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AZIZ SANCAR: "WHATEVER YOU DO, DO IT WELL AND WORK HARD!"

Aziz Sancar shared the 2015 Nobel Prize in Chemistry with Tomas Lindahl and Paul Modrich.

Aziz Sancar was influenced by a chemistry teacher in high school and it was at that time his relationship with the subject began. Prof. Mehmet Öztürk says that Sancar gets his work discipline from his father and his intelligence from his mother. While he had his heart set on studying chemistry, at the insistence of his friends he enrolled in the medical faculty, where he was afraid of failure as a student from the southeast. For this reason he studied day and night and took part in no social activities and even though he loved football he didn't go to a single match.
Sancar says that the three key qualities a successful scientist should have are knowledge-based creativity, industriousness, and perseverance in the face of failure.

Sancar says there may be two reasons when the Nobel Prize in Medicine or Chemistry is shared among people. The first is that these people have made indistinguishable contributions to the same subject.

The second is that they contributed to the same subject, but each independently to its subfields. Aziz Sancar belongs in the second category, because there are five important mechanisms of DNA repair: direct repair (repair with photolyase), nucleotide excision repair, base excision repair, repair of interstrand cross-links, and double-strand break repair.

The fifth mechanism previously received a prize, while the other four received the 2015 Nobel Prize. Sancar was deemed worthy of the Nobel Prize for his work on direct repair and nucleotide excision, Lindahl for his work on the base excision mechanism, and Modrich for his work on the mechanism of DNA mismatch repair.

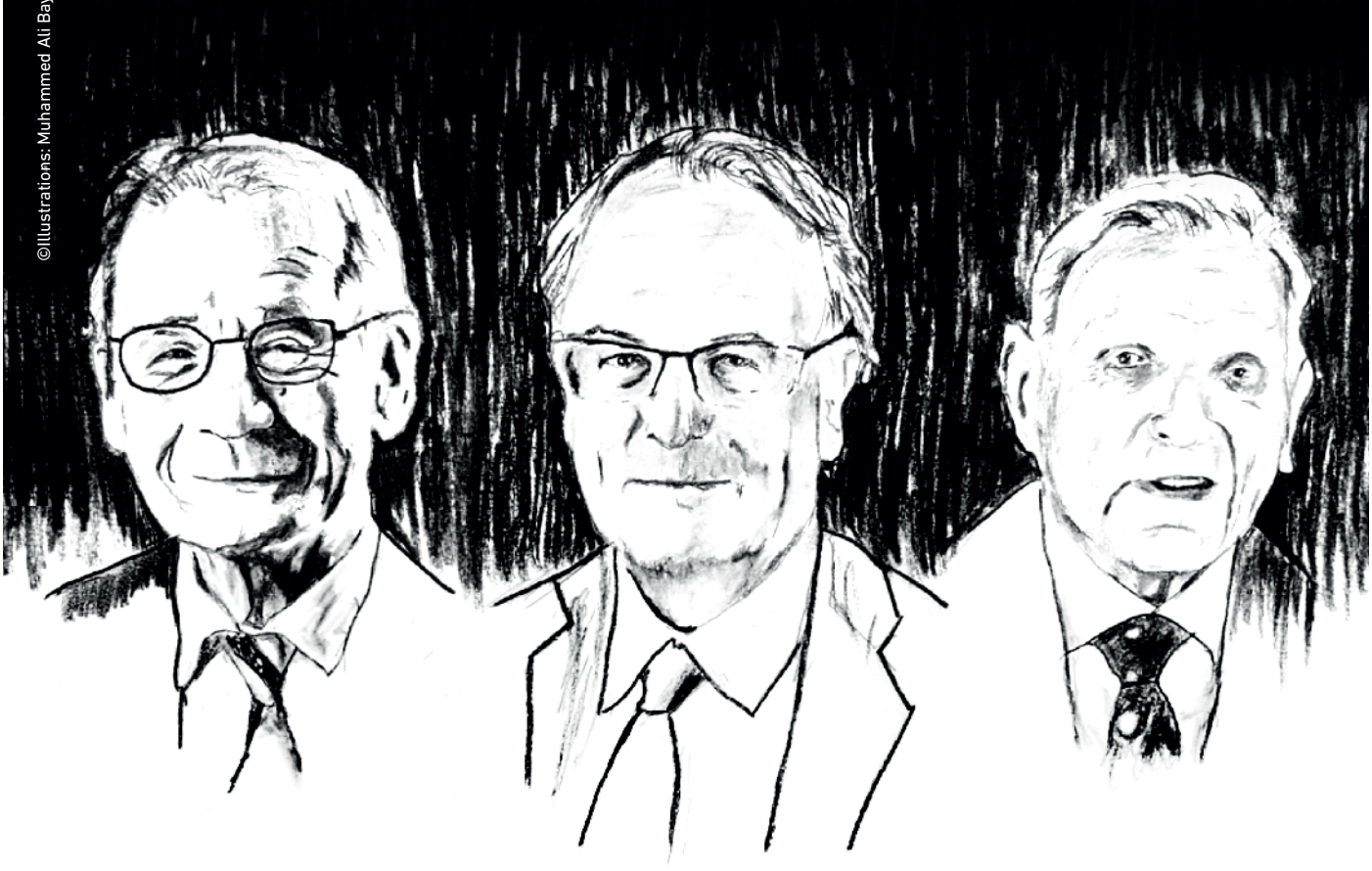
Sancar was frequently asked if he had expected to receive an award. He answered that his work deserved a Nobel Prize and he'd thought that if a Nobel Prize were to be given one day for DNA repair then they would give it to him, adding that what he cared about was his contribution to science rather than winning a prize, and that he had always trusted himself and his work.

Sancar donated the prize money to Carolina Türk Evi (Turkish House), where young people visiting from Turkey can stay and that also functions as a Turkish cultural center. He donated his Nobel medal to Anıtkabir, the mausoleum of Atatürk, the founder and first president of the Republic of Turkey. He stated that this was completely natural and the medal was in the right place, because it was given not to him but to the Republic of Turkey and Atatürk and it was won due to them.

Bilim ve Teknik (Science and Technology magazine), June 2016

Özlem Ak

NOBEL PRIZE IN CHEMISTRY 2Ø19: LITHIUM-ION BATTERIES

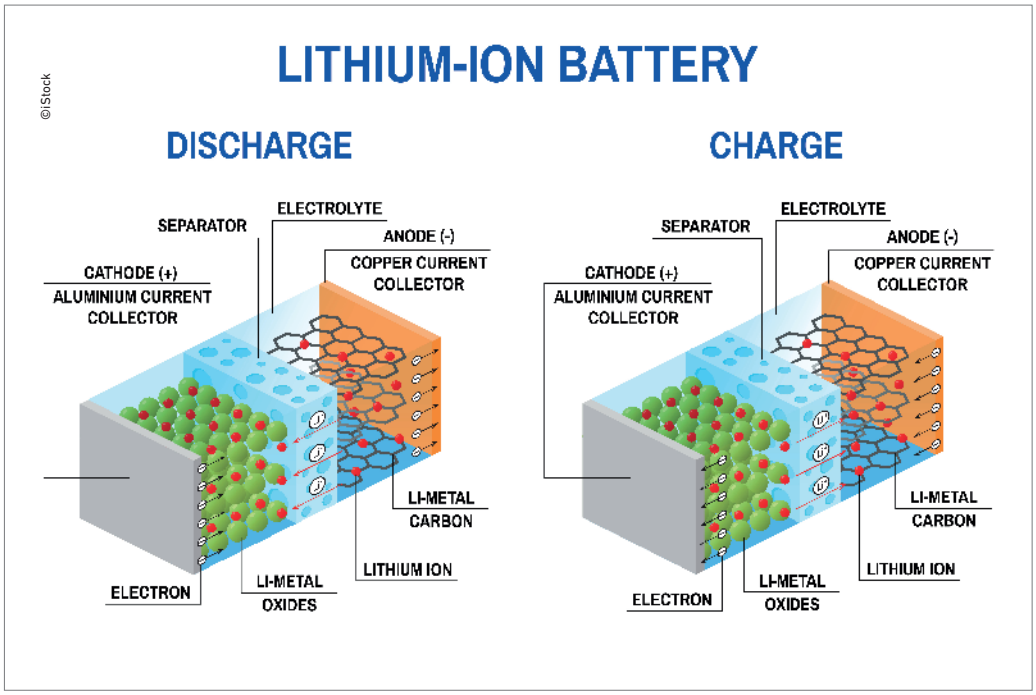


Akira Yoshino

M. Stanley Whittingham

John B. Goodenough

John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino were awarded the 2019 Nobel Prize in Chemistry for developing lithium-ion batteries, used worldwide to power everything from portable electronics to electric cars. The development of these batteries is the basis of our 'new rechargeable world' and has the greatest impact on the modern life of every one of us on the planet. More powerful, safer, and lighter rechargeable batteries are key to the growth of the electric car industry in the future. Many people hope that lithium-ion battery technology will not only meet our energy storage needs for this type of application but also reduce climate change by replacing burning fossil fuels as an energy source. These batteries also possess the ability to store significant energy from renewable sources such as solar, wind, and hydroelectric.



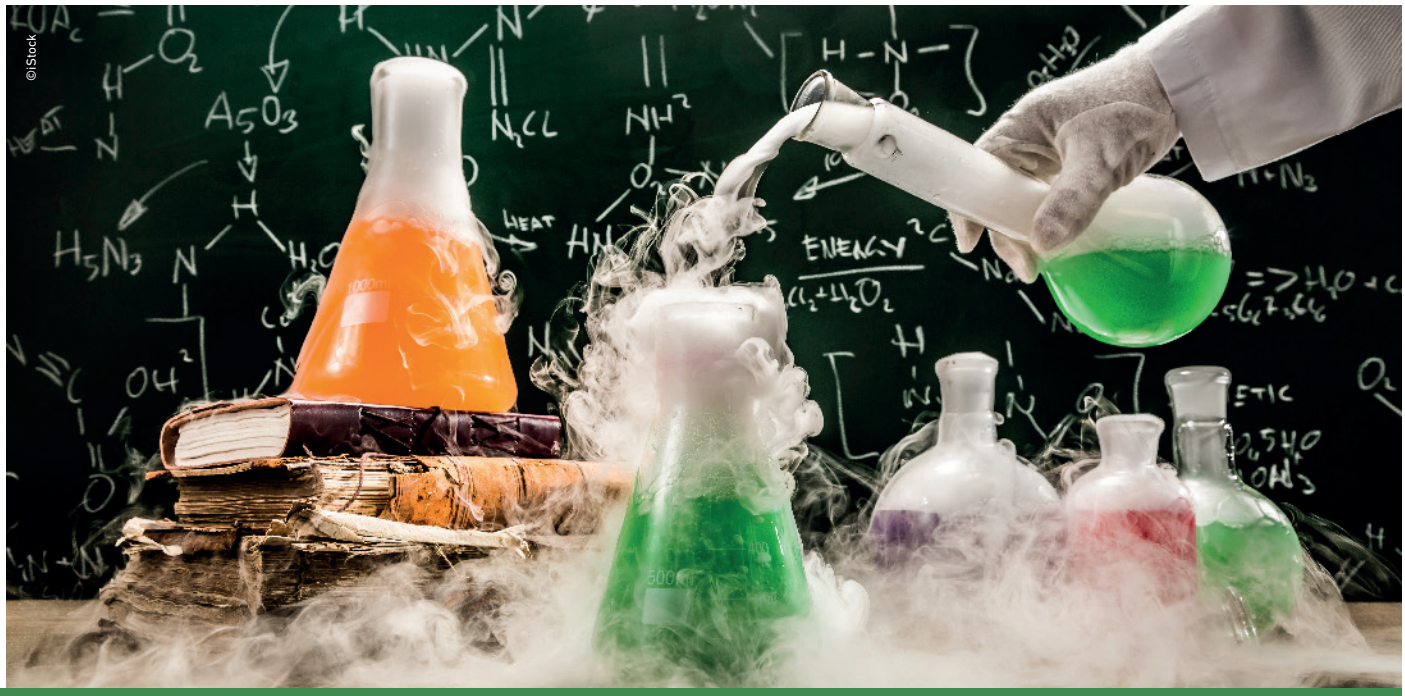
The charge and discharge cycles in lithium-ion batteries, which were first proposed by Whittingham, simply depends on the movement of lithium ions back and forth between the anode and cathode to produce energy. Conventional batteries are based on reversible/irreversible chemical reactions that quickly deteriorate in capacity over time. Whittingham used lithium metal at the anode, which has the greatest electrochemical potential and provides the largest specific energy per weight. The cathode was made of layered titanium disulfide material, with gaps between the layers at the molecular level that can host (intercalate) lithium ions. A battery with a potential slightly larger than two volts was constructed using a permeable membrane separator between anode and cathode. However, the charging/discharging cycles produce unwanted needle-like whiskers or dendrites on the anode that could penetrate the separator and cause the battery to short circuit. These failures can lead to fires and even explosions, making their use in many applications impossible.

Based on Whittingham's work, Goodenough tried to develop a better cathode material to create powerful lithium-ion batteries that would have a higher potential. By using cobalt oxide as the layered material in place of the titanium disulfide cathode, he doubled the potential difference between the two electrodes, making them far more practical for real-world applications.

Yoshino replaced the highly reactive lithium metal in the anode with petroleum coke, a material having naturally occurring layers within its structure that could provide high enough stability for a battery by housing lithium ions. He used cobalt oxide as a cathode material, which also has a layered structure and could house lithium ions. With this design on the market since 1991, Yoshino created the first safe and stable lithium-ion batteries. The rechargeable battery he developed had a high capacity and was remarkably stable; it could be charged and recharged for many cycles before its performance deteriorated. Today, a typical lithium-ion battery consists of lithium cobalt oxide ($LiCoO_2$) or lithium iron phosphate ($LiFePO_4$) as the cathode material, a graphitic carbon electrode as the anode, and lithium salt in an organic solvent between them as the electrolyte.

Lithium-ion batteries are currently considered to be the best type of rechargeable battery. However, there is still a lot of ongoing research focusing on finding ways to improve their performance. Smaller, safer, and lightweight batteries with higher energy and fast-charging capacity have been essential for the miniaturization of portable electronics and the growth of the electric car industry. Most battery experts think that perfect energy storage is yet to come. Some approaches to improving the current lithium-ion battery technology include replacing lithium in the Li-ion technology with magnesium or sodium. In addition, there are many great innovative ideas such as Li-air or Zn-air batteries on the horizon.

Ümit Demir



A BRIEF HISTORY OF ORGANIC CHEMISTRY

In 1807, the Swedish chemist Jöns Jakob Berzelius (1779-1848) called substances that melt and substances that burn, when heated, inorganic and organic, respectively. Although it was recognized that new compounds could be produced from organic sources, until as early as the beginning of the 19th century it was widely thought that organic compounds could not be synthesized from inorganic sources. It was astonishing when Friedrich Wöhler (1800-1882) heated a classified inorganic compound, ammonium cyanate, and obtained an organic substance, urea, in 1828. Although it is now widely accepted that ammonium cyanate is not purely inorganic, Wöhler is generally regarded as the first chemist to synthesize organic material from an inorganic source.

Thus, the vitalists were proved wrong. Moreover, there was a clear distinction between organic and inorganic substances. One important thing was that some organic chemicals seemed to be the same but behaved differently. In 1815, Jean-Baptiste Biot (1803-1873), who discovered the benzyl radical, observed that tartaric acid produced by grapes and tartaric acid produced in the lab behaved differently. While the former polarized light, the latter did not. Furthermore, both acids had the same chemicals in the same proportions. Justus von Liebig (1803-1873) and Wöhler encountered some similar situations. Their analyses of various organic compounds revealed that different substances had the same chemical formulas. It was Berzelius who named these pairs isomers.

As a young chemist, Louis Pasteur (1822-1895) unraveled the mystery of the two types of tartaric acid that behaved differently in 1844. He painstakingly separated the two crystals and discovered that while one group polarized light the way tartaric acid from grapes did, the others polarized it in the opposite direction. He realized that the two types of polarization canceled each other out in the lab-made compound. He also noticed that two different organic molecules might have the same formula but different properties.

In 1861, Friedrich August Kekulé (1829-1896) used diagrams based on bonding in organic chemistry and proved that Pasteur was correct; the shape (position in space) of an organic compound determines its properties.

Even before basic concepts of organic molecules were understood, chemists had begun to synthesize new organic molecules having important properties. Adolph Wilhelm Hermann Kolbe (1818-1884) was the first chemist to make an organic compound, acetic acid, from chemical elements. Nitrocellulose, also known as guncotton, was synthesized by accident by Christian Schönbein (1799-1868) in 1846. This very explosive chemical was discovered when his wife's apron, with which he was wiping up a spilled mixture of acids, exploded and vanished in a puff of smoke. When people tried to manufacture it in quantity, there were many fatalities. In the same year, a marginally safer explosive, nitroglycerine, was discovered. Eventually both chemicals were tamed into cordite and dynamite. Thus, the modern age of high explosives started.

Ten years later William Perkin (1838-1907) accidentally started another industry. He was trying to synthesize quinine, but he produced the first synthetic dye, mauve, which made him rich. Later, he initiated his second industry by making the first synthetic perfume ingredient, coumarin. Perkin was British, but in the second half of the 19th century most of the organic chemists were German, and Perkin's teacher was a German scientist, August Wilhelm von Hofmann (1818-1892), teaching in Britain. He synthesized his first dye, magenta, in 1858, and after returning to Germany he developed several violets. Other chemists in Germany produced natural dyes from easily available chemicals, obtaining a red dye called alizarin in 1869 and indigo in 1880. These dyes form the basis of the German chemical industry. Moreover, these dyes had an important impact on biology, leading to the discovery that coloring bacteria/cells with dyes made invisible structures visible.

Another British chemist, Alexander Parkes (1813-1890) succeeded in converting nitrocellulose to a nonexplosive but still quite flammable material, celluloid, in 1865, which was the first plastic. This was improved by an American inventor, John Wesley Hyatt, who was searching for a replacement for ivory billiard balls.

In the 20th century, British and American organic chemists dominated the plastics industry, producing rayon, Bakelite, nylon, Teflon, Lucite, and polyester, among other synthetics.

In the late 19th and early 20th centuries, raw materials for most of these materials were coal, water, and air. Later in the 20th century, petroleum replaced coal.

Turan Öztürk

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TODAY'S PROBLEM

Problem 1. There are 1001 gold coins on the table. Alaaddin and the monster play the following game. In each move Alaaddin takes a number of coins from the table, puts them into a new empty pouch, and after that the monster, depending on the number of coins in the pouch, either takes this pouch or gives it to Alaaddin. The game ends if either Alaaddin or the monster gets 12 pouches. In this case whoever got less than 12 pouches also takes all the coins remaining on the table. The game also ends if no gold coins remain on the table. The monster tries to minimize the total number of gold coins that Alaaddin will get. Determine the maximum possible number of gold coins that Alaaddin can get with certainty.

Azer Kerimov

TURKEY: A COUNTRY BETWEEN THREE CONTINENTS

Zeki Koday

Turkey is located in the northern hemisphere. It lies east of the prime meridian (Greenwich) between 36 and 42 degrees north and 26 and 45 degrees east. The territory of the country in the Asian and European continents is separated by the Bosphorus and the Dardanelles. Turkey's territory in Asia (97%) is known as Anatolia, while the territory in Europe (3%) is known as Thrace. The country's territory is located where the old lands of Africa, Asia, and Europe are closest to each other. The area of the country is 780 thousand square kilometers and as of 2020 its population is 83 million. Turkey is surrounded by sea on three sides, allowing higher diversity of climate and agricultural products grown.

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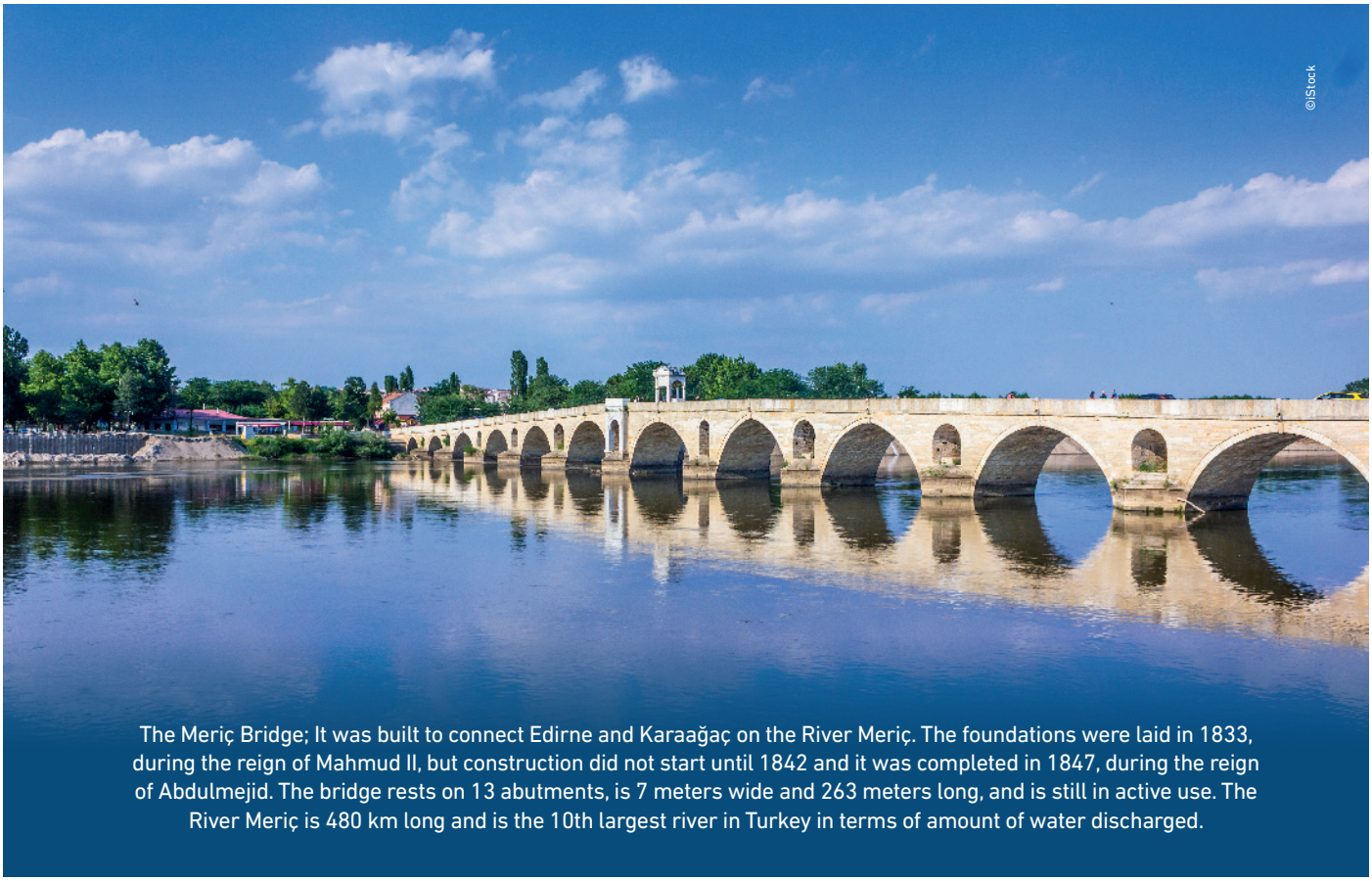
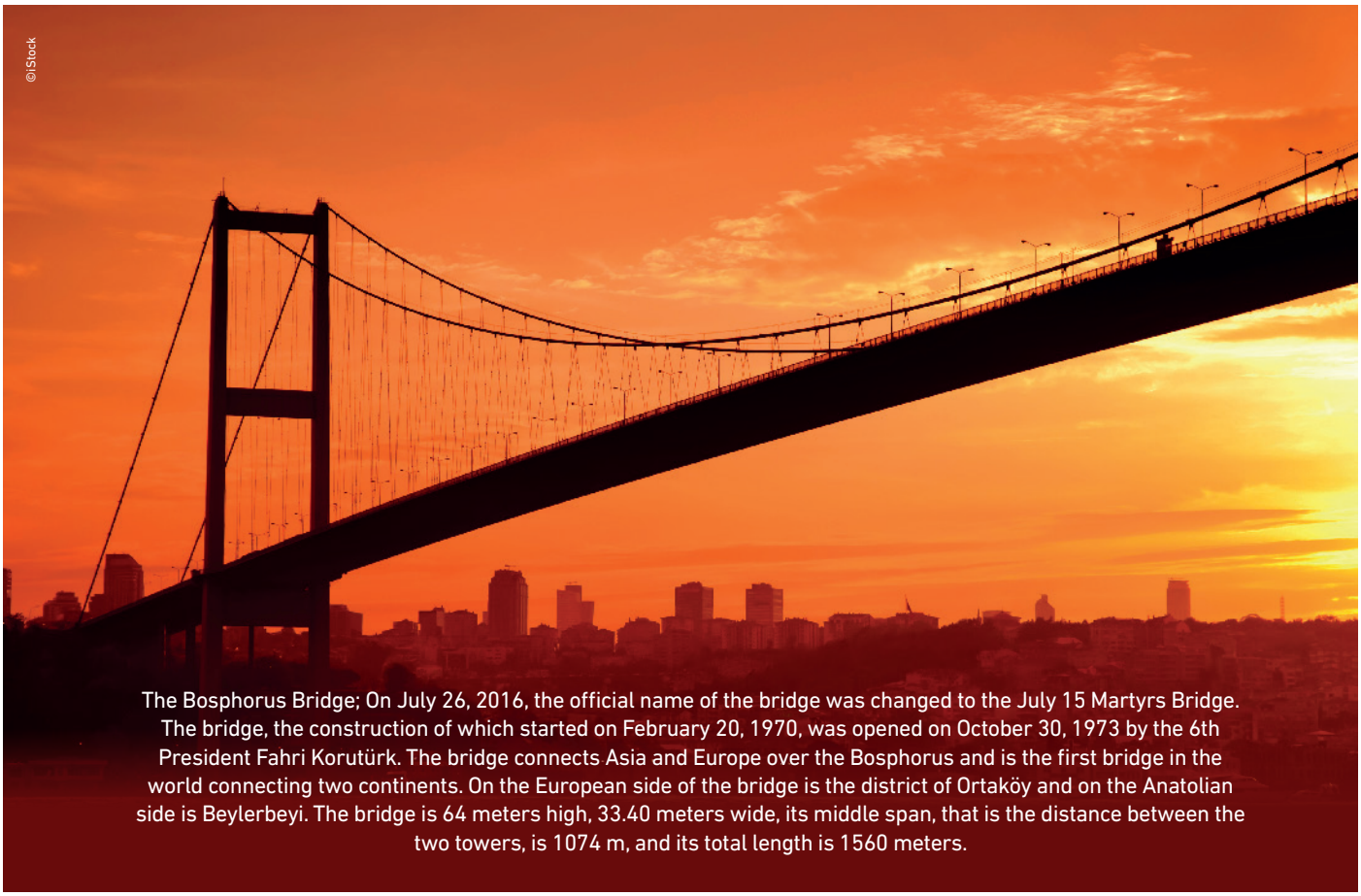


The Meriç Bridge; It was built to connect Edirne and Karaağaç on the River Meriç. The foundations were laid in 1833, during the reign of Mahmud II, but construction did not start until 1842 and it was completed in 1847, during the reign of Abdulmejid. The bridge rests on 13 abutments, is 7 meters wide and 263 meters long, and is still in active use. The River Meriç is 480 km long and is the 10th largest river in Turkey in terms of amount of water discharged.



The Bosphorus Bridge; On July 26, 2016, the official name of the bridge was changed to the July 15 Martyrs Bridge. The bridge, the construction of which started on February 20, 1970, was opened on October 30, 1973 by the 6th President Fahri Korutürk. The bridge connects Asia and Europe over the Bosphorus and is the first bridge in the world connecting two continents. On the European side of the bridge is the district of Ortaköy and on the Anatolian side is Beylerbeyi. The bridge is 64 meters high, 33.40 meters wide, its middle span, that is the distance between the two towers, is 1074 m, and its total length is 1560 meters.

Kurşunlugerme viaduct; It is located in Çatalca, İstanbul. It was built in the 2nd century to meet the water needs of Istanbul from the streams in the Stranca Mountains. This water system, which is 212 km in length, has been repaired several times after damage due to earthquakes and wear and tear. This structure has survived in part to this day. The photograph was taken from the valley, whose slopes are covered with lush forests, where the aqueduct is located in the village of Gümüşpınar in Çatalca district.

The stone bridges in Çamlıhemşin, Rize, in the Eastern Black Sea Region are located in deep and narrow valleys. There are many bridges built in this way in this region where the country's lushest forests are located, and although the construction dates of the bridges are not known exactly, they go back to 600-800 years ago. Some of these bridges are still in active use today. Before the current Black Sea coastal road was built, transportation in the region was of great strategic importance as it was achieved via these bridges.

The Temple of Trajan in Pergamon. UNESCO world heritage site in Turkey

Pergamon ancient city; It is the most outstanding settlement of the Hellenistic Period and is located in Bergama, İzmir. The ancient city of Pergamon was the capital of the Kingdom of Pergamon for 150 years between 281 and 133 BC, and it was a spectacular structure on a hillside overlooking the plain in front of it with its palaces, social and commercial areas, magnificent library, large theater area, and aqueducts and it is included in the world cultural heritage list.

A view of the coast of Kemer district in Antalya province. The Mediterranean and Black Sea coastlines are generally straight. However, the western parts of Antalya and the Muğla coastlines are very indented and caused many small peninsulas and gulfs. This type of coast offers unbeatable views on both boat and road trips.

Turkey covers 785,347 sq km and the population is 83 million. Turkey ranks 37th in the world in terms of area and 18th in terms of population. It is the country with the largest population among European countries after Russia (about 146 million). As previously mentioned, Turkey's geopolitical position is one of the world's most important. It has territory in both Europe and Asia and is in the heart of Eurasia. It is located at the crossroads where Africa, Asia, and Europe, known as the old lands, are closest to each other. It cannot be separated from the political and economic developments here due to its location between the Balkans, the Caucasus, and the Middle East. It is the only country in the Turkic World (Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan, and Turkmenistan) that has a coast and is a window for the Turkic World that opens up to the world by sea. These lands have hosted the establishment of two great empires, the Roman and Ottoman empires.

The settlement of Anatolia dates back 8-10 thousand years. Climate has played a major role in the settlement history being so old.

In fact, historical settlements belonging to ancient civilizations are very common in all countries that have a Mediterranean coast, because the subtropical Mediterranean climate was the most suitable climate according to human needs in times before a certain level in terms of science and technology had been reached. Çatalhöyük in Konya Province is an ancient settlement dating back approximately 10 thousand years and is considered to be the first settlement in the world in some sources. There are also many other ancient settlements such as Ephesus, Miletus, Bergama, Troy, Göbekli Tepe, and Zeugma.

About 90% of Turkey's population live in cities and 10% in villages. Although the average altitude of the country is 1132 meters, the majority of the population live near sea level. Ankara, the capital, is a modern city with a population of about 4.5 million. Istanbul, which is the largest city, with a population of approximately 16 million, is one of the largest cities in the world. It is also the only city with land on two different continents.

As previously mentioned, Turkey is one of the world's most productive countries in terms of agricultural activities and products. The main fruits grown in the country include olives, citruses (oranges, lemons, tangerines, and grapefruit), bananas, grapes, apples, pears, cherries, figs, pistachios, apricots, and hazelnuts. Of these, Turkey ranks first in the world in hazelnut, fig, apricot, and cherry production; fourth in olive production; and fifth in apple production. In short, Turkey is like the world's fruit paradise. Growing tea in the country started to gain importance after 1940 and it is ranked sixth in world tea production today. Tea production is carried out along the Black Sea coast in the northeast of the country. That area receives an average of 2000 mm of precipitation all year round and there is no dry period. In summer the weather is generally overcast and foggy. Since snow falls on the leaves in winter there is no infestation or disease, and so no pesticides are used in the tea plantations. For those reasons, Turkish tea is one of the best known and most popular teas in the world in terms of quality.

Amasra used to be one of the important coal-mining areas. Today, it is a quiet Black Sea town known for tourism.

Fairy Chimneys; Their fascinating appearance has always attracted interest. The lava from Mount Erciyes, Güllüdağ, and Hasandağ, located around Cappadocia, spread out. Lava and tuff erupted at different times from these mountains and spread over a wide geography in this region. In the formation of fairy chimneys formed on slopes and in valleys, erosion by flood waters and winds played the major role. As volcano ash and tuff are easily dug into, caves and churches have been built as numerous shelters.

Turkey also produces grains such as wheat, barley, corn, and rice. In addition, tobacco, cotton, sugar beet, chickpeas, lentils, peanuts, melon/watermelon, and potatoes are the other main products grown. Vegetables are grown in large quantities throughout the year due to the favorable climatic conditions. Turkey ranks second in production in greenhouses after Spain. Countries in the Mediterranean basin such as Turkey, Italy, and Spain meet the demand for vegetables from northern European countries covered by snow in winter.

Cattle, sheep, goat, and poultry breeding and beekeeping are among the important activities in animal husbandry. Turkey ranks second in the world in honey production, with 81 thousand tons, after China.

Turkey does not have significant underground resources such as oil, natural gas, and coal. However, due to its geographical location it is close to Middle Eastern countries rich in oil and natural gas reserves, and so they can easily be supplied through pipelines or by tankers by sea. In terms of minerals, boron and chrome are the most important underground resources of the country. Approximately 70% of the world's boron reserves are in Turkey.

Turkey is a bridge that connects Asia to Europe in terms of transport. For this reason, the country is a very important junction in terms of highways, railways, and airways. Anatolia played an important role in transportation and trade in the past due to its location on the historical Silk Road. The Bosphorus is the strait with the heaviest maritime traffic in the world after The Sound. An average of 50 thousand ships pass through this strait annually. The Bosphorus is not only important for Turkey; it is also important for other countries on the Black Sea, namely Georgia, Russia, Ukraine, Romania, and Bulgaria. Those countries can access other seas and oceans using this strait. Three bridges have been built over the Bosphorus, greatly easing Istanbul's road traffic.

The Yavuz Sultan Selim Bridge; The bridge built on the north side of the Bosphorus overlooking the Black Sea is also known as the Third Bosphorus Bridge. The bridge was named after the ninth Ottoman sultan and the first Ottoman caliph Selim I. The bridge joins Sarıyer's Garipçe district on the European side with Poyrazköy in Beykoz on the Anatolian side. This bridge ranks first in the world due to its width of 59 meters and it is also a rail crossing. The central span of the bridge, i.e. between the two towers, is 1408 m, and the total span is 2164 meters. Its construction began in May 2013 and it was opened by the 12th President Recep Tayyip Erdoğan in August 2016.

İstanbul Airport; Its foundation was laid on June 7, 2014 and it came into service on October 29, 2018. The airport, which has two terminals and six independent runways, is intended to serve 200 million passengers annually.

In the establishment of industrial facilities in the country, as factors such as raw materials, transportation, and labor play a role, they are mostly located at or near the coast. There are many industrial facilities in the country such as iron/steel, sugar, cement, textiles, oil refineries, and thermal power plants. White goods production and the automobile assembly industry are among the leading lines of business.

The oil refinery in Kocaeli has an annual crude oil processing capacity of 10 million tons and constitutes one of the largest industrial facilities in the country.

The Karaburun Peninsula in İzmir is located in a very windy region. For that reason, many wind turbines have been installed for electricity generation.

The country is one of the world's holiday paradises. Around 40 million tourists visit Turkey every year. Attempts are made to reduce the country's balance of payments deficit via tourism revenues. Turkey's clean seas and beaches and hot and dry summers make it a favorite country for tourists. It is also a popular destination in terms of winter tourism, with famous ski resorts such as Uludağ, Kartalkaya, Erciyes, and Palandöken. It is a country where people are skiing in one place while others are swimming in the sea somewhere else. It is important to highlight the advantages Turkey's tourism has in terms of climate. Other than these, there are natural riches such as caves, waterfalls, forests, and 'fairy chimneys'. It also has great potential in terms of cultural tourism as it has hosted different civilizations. Ancient settlements, historical churches and mosques, castles, and walls are among the most important examples.

Turkey does most business with European countries and neighboring countries. Agricultural products, cars, ready-to-wear clothing, textiles, and white goods are the leading products exported. Imports comprise oil, coal, natural gas, and electronics. In this country with a national income of about 10 thousand dollars per capita, the people are happy, peaceful, and friendly.

Derinkuyu; It is located 30 km from Nevşehir in Cappadocia. By digging down into the volcano ash and tuff 7-8 level underground cities were built. These structures built to hide in are barely noticeable.

One of the important winter tourism centers in Turkey, Palandöken ski resort, is 7 km from the city of Erzurum and about 20 km from the airport.

The country's only ski jumping towers are located in the city of Erzurum. In some countries it is necessary to travel more than an hour to reach jumping towers, while in Erzurum they are 15 km from the airport and a 10-15 minute walk from the city center. The jumping towers hosted the Erzurum 2011 World University Winter Olympics.

Uludağ National Park; It is located in Uludağ, south of the city of Bursa, and can be reached from the city center by cable car to the top of the ski center. The national park is covered with forests formed mostly by black pine and fir trees.

Uludağ ski center; Although it is in the city of Bursa, it is important in terms of its location close to big cities such as İstanbul, Ankara, and İzmir.

One of Turkey's most important tourism centers, Bodrum, according to the famous historian Herodotus, was founded in 2000 BC. Besides being a center of attraction in terms of yacht tourism and beach tourism, it is also important in terms of being a place where you can have a vacation in summer and winter. The winter population of Bodrum is 180,000, while the summer population exceeds one million.

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