavated

Today, it is a picturesque small town with approximately 13,000 inhabitants in the state of Nuevo León in north-eastern Mexico: Aramberri. It has long been known for its unusual cacti. However, Aramberri's fame is for a marine monster that expired its life approximately 145 million years ago in the Upper Jurassic, 1.8 kilometres from today's city centre.

At that time, in the Kimmeridgian, a period of the Upper Jurassic, the bizarre faults of the Sierra Madre Oriental on the outskirts of Aramberri were flat ocean floor 150 to 200 metres below sea level. A continuous rain of fine clay particles mixed with dead fish, ammonites and other marine animals fell into the dark depths to be compacted to a black, stinking mud that rapidly buried and preserved the carcasses of animals. There was almost no oxygen, and no ocean currents reached this lifeless world. Today the black mud has compacted to a brown sedimentary rock of clay and lime, so-called marl bands, which are full of fossils. Calciferous gnarls, so-called concretions, built up around some of the carcasses, protecting the fossils from pressure for millions of years. These fossils are generally preserved in 3D, whereas those in the marl are flat like little decals.

The excavation team in Aramberri is working on an enormous concretion. It has a diameter of over six metres and is almost one metre thick. Visible on the edge are the bluish bones of the gigantic marine reptile that made Aramberri famous. Fragments of the monstrous stone coffin rolled down the entire slope to a dry river bed and now lie amongst cacti and thorn shrubs. In the blazing heat, work progresses with gasoline driven jack hammers, pick axes and pick hammers. During the monotony of hard physical labour the mind has time for fantasies and to travel back in time to when this was still the ocean floor: The bathyscaph shudders. The cables tighten and the research team is slowly hauled upwards. A pliosaurus warning just came in on the radio. In a black muddy cloud the hull of the bathyscaph slowly

At 15 to 18 metres, the pliosaur ruled the Gulf of Mexico. Below: A 450 kilogramme plaster and stone chunk with remains of the marine dinosaur needs to be moved to the valley. Assistants place slings for transport by helicopter. Right: A preparer has opened the plaster casing and is working his way through the rock using an air pressure chisel.



leaves the ocean floor. Dead fish lie everywhere, most of them almost completely buried in the soft silt. The disc-shaped body of a ganoid fish, ammonite shells and the arm of a feather star waft through the rays of the spotlights. Then the research ship "Kimmeridge" increases its speed and heads for Aramberri Island, which lies more than 300 kilometres off the mainland. The water becomes more turbid with every metre. This muddiness permits abundant life in the upper layers of the water. Cool deep currents push plankton over the edge of the shelf and upwards where it mixes with the warmer surface water. There, these microorganisms thrive and form the basis of one of the most multifarious food chains of the Upper Jurassic.

Shoals of fish: In addition to the heavily armoured ganoids, early bone fish dart through the water whenever a shark comes into view. The higher the bathyscaph rises, the more ammonites there are. Most of them hang in the water like balloons. The outlines of ichthyosaurs are also visible. In small groups they drive molluscs such as belemnites before them. The reason for interrupting the mission is still not in sight. They are the most formidable predators the world has ever seen:

the pliosaurs. Just as Aramberri Island becomes discernable in the cloudy blue of the ocean the bathyscaph is rocked by a terrific blow. The four metre long fin that passes before the portholes is immediate proof that the boat has been rammed by a pliosaur. Records and instruments are thrown around the cabin as the bathyscaph rumbles over the back of the enormous, 50 tonne monster. It must be between 15 and 18 metres long. The two pairs of fins move up and down like gigantic wings. Its body with the short tail looks almost like that of a sea turtle. Its neck is almost as long as its body and thick as a tree trunk. Its head is over three metres long and equipped with conical teeth, the longest measuring over 20 centimetres. As the marine reptile turns to the left, one small eye covered by an eyelid is visible in its mighty, scarred head. One of the scars forms a deep groove behind the left eye. Then we stare into its terrifying maw. Pale shreds of flesh hang between the fearsome teeth like paper handkerchiefs fluttering in the current. What happens next send shivers down our spines. It appeared out of the void; none of us had noticed it, not even the pliosaur. Too late the ponderous marine behemoth attempts to change direction when the almost five metre long jaw of a second pliosaur grabs it. Like 40 centimetre long daggers, its teeth sink into the other's skull. The dull crunch of bones penetrates the boat's hull. The small pliosaur pulls its head away as the attacker tries to adjust its grip. It dives under the body of its attacker, leaving a trail of blood in its wake. The mortally wounded pliosaur slowly sinks into the depths as its attacker surfaces for air. It is too massive for a quick turnaround and immediately abandons the pursuit.

"Lunchtime!" This welcome word after a good three hours of back-breaking work brings us back to everyday excavation life. Pure fantasy, you might think. But it isn't. There is certain proof that the monster of Aramberri met its match 145 million years ago. The spines of the vertebrae, which had detached themselves from the body of the vertebrae without breaking, show that

A group photo with the pliosaur. The mayor, municipal council, teachers and students gaze with amazement at the white silhouette of the marine monster. Below: At the Aramberri excavation site, the crew with volunteers and workers have cleared away half the mountain.

despite its length of 15 to 18 metres the pliosaur was a young animal. To date about a quarter of its skeleton has been excavated; the bones provide information about the monster's final weeks. One bite to the head hit the upper side of the left pterygoid bone and broke through, deep into the bone. To have left such a wound, the tooth must have penetrated the entire depth of the skull. To do this the crown of the tooth must have been at least 40 centimetres long. That the bone healed is proof that the monster of Aramberri survived that bite. However, a second wound to another skull bone was fatal: Its edges are sharp, there are no signs of healing. Nevertheless, shortly before its death, the giant pliosaur had luck hunting. Slightly digested bone fragments from a final meal were found where its stomach once was.

What started as a chance discovery in 1985 has now turned into a German-Mexican research project. In 2003 the newly elected governor of Nuevo León provided a helicopter to recover a fragment weighing 450 kilogrammes. He also approved the construction of a road to the excavation site, which was completed during the 2004 campaign.

The pelvis of the pliosaur encased in plaster is hoisted out of the pit and will be moved to the pick-up location using the wooden ladder. Since there are no roads across the impassable terrain to the excavation site, the colossus must be transported by helicopter. Below: Temperatures at the excavation site frequently reach 40 degrees or more in the shade – extreme conditions for the crew.

Now the infrastructure is in place to recover the gigantic concretion that has now been uncovered to a depth of three metres. The outline of large bones is visible on the surface. It is not yet known how deep the concretion projects into the hill, but an excavator will soon answer that question. What type of pliosaur it can will only be determined after it has been prepared. Is it a new species? Is it more similar to European or Pacific pliosaurs? Or is this behemoth unique and native only to the Gulf of Mexico? One thing is certain: It is the largest known and most complete skeleton of a pliosaur that haunted the prehistoric Gulf of Mexico during the Jurassic age, which at that time was hardly 2000 kilometres away from Karlsruhe, where its remains are being prepared and studied today.

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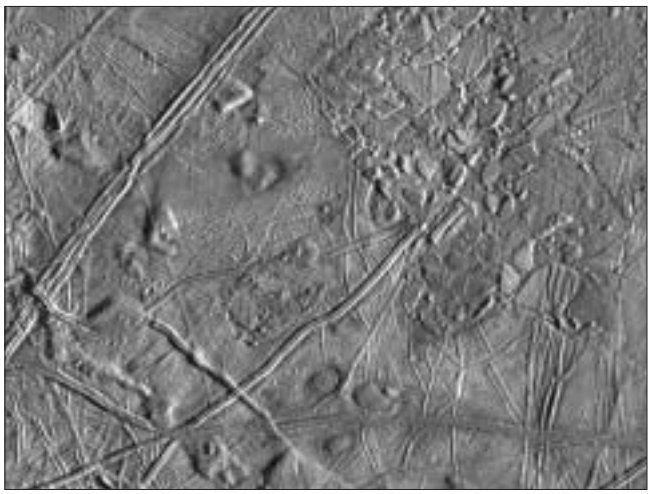
Could There be Life in the Jovian System?

Recent studies indicate the possible presence of sub-surface oceans within the large icy satellites of Jupiter. Researchers use space probes and computer simulations to investigate the evidence

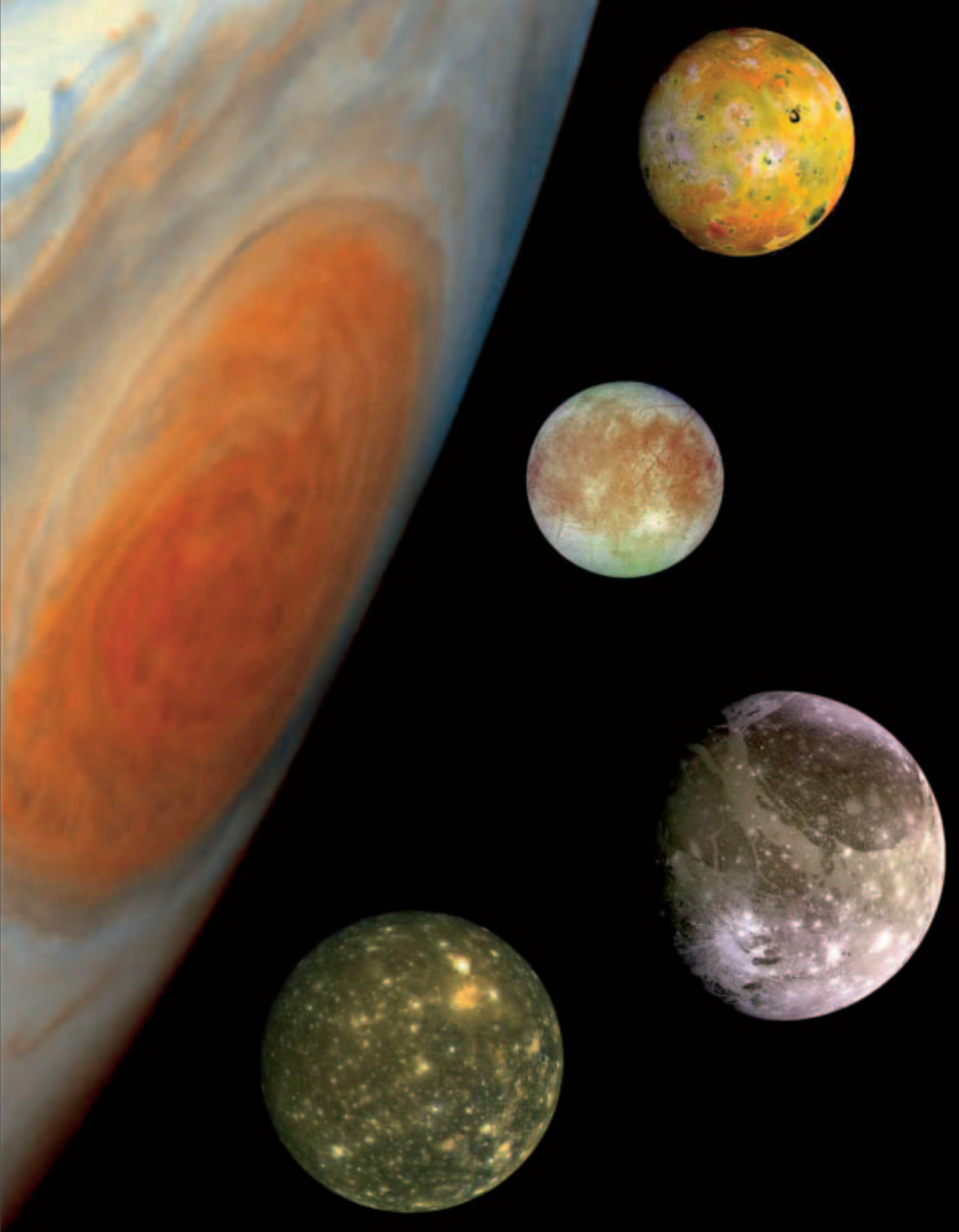
When in 1610 Galileo Galilei discovered the four large Jovian satellites, named the Galilean satellites after him, he saw them as confirmation of Copernicus's heliocentric theory. After all, the four satellites, Io, Europa, Ganymede, and Callisto, which revolve about Jupiter in nearly circular orbits, form a miniature solar system which is not centered at the Earth.

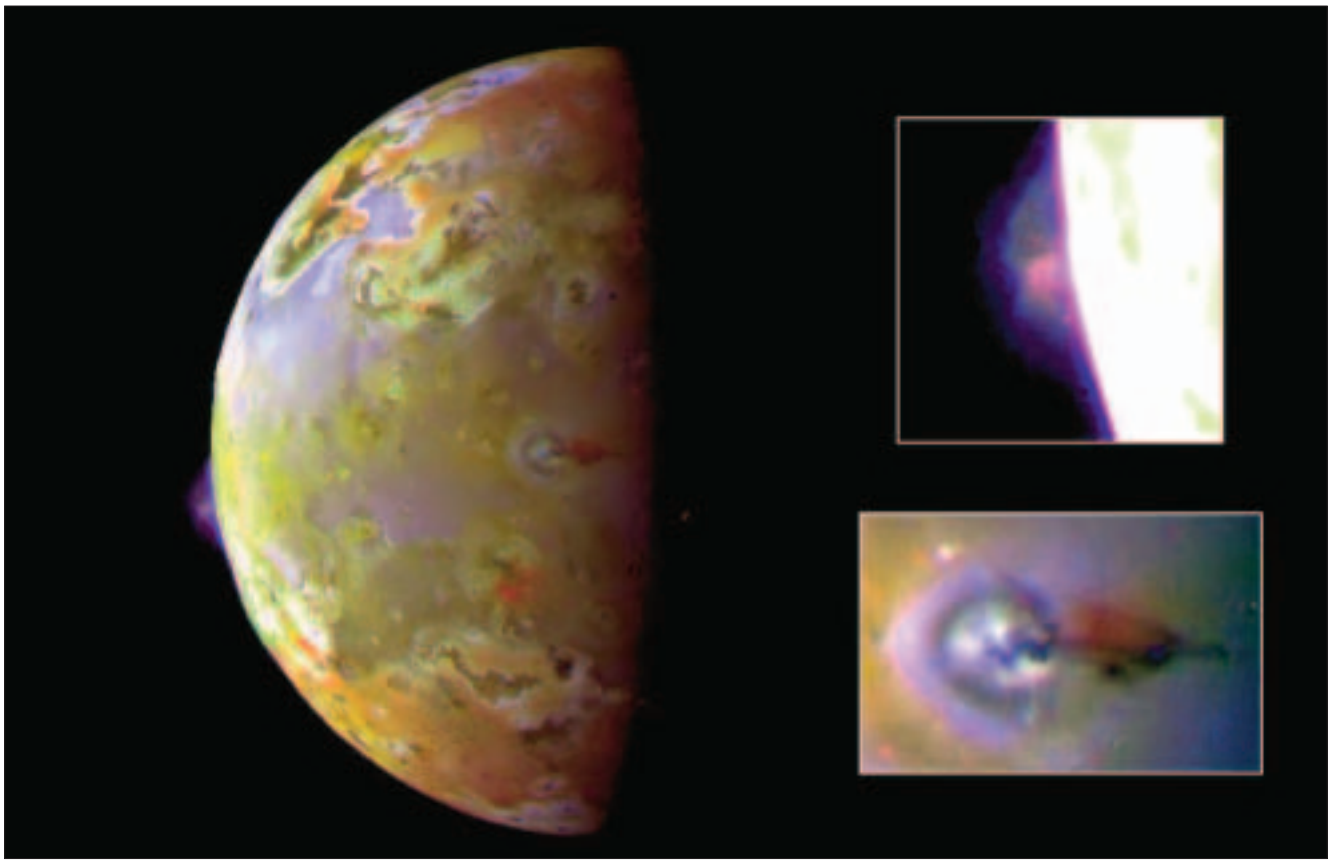


Right: Beautiful and imposing: The four Galilean satellites of Jupiter, Io, Europa, Ganymede and Callisto (from top). Above: Europa's icy surface is marked by a variety of geological formations – a clear indication of geological activity in the not too distant past. This picture covers an area of about 14,000 square kilometres.

Nowadays we not only look at the planets and their satellites through telescopes, such as the Hubble Space Telescope, but also send robotic explorers out into space in order to study the celestial bodies up close. As far as the Jovian moons are concerned, the Galileo spacecraft, which orbited Jupiter from 1995 onwards and conducted multiple flybys of all of the Galilean moons before it was deliberately crashed into the planet in September 2003, is particular noteworthy. One of the key questions posed by this and other missions is where water can be found in the solar system or where there once was water, which is thought to be essential for life to develop. The new clues indicating the presence of large oceans below the surfaces of Europa, Ganymede and Callisto are particularly significant. The most convincing argument for this are induced magnetic fields around Europa and Callisto, measured for the first time by the Galileo spacecraft. Because Jupiter's magnetic poles are tilted relative to its axis of rotation and its satellites revolve in its equatorial plane, they are subjected to a periodically varying magnetic field. The presence of electrically conductive layers within the moons would cause Jupiter's powerful magnetic field to create electrical currents within the moon, and those currents in turn would create a secondary magnetic field around the moon. Data recorded by Galileo show that such layers exist at a depth of about 100 kilometres. This suggests the presence of water oceans, in which dissolved salts act as an electrolyte.

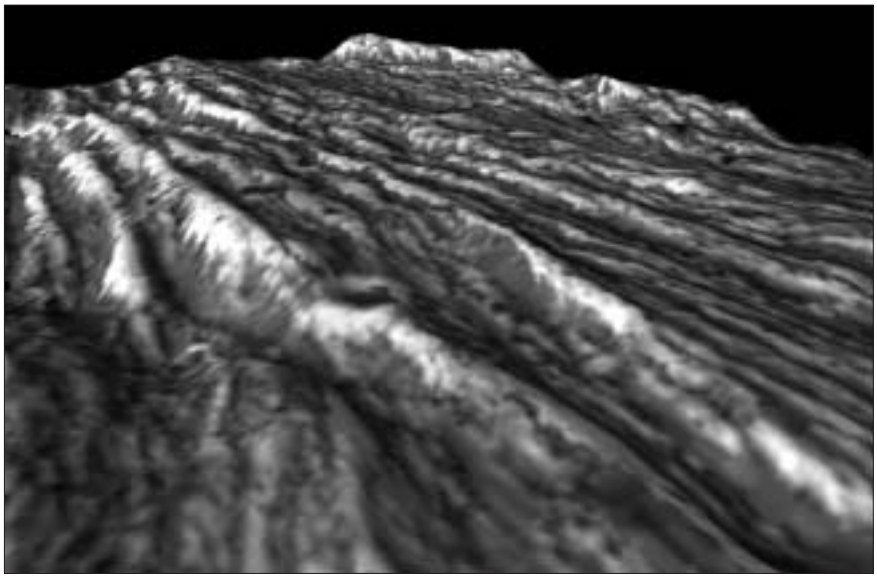
Almost all of the moons in the outer solar system consist of rock and at nearly equal shares, the latter of which is primarily water ice along with some methane and ammonia ice. This can be inferred from their densities, measured by the two Voyager probes launched in the 1970s. Galileo measured the gravitational fields of Jupiter's large moons more precisely. This data can be used to model their internal structure indicating that, with the exception of Io, the moons are encased in a crust of ice and water. On Europa the outermost water-ice liquid shell is about 130 kilometres thick according to these calculations and on Ganymede and Callisto about 600 to 700 kilometres thick. On Europa and Ganymede there is a rocky metal/silicate core below the outer ice shell. If one assumes that these moons formed from more-or-less homogeneous mixtures of ice, rock and iron, then it is apparent that these components have separated out over time. Callisto, on the other hand, appears to be composed of an ice-rock mixture both inside and out, much as it originally would have been. As is the case for any planetary body, pressure rises with increasing depth within the Jovian moons. In Ganymede's and Callisto's ice shells the pressure becomes so great that layers of high-pressure ice, of





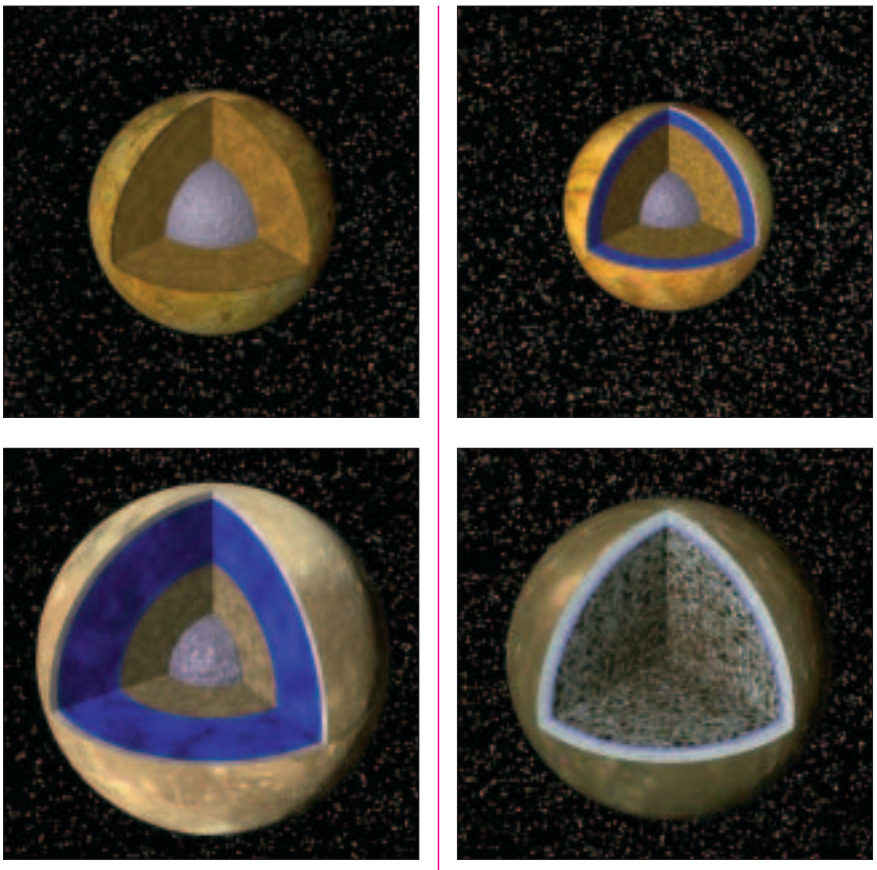
Tidal friction within Io causes intense heating and volcanic activity. The heat flux within this Jovian moon of several Watts per square metre is around 20 times greater than that on Earth. Below: Grooved terrain on Ganymede. Ganymede has highly cratered areas, as seen on Callisto, as well as younger tectonic deformations.

different crystal structure and higher density, form. The formation of oceans is possible due to a familiar characteristic of ordinary low-pressure ice I, whereby the melting point decreases with increasing pressure (this phenomenon is what makes ice skating possible, since the pressure from the ice skate causes a layer of molten water to form). If the temperature and pressure are sufficiently high within the moons, then an ocean could form between the ice shell on the surface and the high-pressure layer of ice, since the melting point of the ice rises again with increasing pressure in the high-pressure phases. But how can temperatures within these moons reach or even supersede the melting point of ice? The surface temperature of the Jovian moons is approximately minus 173°C, and thus about 150 degrees below the lowest melting point of pure ice. However, it is possible that the melting point is even further depressed if the ice in the satellites is not pure H_2O, but contains other components such as ammonia, methane, and/or salts. Heat is also generated within the moons by the decay of radioactive substances with a long half-life, which are contained in the rock. Computer simulations have shown that the temperature of the ice may rise to just a few degrees below zero, which would explain how the



oceans could come about thanks to the heat generated.

In the case of Europa, the heat generated by tidal friction also needs to be included in the energy balance. Tidal friction is friction within the moon's interior, brought about by the tidally induced deformation caused by Jupiter's enormous gravitational acceleration. Although the amount of heat generated in Europa is thought to be less than that caused by Jupiter's tidal flexing of Io, whose orbit is much closer to Jupiter (the volcanic activity and the heat generation resulting from tidal flexing on Io is far more vigorous than that on Earth) computer simulations show that the heat generated by tidal friction in Europa's ice shell could exceed that generated by radiogenic heating. It is impossible to predict a precise thickness of the ice layer since the properties of the ice are not sufficiently well known. It is fairly safe to assume, however, that the ice layer would be no more than 50 kilometres and no fewer than a few kilometres thick. If these estimates are correct, then the oceans would be from a few tens of kilometres up to over 100 kilometres deep with the rocky core at the bottom. The oceans in Ganymede and Callisto are probably covered by significantly thicker ice sheets of 100 kilometres or more in thickness, since tidal heating would be negligible due to their far greater distance from Jupiter. Numerous geological features on the surface of Europa suggest the presence of a layer of liquid water underneath the cold icy crust covering the surface. For example, impact craters on Europa look different from those on other icy moons. The particular crater morphology is currently best explained by a weak, mobile layer beneath the brittle icy crust at the very surface. Such a layer could possibly be water, or slush, capable of flowing, beneath the moon's icy surface. However, the magnetic field measurements and the thermal simulations rather suggest the presence of an internal ocean. No such geological clues exist on Ganymede or Callisto. Since the oceans would be at much greater depth on these moons, this



The internal structure of the Galilean satellites. With the exception of Io (top left) all of them have a high proportion of ice or water.

is not unexpected. Europa is particularly interesting as a candidate for the possible existence of life in its oceans for two reasons. Firstly, tidal friction provides an effective source of heat. Secondly, the moderate depth of the ocean allows comparatively simple measurement by future missions. Estimates have shown that the tidal heating could meet the energy requirements of a primitive biosphere. What remains unclear at present is whether Europa's ocean could have existed for long enough, in other words, for billions of years, in order to allow enough time for life to evolve. To answer this question it is necessary to examine the moons' heat balance and orbit trajectory together. In doing so interesting interactions between Jupiter's three inner moons become apparent. Due to their resonant orbits, called Laplace-resonant orbits after Pierre-Simon, Marquis de Laplace, the French mathematician and astronomer who explained the phenomenon, the moons transfer energy and angular momentum. On the one hand, this results in a particularly stable orbit configuration. On the other hand, it allows non-linear feedback to bring about periodic oscillations in Europa's orbit and thus heat generation within Europa. This causes variations in the thickness of the ice crust. Computer simulations, however, have shown that complete freezing of the ocean is also prevented over prolonged periods of time. Europa therefore remains a key candidate – alongside Mars – in the search for extraterrestrial life in our solar system.

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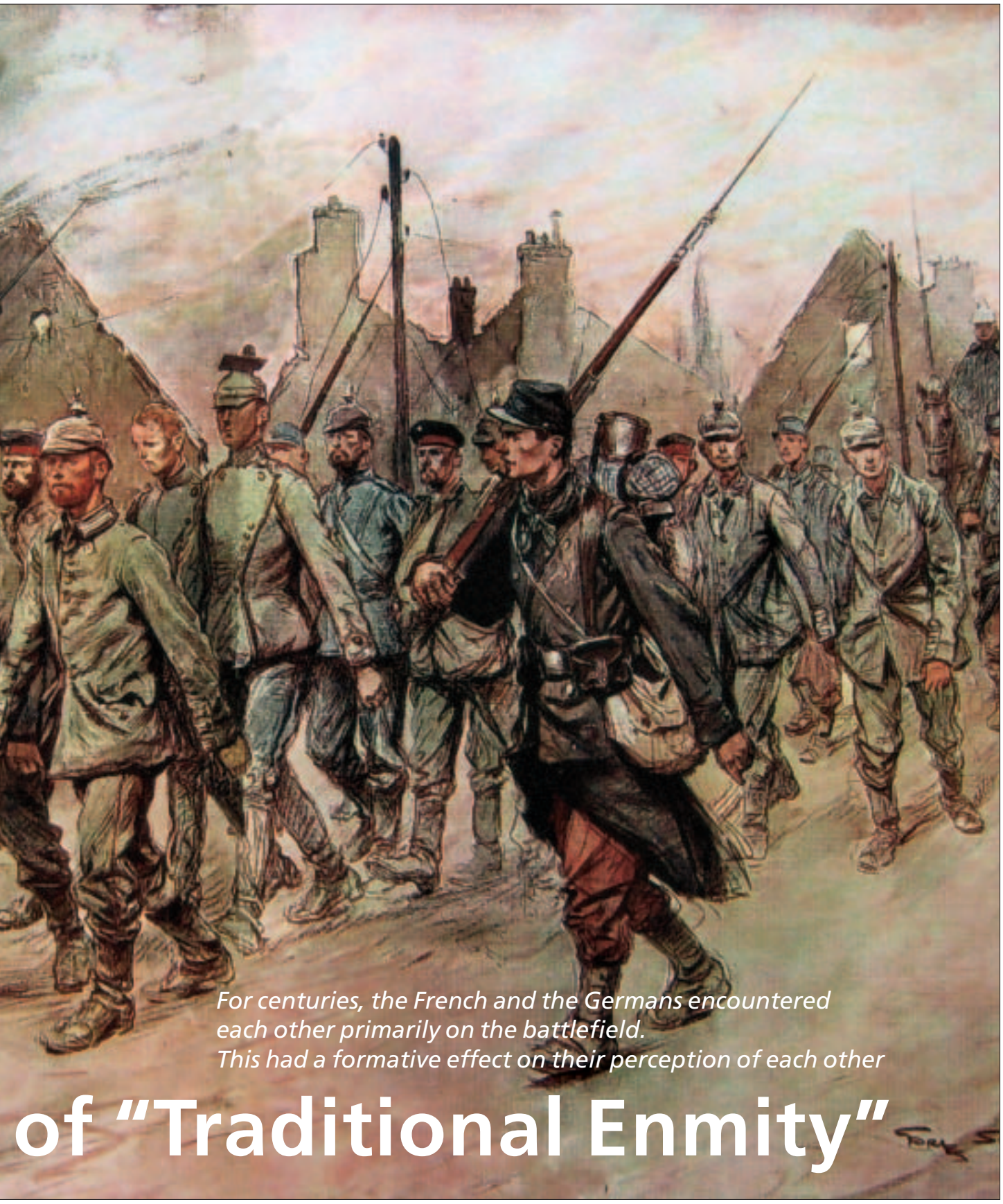
Our accommodation was excellent today. Our hosts were friendly, we ate well and we drank well, very well, Burgundy and Bordeaux wines, as much as we wanted. We've never had such good quarters, and probably never will again. The people were really afraid of us. They thought we were going to kill everybody! But now they've seen for themselves that we're not barbarians, just ordinary people."

In his letter to his wife dated the 8 September 1870 from the campaign in France, Regimental Quartermaster Friedrich Nützel from Erlangen was recounting a story that could equally well have been repeated on a daily basis by innumerable other campaigners about countless other encounters between the German and the French in the 1870-71 war between their countries. Before the advent of mass tourism, the people of these two countries encountered each other most often as a result of war. War was thus one of the most significant factors in how French and Germans came to perceive each other. The Seven Years' War from 1756-1763, the 1870-1871 Franco-German War, as well as the First and Second World Wars all serve as good examples.

When French troops crossed the border in the spring of 1757, they began what was to be a six-year French occupation of German territory. Attitudes to the occupying forces varied from region to region. Inhabitants of the Palatinate, close to the border, remembered how the French wrought destruction upon the region at the end of the Palatinate phase of the Thirty Years War in the 17th century. Now however, the two countries were allies, and the residence city of Mannheim regularly saw them celebrate festivals together at carnival time. In con-

Day-to-day life during the First World War: German prisoners of war are led away by French soldiers. Georges Scott painted this watercolour that appeared in 1914 in the large-circulation French weekly "L'Illustration". Scott rose to considerable fame as a war front artist in the First World War.

The Stages



For centuries, the French and the Germans encountered each other primarily on the battlefield. This had a formative effect on their perception of each other

of "Traditional Enmity"

Propaganda posters from the Second World War. Right: Advertising for Civilian labour service in Germany. Middle: The National Socialist [Nazi] agitators call for the manpower "to save Europe from Bolshevism". Bottom: Trying to improve the negative image of the German soldier: "Refugees! You can trust German soldiers"

trast, northern parts of the country, such as the state of Hannover, had never known occupation by French troops.

Contacts between the military elite of both sides were typical of the time: across Europe, members of this elite recognised each other, and were bonded by the business of war, not by national identity. After a pitched battle, high-ranking officers from both sides would meet and discuss in inns or in ducal drawing rooms. At times they would meet as fellow-travellers, at other times as prisoners of war who had been released upon their word of honour. Or they might tear a leaf from the King of Prussia's book, and correspond with each other.

Contacts between soldiers and civilians were governed by logistics requirements. The length of occupation varied from region to region – from the eight month occupation of Hannover, through the three years in Göttingen to the continuous six year presence in the western Prussian provinces along the Rhine. The French military supply system, reliant on field magazines, only functioned in the early stages of the war. By no later than 1761 disorderly confiscation, commandeering and plundering had become commonplace. Taking of local councillors as hostages in order to extort money was frequent, and at times took on such proportions that local administrations almost broke down. Atrocities by the French, such as rape and murder remained the exception, however. Off the battlefield, it was understood that civilians and soldiers would stick to the conventions of war, of which two points were non-negotiable: firstly, civilians were not to be involved in combat, and secondly, they would supply the armies with food and provisions.

The 1870-71 Franco-German War took place in two phases, with varying degrees of confrontation between the two sides. In the first phase, from the start of the war in July 1870 until the Battle of Sedan on 1 September 1870, the Prussians and their allied troops fought against the troops of the French Empire. The German army's initial thrust was followed by the occupation of defeated *departements* and this resulted in a great deal of contact between German soldiers and French civilians at all levels.

The German army fed itself largely from the conquered territory and was certainly an economic motor due to the money it spent in France. The French civilian population, on the other hand, had to put up with billeting officers and the confiscation of personal property and food. If a village refused to provide what was required it would come under punishing fire. Nevertheless, the basic unwritten law, which stated that the lives and property of civilians not involved in combat were to be protected by the rules of war, applied. The German proclamation of 1870 promised the civilian population protection, but at the same time threatened them with severe punishment, should they take up arms against the German army, or engage in spying for their own side.

The second phase of the war lasted from the collapse of the Empire on 2 September 1870 until the armistice in January 1871. At this time, there were already several hundred thousand French prisoners of war on German soil. They enjoyed some limited contact with the civilian population. The prisoners of war were interned in fortresses or camps. Only some of the officers were accommodated in private homes.

The founders of the newly established Third Republic in France recruited fresh volunteers in the autumn and winter of 1870. Although it would be an exaggeration to speak of a popular uprising against the occupying forces, the German army nevertheless found itself confronted by new soldiers and unexpected combat tactics. The "franc-tireurs", as the Germans called the

An easily remembered image of misery: German prisoners of war herded together like cattle to spend the night behind barbed wire. The painting by Lucien Jonas dates from 1917. Temporary camps were often set up behind the front for prisoners of war to await their transportation.

new troops (an oversimplification) sabotaged railway lines and attacked transports. Some of these fighters neither wore uniform, making them indistinguishable from civilians, nor were under the command of an officer.

The German army responded with increasing pressure on the civilian population, whom they could now no longer consider generally peace-loving. Whole villages were burnt down because they were suspected of having franctireur hideouts or ambush points. Civilian hostages were tied to locomotives in order to protect trains and railway lines. The German fear of what came to be called "the little war" continued until the First World War.

The historical remembrance of the franctireur troops in the 1870-71 war set the backdrop for the taking of hostages and the mass executions of civilians, as well as the destruction of cultural monuments by German troops, which happened especially during the mobile phase of the war in August and September 1914. French newspapers reported the "atrocités allemandes" on an almost daily basis. Surprised by the fierce resistance of the invaded country and the destructiveness of the attackers in this industrialised war, both sides accused each other of mistreatment and mutilation of prisoners of war and casualties.

During the static phase of the war, which began in November 1914, opposing soldiers faced each other in trenches sometimes less than a hundred meters apart. Being this close to the enemy did no more to cast doubt on the image of Germans as barbarians than personal contact with German prisoners of war. It did, however, result in isolated acts of humanity, such as the arrangement of spontaneous ceasefires to allow for recovery of the wounded.

Contact between the German military and the French civilian population occurred above all in the ten *departements* in northern and eastern France that fell under German military rule in 1914. In an age before radio, the border regions were almost completely isolated from the rest of France right up until their liberation. The occupied territories served as a source of supplies and provisions for the German army, as well as being a transit zone and rest area. The behaviour of the German soldiers towards the local inhabitants depended on the type and duration of their mission. It ranged from indifference through arrogance to outright aggressiveness when war-suitable materials and large mansions and private rooms were commandeered. Although isolated instances of resistance by civilians against the occupying forces were punished by deportation, imprisonment or death, there was no repetition of the excesses of the initial weeks during the four years that occupation lasted

German occupying soldiers in France during the First World War: Rude German soldiers invite the lady of the manor to join them in drinking to the Kaiser's health. This affront forces the genteel women to rise stony-faced from the table. The painting is entitled "Courtoisie boche" ("German courtesy") and was painted in 1915 by Lucien Jonas.

in some places. It was only during the German retreat in the spring of 1917 and the autumn of 1918 that entire regions in the occupied areas were systematically destroyed.

After the invasion of France in May 1940 the German army succeeded in forcing the French forces to capitulate after a relatively short campaign. The static war with many casualties, dreaded by many after the experience of the First World War, did not take place. Hundreds of thousands of people fled before the advancing German troops, with the "atrocités allemandes" of the First World War in mind, fearing atrocities by the German soldiers. The act of occupation, however, passed without great bloodshed. The country was divided into several occupation zones and a German administration was put in charge of them. In southern France the Vichy Regime under Marshall Pétain ruled, collaborating with the occupying forces. German rule lasted for nearly four years, during which it was able to exploit France's economy and implement its racist policies.

The destruction of Reims Cathedral in 1914 infuriated the French, who for a long time held a bitter grudge against the Germans as a result. Not only the French viewed this act, which took place at the beginning of the First World War, as evidence of the German Army's "barbarism" and "lack of culture". In propaganda literature "Reims" crops up time and time again.

German control was maintained by a relatively small but nevertheless constant military and police presence. Broad sections of the French elite collaborated with and thus supported the effort of the occupying forces to maintain "law and order". The vast majority of the population remained reserved and passive toward the Germans, especially since only a minority of the French population – Jews and communists – were exposed to persecution. This reserve was reinforced by intense propaganda on the part of the Germans and the Vichy government.

Only an infinitely small minority offered active resistance, which in the first place was met with disapproval by the majority of the population, because it always led to ruthless reprisals by the occupying forces such as executions of hostages.

Only from 1942 onwards, when increasing numbers of French citizens were forced to go to Germany for "labour service" ("Arbeitseinsatz"), did the "Résistance" gain in popularity. A partisan war developed, to which the occupying forces responded with increasingly vicious reprisals.

The day-to-day experiences of the French civilian workers and prisoners of war in Germany – at times numbering more than 1.3 million – varied immensely. Their working and living conditions were nevertheless far better than those experienced by the Eastern Europeans – they could even, to a limited extent, develop personal relationships with Germans. The French labourers were, however, also the object of resentment by racist "Volksgenossen" as well as being at the mercy of German security and police authorities.

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Of Anarchy in Apian Society

Biologist Peter Neumann, from Halle, is studying social parasitism among South African honeybees

Some of the earliest objects of Neumann's curiosity were wasps and ants which he observed on the beach during long summer holidays at the Baltic. Even as a young child, Peter Neumann was captivated by what ants are able do with something like a piece of chocolate. But that was just the beginning. Later he wanted to "know more about the colourful life of colonies of social insects," he recounts with a slight Berlin accent, "and to understand how the many social layers, for instance in a colony of 30,000 bees, function."

The privatdocent at the Zoological Institute of the University of Halle-Wittenberg is fascinated by the biology of honeybees. "You have to see it – it's wonderful," says Neumann, and hurries from the conference table in his office to a cross-sectional model of a honeybee the size of a violin case. This tall, young scientist can explain the anatomy of a worker bee as vividly as his studies describe European and South African bee species.

As the recipient of an Emmy Noether fellowship, Neumann studied the characteristic behaviour of the South African "Cape honeybee" *(Apis mellifera capensis)*, and within the framework of his DFG independent junior research group, he studied "social parasitism among honeybees". The parasitism of the Cape honeybee consists of its female worker bees taking over colonies of other honeybee subspecies. They establish themselves as "pseudo-queens" in the foreign colony and lay their own fertilised eggs. Workers laying eggs means that "the normal role allocation in the hive, namely the queen being responsible for laying eggs, and the female worker bees being responsible for

nest building and foraging, is turned upside down," explains Dr. Neumann. The consequence is anarchy in the apian society: The population of the host colony declines and normal operation of the hive collapses. The consequence of this is that over 100,000 infested bee colonies were destroyed in just a single year of observation, and migratory beekeeping in northern South Africa is set to collapse. In close collaboration with South African scientists, Neumann was able to decode "the social-parasitic reproduction cycle". Based on modern molecular genetic analyses, the research also offers the opportunity "to study the evolution of social parasitism in real-time using the Cape honeybee as a model". This is a new piece in the evolutionary puzzle.

Born in 1967, Peter Neumann studied chemistry and biology at the Technical University and the Free University of Berlin. His research took him to Uppsala and Sheffield, before he was awarded a doctorate at the Martin Luther University in Halle-Wittenberg in 1998 for his thesis on apiculture. As a postdoctoral student he spent two years conducting research at Rhodes University in Grahamstown, South Africa. On his return to Germany he entered the second (domestic) phase of the Emmy Noether programme in the spring of 2001 and established the independent junior research group mentioned above. At the same time he qualified as a university lecturer in Halle. Since 2005 he has coordinated a network researching the "small hive beetle", which was funded by the German Federal Ministry of Consumer Protection, Food and Agriculture.

The rather nondescript, shiny black hive beetle, about six millimetres in length, is a comparatively harmless bee parasite in its native South Africa. However, it poses a serious threat to bee colonies on other continents. Introduced through the international bee trade, the parasite has already caused damage in the millions in North America and Australia, and it seems only a matter of time before the beetle reaches Germany. So, in addition to information campaigns, it is now more important than ever "to research the as yet unknown biology of the small hive beetle as well as new and modified methods of pest control," stresses Neumann, adding that "basic researchers, apiarists and environmentalists need to work together to counteract this threat." One thing is certain: Neumann's research on the biodiversity and evolutionary ecology of invasive species will make a significant contribution.

Rembert Unterstell

In this column we publish occasional articles on outstanding young researchers.

The Business of Being Princess

Anna von Sachsen was a Renaissance princess with very good business competence. She used her experience and expertise in agriculture at the Dresden Saxon Court to bring about an agrarian boom

All that can be heard in the reading room are keyboards clicking and the occasional whisper. The Saxon State Archives in Dresden, like any other library, is a place of quiet and dedicated concentration. A researcher in the history of women's development is searching through old hand-written documents for evidence and accounts of authorship by women.

Princess Anna von Sachsen (1532-1585) left us a great many such documents: her correspondence runs to some 16,000 German-language letters and copies of letters, written to princes and princesses, administrators and people at court. They are real-life, everyday documents: transactions, queries, news, suggestions and advice, instructions and replies to other people's letters.

They bear testimony to the energy and dedication of a Renaissance princess, of her vitality and competence in politics, theology, botany, and what is even more out of keeping for a princess, agricultural and

agrarian affairs. This kind of expertise on the part of a woman, in landscaping, in farming and economics, was hitherto unknown in the history of agriculture.

Anna von Sachsen lived from 1532 until 1585, a time of vigorous intellectual change brought about by the Reformation as well as the Renaissance, which had gradually crossed the Alps from the south. Ancient documents, including documents about agriculture, were coming to light during this period and were often eagerly emulated. Printing made it possible for ancient documents to be widely disseminated.

Knowledge and expertise were not only taught at universities, but also at court, in craftsmen's workshops, in convents and on country estates. Anna von Sachsen, born Princess of Denmark (from the House Oldenburg), studied botany and the art of healing through plants in her youth, and very probably learnt the basis of landscaping and the progressive methods of Danish agriculture.

This is borne out by her competent management, of some 70 large-scale farm estates working from the Elector's Court in Dresden. Women of Princess Anna's rank were educated and trained for "management positions". As Consort to the Archduke Prince August von Sachsen (1526-1586) she belonged to a royal family with sufficiently considerable political power to be able to appoint Heads of State of the German Holy Roman Empire.

Anna was a second generation Protestant. Her letters convey a sense of responsibility, as Princess Consort for a positive outcome of the religious revolution. Anna's interest and involvement in economics was closely linked to the new religious doctrine. In the Protestant principalities, economic activity and competition from the Church was largely neutralised. Martin Luther elevated marriage as an institution. It became a nucleus for exercising economic dominance and dedication. The Prince and Princess were now to be seen as a conscientious husband and wife team working together. The ideal qualities of the Christian wife had always been meekness and obedience; to these the Protestant ideology added the practical qualities of diligence as well as the ability to work with numbers. In this respect, Anna, as a Protestant "patroness", contributed greatly to the Prince's economic policies. Anna's initiative can be said to be behind the large-scale country farm-estates (or "projects" as they were then called) becoming strong and independent self-managed affairs from 1568 on. Anna appointed new regional administrators, as well as a professional advisor, the Saxon aristocrat Abraham von Thumbshirn, with whom she discussed her ideas and her goals.

A ruling couple such as Anna and August von Sachsen operated according to sound economic principles, and formed a joint enterprise. A large proportion of their income came from the produce of the labour of the rural serfs working on their farm-estates. Tax revenue was small.

If we wished to illustrate their situation by drawing a comparison with a modern-day example, we could imagine the German Chancellor and his wife as being managing directors of a car manufacturer. The entire Court would be like the Federal Chancellery or any other governing body, but supporting itself by its own resources. Sixteenth Century documents reveal the most astounding economic everyday realities at the Elector's Court in Dresden, such as when Anna orders the transfer of 200 sheep to Dresden, destined for the Court kitchens or when she authorises, in minute detail, a project administrator to use Saxon forest wood for repair work on a barn-stable roof, we find it hard to imagine that people of ducal rank could concern themselves with such trivial details. However, it does show us the painstaking care needed when managing natural resources such as forests, sheep pastures and arable land. Practically everything that was consumed at the Court in Dresden was the fruit of its own economic activity. Anna personally saw to it that butter and cheese production surpluses got

Left: Princess Anna von Sachsen. Her portrait is drawn from the altarpiece of the Princess' family by Lucas Cranach the Younger. She was active as an agrarian pioneer at the Elector's Court in Dresden, where, in 1570, there also appeared the first German-language manuscript of agrarian studies.

good market prices. Whenever Anna and August travelled from Dresden to take the waters in Karlsbad in Bohemia, as in the spring of 1750, they took with them large quantities of fish, caught in the streams and rivers of the Erz Mountains and then sent along in barrels. Even when they journeyed to other places, such as the imperial parliament, their provisions came from Dresden. A full set of cooking utensils was taken along, and even a field stove. They were the last word in modern logistics. The Saxon economy functioned like a de facto command economy. In Anna's letters to her aristocratic administrator, this cannot be disguised, in spite of her respectful tone. She might address him as "Dear Esteemed Friend": he nevertheless had to follow orders from above, for example, all produce from the projects was to be accounted for in terms of monetary value, even when intended for consumption at the Court of the Prince. Economic expertise, which was then known as "housekeeping" or "oeconomia", in Anna's day, above all meant land and house husbandry. Like many forms of knowledge that today are taught in universities, transmission was largely oral. It was only towards the end of the 16th century that the first written agrarian studies began to appear, setting themselves apart from the writings and examples of Antiquity by serving to record contemporary experience. We owe the earliest examples of this type to the Saxon Court at Dresden. The anonymous manuscript *Haushaltung in Vorwerken [Estate Farm Husbandry]* (ca. 1570), is a 366 page folio volume. This was the first book

The ornately decorated frontispiece of the first Saxon Book of Herbs, thought to be commissioned by Princess Anna in 1563.

in common language that dealt with agrarian practice in a German region. Subsequent printed works on agricultural management were to draw upon this manuscript. To get an idea of the way in which Princess Anna contributed to the development of Saxon agriculture and agrarian studies in Dresden, we need to carry out subtle text collation. One important criterion is *Rechenhaftigkeit*, the belief and the ability in computation. This was as characteristic of the Prince and Princess as *Haushaltung in Vorwerken.* A good example of this is the way that the year-round exploitation of a single head of sheep was worked out to the last Heller.

One of the most surprising documents in agrarian history is to be found among Anna's correspondence with her administrators. In one register, dated 9 October 1570, there is a detailed list of seeds, along with techniques for sowing fields manured in different ways. This is probably documentation relating to the start of a field trial campaign. The variables in these manuring equations were cow and sheep dung, as well as direct pasturing of sheep, known as "penning". Anna learnt from experience, but also by exchanging knowledge with friendly principalities, Saxon noblemen and rural serfs. Occasionally she kept her knowledge to herself, as today one might keep an industrial secret, partly because of possible economic advantages. Anna and August, Saxon Prince and Princess and working team, were not averse to magical practices, in political as well as economic matters. One divining technique widely resorted to at that time was geomancy. But above all, the Princess was a religiously devout woman as well as a capable businessperson. She believed in the omniscience of heaven, and in divine providence. After receiving an administrator's report concerning a ruined harvest in the summer of 1569, she remarked with sagacious confidence "The Almighty Father's future harvests will be all the more abundant".

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New Insights into Fat Metabolism

Being overweight is one of the main risk factors for diabetes. What role does the distribution of fatty tissue in the human body play? Modern imaging processes are providing new answers

Desk work, minimal physical recreational activity and high-calorie nutrition – who is not familiar with daily life in our affluent society? However, our modern lifestyle has its price. Diabetes mellitus type 2 is a widespread disease that has increased drastically in recent years. At this time, approximately six percent of Germans are suffering from this disease. Researchers estimate that in Germany, eight million people will have the disease by the year 2010. Although formerly known as adult-onset diabetes and usually only occurring in people over forty, today more and more young people are affected by the disease.

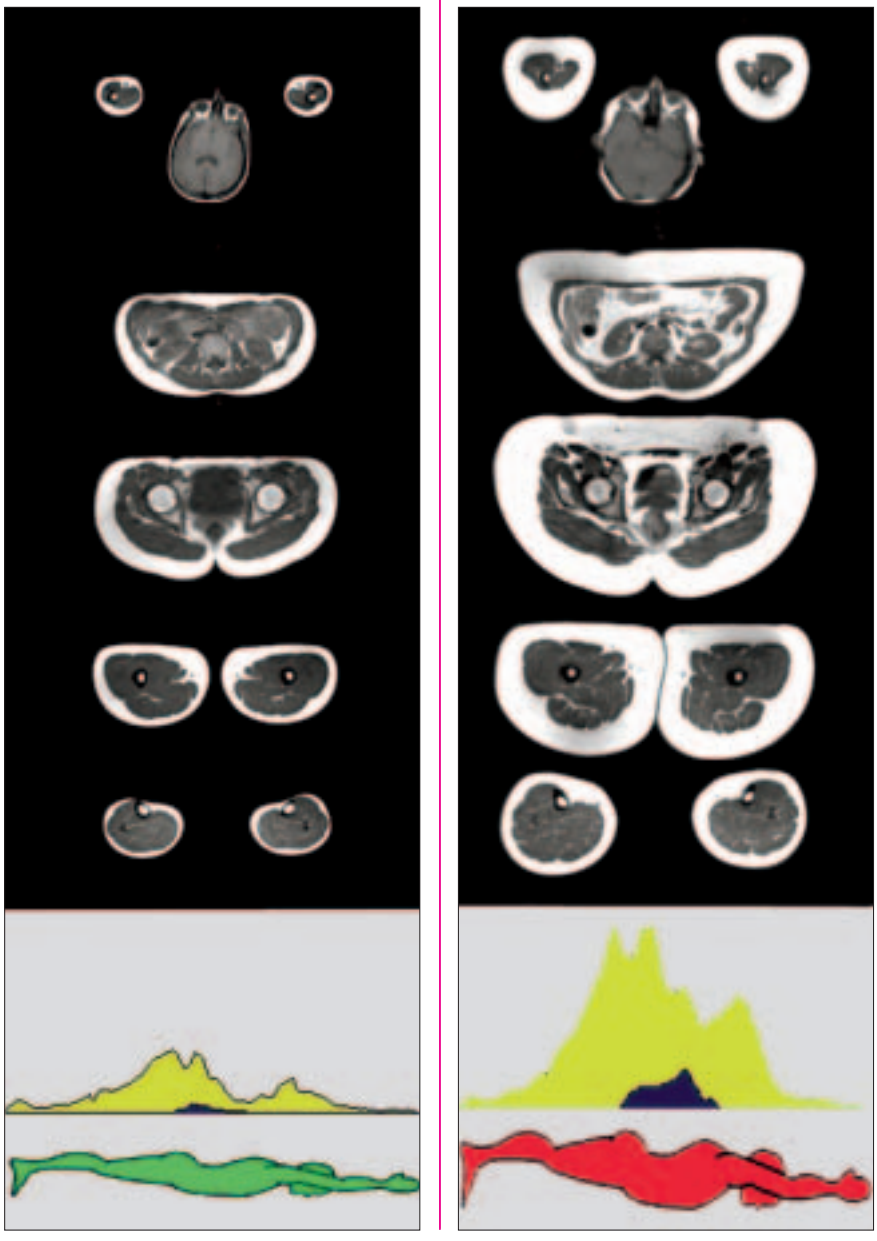
Besides having a direct adverse effect on health, diabetes also significantly increases the risk of strokes and heart attacks and, thereby increasing the costs of the health care system. Not least for this reason, the prevention of diabetes is of paramount importance. Researchers are looking into the possibility of determining the personal risk profile of each individual in order to provide targeted and systematic preventive treatment for people at high risk. Ideally, the possibility of individual prognoses would aid in determining the necessity and tolerance of various preventive measures.

In addition, the decrease in the production of insulin, a hormone that lowers blood sugar levels, the decrease in the effectiveness of the insulin, so-called insulin resistance, is one of the dysfunctions that are the result of diabetes mellitus type 2. The end result is a decrease in the sensitivity towards insulin of, in particular, muscle, liver and fatty tissues, which is most frequently observed in overweight people. Since approximately 85 percent of patients with diabetes are overweight, the excessive accumulation of fat in tissue (also called adiposis or obesity) is seen as the most significant risk factor for inducing the disease. On the other hand however, there are people whose blood sugar levels are not elevated or are relatively sensitive to insulin despite being markedly overweight. So which factors in fatty tissue are associated with insulin resistance? What causes the different levels of insulin sensitivity in people with the same amount of body fat? What role does the distribution of fatty tissue in the human body play? Scientists at the University Hospital of Tübingen are

Examination with a magnetic resonance (MR) tomograph. In order to determine the distribution of body fat, the subject is passed step by step through the tomograph in a ventricumbent position with outstretched arms. This permits the entire body, from the fingers to the toes, to be scanned.

searching for the answers through the Tübingen Lifestyle Intervention Programme (Tübinger Lebensstil-Interventionsprogramm, TULIP). The subjects, primarily overweight people as well as first degree relatives of people already suffering from diabetes, are participating in nutrition and sports programme lasting two years with the objective of losing weight and improving their physical condition. The study began in the summer of 2003; in the first two years alone 250 participants were examined.

One important aspect of the TULIP study is to record measurable data concerning the fat distribution prior to and after the lifestyle changes. To date, the standard procedures for measuring body fat were weighing under water and the so-called DEXA method. The underwater method utilises the different specific densities of body tissue. The DEXA method assumes that different body tissues attenuate x-rays to varying degrees. Hence, body mass can be broken down into lean tissue, fatty tissue and bones. In addition, less price intensive processes have become established that require no radiation and are based purely on statistics. However, none of these methods can reveal information regarding the distribution of fatty tissue in the body. In fact, according to recent discoveries, not only the percentage of fat in overall body weight is decisive as to whether or not a person will develop insulin resistance but, furthermore, where the fat is stored in the body.



The body stores fat primarily in the subcutaneous fatty tissue and the abdomen. Normally there is a balance between the breakdown of fatty acids and fat storage in cells. However, in obese people this balance is disturbed. Not only the actual fat cells build up and break down fat when there are too many fatty acids in the blood, other organ cells also store fat for reasons which are still unknown; these cells are frequently so disturbed that their reaction to insulin is impaired. Therefore, the fat concentration of various organs that normally contain hardly any fat but are, nevertheless, primarily affected by insulin resistance, for instance the skeletal muscles or the liver, is of great interest.

As already mentioned, it is therefore necessary to be able to view inside a person and obtain three-dimensional images of the fat distribution from the finger tips to the big toes. The most suitable method for this purpose is magnetic resonance tomography (MRT), which is safe for the organism when specific safety measures are observed. It is one of the most up-to-date imaging modalities and is firmly established as a method of radiological diagnosis.

MRT measures the distribution of hydrogen protons in the body, creating images in every desired level of the interior of the body. This method is based on proton rotation and the associated magnetisation.

Comparison of MR tomograms: On the left: Images of various regions of the body of a slim insulin-sensitive person and (beside it to the right) of an overweight insulin-resistant person. The fatty tissue in the image is significantly lighter. A series of 120 images provides individual fat profiles (yellow) and also shows the abdominal fat (blue).

To measure the latter, the patient is subjected to a very strong but safe magnetic field in a tomograph. When a high-frequency pulse is radiated with the resonance frequency of the hydrogen protons, the magnetiasation's state of equilibrium is disturbed. After switching off the pulse, the patient automatically emits frequency signals enabling a computer to calculate images of individual body layers. Due to the fact that the signals or the "replies of the nuclei" vary in strength and length depending on the type of tissue, they are transformed into the various levels of light intensity of the individual images. In this case, fatty tissue is significantly lighter than other tissue, and its distribution can be seen and measured by means of special evaluation software programs.

In the TULIP study, during a measuring period of approximately 20 minutes, a series of 100 to 120 images are taken of the volunteer in order to measure the proportion of body fat and, furthermore, to identify the different areas containing body fat. In this way, the researchers create individual fat profiles, which also permit the precise determination of so-called visceral fatty tissue which surrounds the inner organs of the abdomen. Due to metabolism, the visceral fat is especially active and its mass is closely associated with insulin resistance and the risk of diabetes.

In Tübingen, magnetic resonance spectroscopy is furthermore used to view miniscule quantities of fat in muscle or liver tissue. The concentration of globular fat droplets in muscle cells is of special interest. Current studies prove that there is a link between this form of fat and insulin sensitivity. Insulin resistant people have a significantly higher concentration of fat droplets than insulin sensitive people. Furthermore, these fat deposits seem to have an effect on glucose metabolism. In addition, they are evidently subject to complex control by hormones and genetic factors. Therefore, it is worthwhile carrying out research to obtain how the fat concentration in the muscles alters with a different lifestyle and whether or not lifestyle change offers a positive effect on insulin sensitivity. The TULIP study has already obtained some results from the examination of fat concentrations in the liver and visceral fat concentrations. After nine months, the first 100 participants had reduced their weight by an average of 2.5 percent, whereas the concentration of visceral fat had decreased by 14 percent and the concentration of fat in the liver by 32 percent. On this basis, a change in lifestyle seems to have a particularly beneficial effect on fat deposits that are crucial for metabolism. In addition, it was shown that the visceral fat concentrations and fat concentrations in the liver are closely linked but each is, at the same time, a separate decisive factor in insulin sensitivity. If a participant had a high concentration of visceral fat at the beginning of the study, he is less likely to be able to improve his insulin sensitivity and his blood sugar level despite intensive improvements in nutrition and increased physical activity.

The combination of various processes carried out by the TULIP study has, for the first time, allowed for the measurement of different types of body fat and a detailed examination of fat metabolism. The long term observation of lifestyle change through nutrition and training programmes offers a unique insight into physiological correlations. Knowledge gained as to the correlation between the distribution of body fat and the course of insulin resistance as well as other measurements, permits conclusions to be drawn as to how the preventative treatment of patients at risk can be individually optimised.

The tomograms are viewed on the screen. The MR tomograph can be seen in the background. The measurements are controlled from the examination room, but there is continuous visual and voice contact with the person being examined.

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The Deutsche Forschungsgemeinschaft

The DFG (German Research Foundation) is the central self-governing organisation responsible for promoting research in Germany. According to its statutes, the DFG serves all branches of science and the humanities. The DFG supports and coordinates research projects in all scientific disciplines, in particular in the areas of basic and applied research. Particular attention is paid to promoting young researchers. Researchers who work at a university or research institution in Germany are eligible to apply for DFG funding. Proposals will be peer reviewed. The final assessment will be carried out by review boards, the members of which are elected by researchers in Germany in their individual subject areas every four years.

The DFG distinguishes between the following programmes for research funding: In the *Individual Grants Programme,* any researcher can apply for financial assistance for an individual research project. *Priority Programmes* allow researchers from various research institutions and laboratories to cooperate within the framework of a set topic or project for a defined period of time, each working at his/her respective research institution. A *Research Unit* is a longer-term collaboration between several researchers who generally work together on a research topic at a single location. In *Central Research Facilities* there is a particular concentration of personnel and equipment that is required to provide scientific and technical services.

Collaborative Research Centres are long-term university research centres in which scientists and academics pursue ambitious joint interdisciplinary research undertakings. They are generally established for a period of 12 years. In addition to the classic Collaborative Research Centres, which are concentrated at one location and open to all subject areas, the DFG also offers several programme variations. Transregional Collaborative Research Centres allow various locations to cooperate on one topical focus. Cultural Studies Research Centres are designed to support the transition in the humanities to an integrated cultural studies paradigm. Transfer Units serve to transfer the findings of basic research produced by Collaborative Research Centres into the realm of practical application by promoting cooperation between research institutes and users.

DFG Research Centres are an important strategic funding instrument. They concentrate scientific research competence in particularly innovative fields and create temporary, internationally visible research priorities at research universities.

Research Training Groups are university training programmes established for a specific time period to support young researchers by actively involving them in research work. This focuses on a coherent, topically defined, research and study programme. Research Training Groups are designed to promote the early independence of doctoral students and intensify international exchange. They are open to international participants. In International Research Training Groups, a jointly structured doctoral programme is offered by German and foreign universities.

Other funding opportunities for qualified young researchers are offered by the *Heisenberg Programme* and the *Emmy Noether Programme.*

Humanities Research Centres were created in the new federal states to improve the existing research infrastructure. These centres have been established for a specific time period and serve to promote interdisciplinary research.

The DFG also funds and initiates measures to promote scientific libraries, equips computer centres with computing hardware, provides instrumentation for research purposes and conducts peer reviews on proposals submitted within the framework of the *Hochschulbauförderungsgesetz*, a legal act which provides for major equipment and the construction of institutions of higher education in Germany. On an international level, the DFG has assumed the role of Scientific Representative to international organisations, coordinates and funds the German contribution towards large-scale international research programmes, and supports international scientific relations.

Another important role of the DFG is to provide policy advice to parliaments and public authorities on scientific issues. A large number of expert commissions and committees provide the scientific background for the passing of new legislation, primarily in the areas of environmental protection and health care.

The legal status of the DFG is that of a private association. Its member organisations include research universities, the Academies of Sciences and Humanities, the Max Planck Society, the Fraunhofer Society, the Leibniz Association, the Helmholtz Association of National Research Centres, research organisations of general importance, and a number of scientific associations. In order to meet its responsibilities, the DFG receives funding from the German federal government and the federal states, as well as an annual contribution from the Donors' Association for the Promotion of Sciences and Humanities in Germany.

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Illustrations

Grousset (cover, pp. 4 b. l., 7 a.); Querbach (p. 2, back); Andrea Schmidt (p. 4/5); Staatliches Museum für Naturkunde Karlsruhe (p. 5 b.); Frey (pp. 6 c., 7 c.); Buchy (p. 6 b. l.); NASA/JPL (pp. 8-11); Lindner-Wirsching/L'Illustration (pp. 12 / 13, 15); Schröder (pp. 14, 16); private (p. 17); Schlossbetriebsgesellschaft mbH Augustusburg/Scharfenstein/Lichtenwalde (p. 18); Sächsische Landesbibliothek/Staats- und Universitätsbibliothek Dresden (p. 19); SLUB Dresden/Deutsche Fotothek/Regine Richter (p. 20); Machann (pp. 21-23).
Layout of pictures: l.: left; r.: right; a.: above; c.: centre; b.: below

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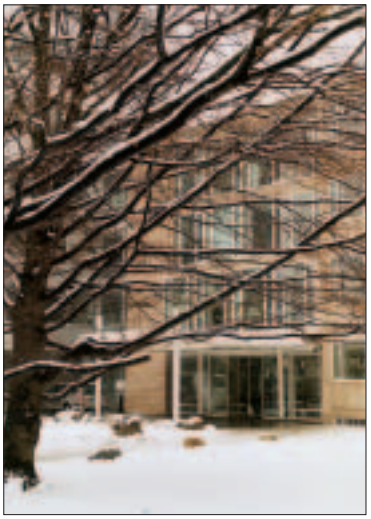

A rare scene indeed! The DFG Head Office in the snow. Here we see the Head Office in Bonn covered in white. If it happens at all, it never lasts for long.