МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
імені В. Н. КАРАЗІНА

# МЕТОДИЧНІ ВКАЗІВКИ ТА ЗАВДАННЯ ДЛЯ САМОСТІЙНОЇ РОБОТИ СТУДЕНТІВ З ПРАКТИКИ ПИСЬМОВОГО АНГЛО-УКРАЇНСЬКОГО НАУКОВО-ТЕХНІЧНОГО ПЕРЕКЛАДУ

Для студентів 3 курсу
факультету іноземних мов

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М 54 Методичні вказівки та завдання для самостійної роботи студентів з практики письмового англо-українського науково-технічного перекладу. Для студентів 3 курсу факультету іноземних мов : навчально-методичний посібник / уклад. : І. М. Каминін, М. С. Осінська. – Х. : ХНУ імені В. Н. Каразіна, 2014. – 28 с.

Методичні вказівки розраховані на студентів освітньо-кваліфікаційного рівня «Бакалавр» денної форми навчання факультету іноземних мов, а також на фахівців, які прагнуть вдосконалити власні навички та вміння ідентифікації та успішного подолання граматичних і лексичних труднощів англо-українського науково-технічного перекладу. Посібник містить автентичні англомовні тексти з різноманітних галузей науки (математики, фізики, хімії, біології, фізіології, медицини, астрономії, геології тощо), розподілені відповідно до граматичних та лексичних труднощів перекладу, що в них зустрічаються.

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# ВСТУП

В умовах змін, що відбуваються у суспільстві й системі вищої освіти на сучасному етапі, процес викладання іноземних мов на спеціалізованих факультетах вищих навчальних закладів характеризується постійним зростанням ролі та значення самостійної роботи студентів.

Навчально-методичний посібник розрахований на студентів освітньо-кваліфікаційного рівня «Бакалавр» денної форми навчання факультету іноземних мов, а також на фахівців, які прагнуть вдосконалити власні навички та вміння ідентифікації та успішного подолання граматичних і лексичних труднощів англо-українського науково-технічного перекладу. Посібник містить автентичні англомовні тексти з різноманітних галузей науки (математики, фізики, хімії, біології, фізіології, медицини, астрономії, геології тощо), розподілені відповідно до граматичних та лексичних труднощів перекладу, що в них зустрічаються. Матеріалом слугували статті зі спеціалізованого часопису «Фізика сьогодні» (*Physics Today*) http://scitation.aip.org/content/aip/magazine/physicstoday, що видається Американським інститутом фізики (*American Institute of Physics)* – міжнародною асоціацією, яка об'єднує не тільки вчених-фізиків, а й представників суміжних наук.

Посібник складається з двох частин. Перша частина містить матеріал для аналізу способів перекладу різних граматичних форм і конструкцій (часові форми дієслова, форми пасивного стану дієслова, агентивний неживий підмет, імпліцитний підмет, герундіальна конструкція тощо). Друга частина містить матеріал для розвитку вмінь подолання лексичних труднощів у перекладі (переклад абревіатур, антропонімів, переклад неоднозначних слів тощо).

Самостійна робота з посібником буде сприяти, по-перше, подальшому розвитку фонових знань, необхідних перекладачеві для роботи у галузі науково-технічного письмового перекладу, і по-друге, розвитку вмінь краще розпізнавати граматичні та лексичні явища, аналізувати структуру англійського речення і визначати граматичні та лексичні труднощі перекладу й засоби їх подолання.

# ЧАСТИНА І

## *ГРАМАТИЧНІ ТРУДНОЩІ НАУКОВО-ТЕХНІЧНОГО ПЕРЕКЛАДУ*

**Task 1. Translate the text into Ukrainian, focusing on grammatical transformations:**

A gelatinous material made of salty gel and rubbery tape has been developed that can conduct electricity, with potential uses in robotic, prosthetic, and electronic devices. As described by Christoph Keplinger of Harvard University and colleagues in their paper published in *Science*, the researchers used a 1-mm-thick piece of tape as the dielectric and a polyacrylamide hydrogel containing sodium chloride as the electrolyte. They sandwiched the tape between layers of the saltwater gel. When the researchers applied a voltage, positive charges lined up on one side of the tape and negative charges on the other. Because the opposite charges attract, they squeeze the rubbery sheet in between, forcing it to contract. By switching the voltage off and on, the sheet is made to expand and contract. Such a material could be used in soft robots and prosthetic limbs to make them more flexible. And because the vibrations caused by the material's expansions and contractions can also generate sound, it could be used in loudspeaker systems.

**Task 2. Translate the text into Ukrainian, focusing on tense verb forms:**

Another element may be added to the periodic table: 115. Researchers at Lund University in Sweden have synthesized what they have dubbed ununpentium. They fired calcium ions at a thin film of americium, then used high-resolution spectroscopy to study the photons released as the new, superheavy element rapidly decayed. The researchers were able to detect some 30 alpha-decay chains that correlated with what would be expected from the formation of element 115. A committee comprising members of the international unions of pure and applied physics and chemistry will review the findings to determine whether further experiments are needed to confirm the element's existence. The research has also provided deeper insight into the structure and properties of superheavy atomic nuclei. Element 115 was first made in 2003 by a collaboration between the Joint Institute for Nuclear Research in Dubna, Russia, and Lawrence Livermore National Laboratory in California.

**Task 3. Translate the text into Ukrainian, focusing on passive voice verb forms:**

Carbon fiber is being used to create parts for bikes, cars, boats, and aircraft because of its strength and light weight. However, when carbon-fiber composites fail, the failure is distributed throughout the entire piece. So when a company approached Kenneth Cheung and Neil Gershenfeld of MIT to create an airplane from a single piece of carbon fiber, they decided to develop a small, repeatable carbon-fiber building block instead. The result is an X-shaped piece of carbon fiber with a hole in the center and loops at the end of each arm. The pieces are hooked together to create pyramidal lattices. When the 2-inch (5.08 cm) pieces were combined to create an 8-inch cube, the structure was able to support 295 kg (650 lbs) before breaking. And when it broke, only a few pieces failed, instead of the complete structure. To control where the points of failure occurred, Cheung and Gershenfeld included pieces that were more flexible in strategic positions in the structure. Their design could be used in any number of applications where weight-to-strength ratios are important.

**Task 4. Pre-test activity. Translate the text into Ukrainian:**

The quantum Zeno effect, proposed in 1977, states that if a quantum system is measured continuously, its state will never change. The behavior was first observed in 1989 in laser-cooled ions, but now, a team of researchers led by Oliver Benson of Humboldt University in Berlin have recorded the effect in diamond crystals. Diamond has been used in quantum computing to store information, but the amount of information has been limited by decoherence – the tendency of quantum systems to change state. The ability to hold stored data in one state will be useful in quantum computing. To that end, Benson's team used defects in the crystals known as nitrogen-vacancy centers, to trap free electrons. Then they manipulated the electrons with magnetic fields and a laser, which disrupted the electrons' oscillations between their two spin states, thus preventing them from decaying – behavior indicative of the quantum Zeno effect. Adapting that effect for actual use in quantum computing is still some way off, but it adds to the evidence that diamonds are an important avenue for investigation.

**Task 5. Translate the text into Ukrainian, focusing on pronoun *it*:**

Researchers in Japan have used x-ray diffraction to study bee wing movement at the molecular level. They found that insect wing muscles and vertebrate muscles share a common mechanism. Both involve the interaction of several proteins. Motor nerves activate proteins called troponins, which cause another protein, called actin, to rotate and expose areas where the motor protein myosin can bind. Once bound, it

curls and pulls the actin, which causes the muscle to stretch. Muscles that move rhythmically, including those in the human heart and insect wings, are sustained by the very act of stretching – as the muscle gets extended, more areas are exposed on the actin for the myosin to bind to. In vertebrates, the release of calcium is what activates the muscle mechanism. However, because it would take too much energy to pump calcium fast enough to sustain insect flight, the researchers propose that insects may have a form of troponin that doesn't require activation by calcium ions.

**Task 6. Translate the text into Ukrainian, focusing on agentive inanimate subject and implicit subject:**

A study from the 1990s had suggested that northern latitudes were experiencing larger than expected seasonal variations in atmospheric carbon dioxide. However, criticisms of the study led its findings to be mostly ignored. A new study by an international team of researchers attempted to resolve those criticisms and found evidence supporting the earlier study. The researchers compared atmospheric carbon dioxide levels from aerial measurements collected between 2009 and 2011 with similar measurements taken from 1958 to 1961. The measurements examined the change in carbon dioxide levels during the spring, when many plants end their dormant period and increase their intake of carbon dioxide to fuel photosynthesis. At latitudes above 45° N, the researchers found that the change in carbon dioxide levels was 50% greater in the recent period than it was in the period 50 years earlier. The cause for the increase in absorption is unclear. An increase in nitrogen deposition from industry may have contributed, as may have an increase in young, fast-growth trees.

**Task 7. Translate the text into Ukrainian, focusing on subjective predicative infinitival constructions:**

Because ball lightning is rarely observed in nature, it is hard to study and therefore not well understood. Lab experiments that generate plasma discharges above electrolytic solutions are likely to provide some insight into the phenomenon. Mike Lindsay of the US Air Force Academy and his colleagues have expanded that approach by using high-speed cameras and varying the acid concentration of the electrolyte solution. They found that they could create longer-lasting plasma balls, which gave them more time to study the balls' properties. By examining the balls in the IR, the researchers observed how their density and structure changed over time. From their observations, they deduced the presence of water vapor, carbon dioxide, and other as-yet-undetermined chemicals in the plasma. However, while the plasma balls share many properties with ball lightning, there are distinct differences. More

detailed study is needed, which will require further extending the lifetime of the plasma balls.

**Task 8. Translate the text into Ukrainian, focusing on infinitive and objective predicative infinitival constructions:**

One common use of magnetic resonance imaging (MRI) is to take pictures of the brain so that doctors can plan surgeries. However, between the imaging and the surgery, the brain can shift position, requiring further imaging that interrupts the surgery. Several companies have now produced real-time MRI options that allow surgeons to directly monitor their progress while they are operating. Currently, the most common such system is produced by MRI Interventions, which has installed 25 of them so far. It combines a standard MRI scanner with a platform, which is attached to the patient's skull, for guiding surgical tools and implants. During MRI, the platform shows up as a grid pattern overlaid on the brain, and software shows where the surgical instruments are relative to the grid. Having direct view of where the instruments are located obviates the need for patients to be awake and responsive, which is one way surgeons currently track where their tools are. The system is also being used experimentally in cancer biopsies and treatments to track needles inserted into the skull.

**Task 9. Pre-test activity. Translate the text into Ukrainian:**

Earlier this month some 300 tons of radioactive water leaked from holding tanks into the soil surrounding Japan's Fukushima Daiichi nuclear plant, which was damaged two years ago by the Tohoku earthquake and tsunami. The water had been used to cool melted nuclear rods from the destroyed reactors. The incident is just one example of the problems that have beset TEPCO (Tokyo Electric Power Company) in its efforts to clean up after the nuclear meltdown. Although the water had been partially treated and its radioactivity was only about 1% of what it had been, it was the large amount of water that leaked and the lack of any kind of safety buffer that has raised global concerns. Because the storage site is just a few hundred meters from the coast, the contaminated water may make its way into the ocean. Various remedies, including freezing or excavating the soil around the storage site, have been proposed. But due to the potential cost and difficulty involved, the Japanese government may need to step in.

**Task 10. Translate the text into Ukrainian, focusing on gerund and gerundial constructions:**

Adam Arkin of the University of California, Berkeley, explores the promise of synthetic biology for combating disease. Instead of developing new drugs, he is engineering an army of bacteria specialized for attacking cancer. By inserting new genes into bacteria, Arkin can augment them with custom components. One gene, for instance, ensures that the bacteria can't survive without a substance ingested by a patient – keeping the living robots from going haywire in the body and multiplying out of control. Others genes encode protein that sense the low-oxygen conditions present in a cancerous mass, or proteins that trigger the bacteria to attack only when they reach a certain density. Biological circuits inside the bacteria govern all of these activities. DNA is transcribed to RNA, which produces proteins. The interaction of those proteins switches on and off different processes, much like a logic gate in a computer chip. Figuring out how to build those circuits is easy on paper, says Arkin. But the genetic programs rarely function cleanly in actual cells. Genetic differences between bacteria can lead to a lot of variability.

**Task 11. Translate the text into Ukrainian, focusing on gerund and gerundial constructions:**

Cliodynamics is named for the Greek muse of history. Founded in the 1990s by Peter Turchin of the University of Connecticut, it is an attempt to mathematically explain cycles of history. Turchin and others are creating models to fit those data sets. By comparing them with other data sets from other times and other cultures, they clearly demonstrate how well they fit. Turchin and his colleagues believe they have found a 100-year cycle of waves of instability that they call the Secular Cycle. They attribute the Secular Cycle to long-term demographic trends, such as populations exceeding production capacity, or a growing elite class competing for limited political and economic power. And in some countries, including the US, they see a secondary 50-year cycle of political violence that is associated with periods of growing social inequality. They explain these cycles as feedback loops like predator–prey cycles, not as rigidly defined rules of history. The cliodynamic approach to analyzing historical data has competition, but the general practice of applying statistical techniques to history is gaining acceptance by the wider historian community.

**Task 12. Translate the text into Ukrainian, focusing on Participle I and Participle I phrases:**

A new design for a nuclear plant proposed by General Atomics has the potential to be cost competitive with natural-gas plants. Besides being smaller than current nuclear reactors, the new design is also more efficient due to the use of helium as a coolant, which allows for higher operating temperatures. The reactor also incorporates a new gas turbine design. General Atomics claims that the reactor will have a 53% heat-to-electricity conversion rate, which is significantly higher than the 32% efficiency of current plants. And, by using much of the normal byproducts as further fuel, the reactors would also reduce the amount of waste generated. The company claims the design is much safer than that of existing plants because, in the case of a power failure, the reactor will shut down and cool without needing to continuously pump coolant. However, the company's claim that the new design will cut the cost of nuclear power by as much as 40% has been called unrealistic. General Atomics is applying for a Department of Energy grant with which it hopes to be able to commercialize the reactor within 12 years.

**Task 13. Translate the text into Ukrainian, focusing on Participle II and Participle II phrases:**

In 2006, a search began for solar twins – stars that are similar to the Sun in mass, temperature, and chemical composition. Iván Ramírez of the University of Texas at Austin and his colleagues have found the closest match yet. Located just 250 light-years away and designated HIP 102152, the star is 97% as massive as the Sun, is 54 °C cooler, and has similar concentrations of more than 20 elements. The biggest difference is that HIP 102152 is 4 billion years older than the Sun – almost twice as old – making it the oldest known solar twin and a potential model of how the Sun will age. One interesting characteristic of the Sun is that it has a lower concentration of lithium than most other stars. While HIP 102152 has an even lower lithium concentration than the Sun, a previously discovered younger solar twin has a higher concentration. That finding suggests that Sun-like stars burn through their lithium as they age. Ramírez and his colleagues are now examining the star to determine if any planets orbit it.

**Task 14. Pre-test activity. Translate the text into Ukrainian:**

Liquid crystals are freely moving rod-like molecules that are oriented in the same direction along their long axis. Their shared alignment causes polarized light to travel through the material at different rates depending on its angle with respect to the

crystal alignment. Controlling the alignment of individual liquid crystals – by turning an electric field on and off – is how images are created on LCD screens. Currently, turning the liquid crystals "on" takes just nanoseconds because of the force applied by the electric field, but turning them off takes longer–milliseconds–because, without the electric field, thermal energy pushes the crystals out of alignment, but doesn't apply nearly as much force. A new technique, developed by Oleg Lavrentovich of Kent State University in Ohio and his colleagues, reduces the turn-off time to nanoseconds as well. They used a normal LCD screen with a liquid crystal called CCN-47, which has plank-shaped molecules instead of cylindrical ones. Because of their shape, the electric field caused the molecules to align on a secondary axis such that the wider sides all faced the same direction.

**Task 15. Translate the text into Ukrainian, focusing on emphatic constructions:**

Over a two-week period beginning in March 2009, the Redoubt volcano in Alaska experienced a series of 20 eruptions that sent ash 15 km high. What was unusual is the eruptions were preceded by 0.5- to 1.5-magnitude tremors that created a noise that humans could have heard. In the last minute before the eruption, the tremors occurred at a rate of 30 per second. The seismic waves merged into a single signal with a pitch that entered the range of human hearing. Within the magma chamber it would have sounded like a scream, but at the surface of the cone, the sound was dampened to a hum. It is the first known example of a volcano producing a "scream." Eric Dunham of Stanford University and his colleagues analyzed the seismic data and localized the tremors' source to a point 2 km below the crater near where the magma chamber fed into the volcanic conduit to the surface. Dunham and his team created a model of the activity, which showed that built-up pressure in the conduit may have been the root cause of the noise. They speculate that the pressure may have caused some of the magma to harden and partially block the conduit and that the rest of the magma pushed around the blockage, which created the rumbling.

**Task 16. Translate the text into Ukrainian, focusing on negation constructions:**

Continuous flash suppression is a visual perception phenomenon in which a repeating flash of light presented to one eye completely suppresses the brain's ability to perceive an image presented to the other eye. Gary Lupyan of the University of Wisconsin – Madison and his colleagues have now found that when a person first hears a word that describes the image, the brain is primed and the suppression effect is itself often overwhelmed. Lupyan says that because the flash suppression occurs at a low level, there is no subconscious processing of the image that the verbal

prompting draws on. That suggests that hearing the word directly affects the visual processing system. Other research has shown a similar relationship between perception and cognition, but visual processing and language are usually studied independent of each other. What that means in the larger understanding of language and perception in humans is still open to debate and, hopefully, further research.

**Task 17. Pre-test activities. Translate the text into Ukrainian:**

**(a)** For decades, archaeologists have been seeking the ancient city of Mahendraparvata, thought to have been located in what is now Cambodia. Thanks to ground-mapping efforts that covered a 9-$km^2$ area, a variety of temples and other structures had already been found amid thick forest. But how they were connected, or if they were even related, wasn't certain. Now, a joint Australian and French team of archaeologists, which used lidar to fully map the city, has revealed a highly populated area covering 35 $km^2$. By shooting laser pulses at the ground from a helicopter, the researchers were able to create a three-dimensional map of ground structures that have long been hidden by dense vegetation. The group crisscrossed the area on and around Phnom Kulen mountain at an altitude of 800 m for several days. What they found was evidence of an apparently highly organized and densely populated city that may have predated the Angkor Wat temple complex, located 40 km to the south. This is the second successful ancient city mapping project announced recently.

**(b)** Growing simple tissues on 3D lattices in the lab is relatively easy. The muscle structure of heart tissue, however, is highly ordered and presents a bigger challenge. Martin Kolewe of MIT, Lisa Freed of Draper Laboratory, and their colleagues have adapted a machine for printing integrated circuits to create a lattice structure that allows the forming of tightly bound heart-like tissue. They used the machine to layer sheets of polymer biorubber that were patterned with a system of microscopic, rectangular holes. The researchers used a computer to align the holes in each layer, then they tested numerous patterns and found arrangements that produced the desired structure. The resulting bundled cells showed a contraction response to electrical stimulation, and the researchers could control the orientation of the growth of the bundles. However, before the tissue can be used in implant procedures, it will have to be grown thicker, with some sort of vascular system to provide blood to maintain the life of the cells, and engineered to mimic the specific behavior of the cardiac tissue.

**(c)** Absolute zero corresponds to the theoretical state in which the average energy of a system of particles is zero. During the normal state of a gas, the majority of the particles are at energies near the average, with just a few at higher energy

levels. Theorists predicted in the 1950s that if a gas could be created in which the situation was reversed – the majority of the particles had higher energy levels–then the temperature could drop to below absolute zero. Using lasers and magnetic fields, modern researchers arranged a stable lattice structure out of a quantum gas of potassium atoms. Quickly adjusting the magnetic field caused the atoms to attract rather than repel each other, and they shifted from their lowest-energy state to a high-energy state. Normally, that would cause the lattice to collapse, but the researchers used the lasers to make it too difficult for the atoms to leave their positions. The result is a gas that has a temperature just a few billionths of a degree below absolute zero. The experiment opens the way to potential stable states of exotic materials, and the theoretical behavior of other systems at sub-absolute-zero temperatures may provide some answers about cosmological phenomena such as dark energy.

**(d)** Bats are well known for using ultrasound to locate insects when hunting. Tiger moths are known to use their own ultrasound to try to jam the bats' sonar. And now three species of hawkmoths have also been revealed to create ultrasound pulses in response to those of bats. Jesse Barber of Boise State University in Idaho and Akito Kawahara of the University of Florida in Gainesville went to Borneo, where they captured male and female members of several species of hawkmoths. They tied the moths into rigs of fishing line harnesses and directed recordings of bat ultrasound at them. Three of the species responded with ultrasound clicks of their own. High-speed video revealed that the males rubbed their grasper limbs – used for holding onto their partners during mating – against their abdomens. The females appeared to rub their genitals against their abdomens. Barber and Kawahara are not sure if the hawkmoths' ultrasound is used as a warning or as a jamming system. But because both moth species have independently developed similar features, they serve as an example of evolutionary convergence.

**(e)** The Doppler effect is the familiar change in frequency or pitch of light and sound waves as a result of the motion of the source relative to an observer. The linear version of this effect has been known since the 1800s, but in the 1980s and 1990s, it was determined that rotating sources of polarized light can demonstrate Doppler shifts as well. One of the other effects is that rotating light sources could give the emitted light orbital angular momentum (OAM) – a rotation in the light's electric and magnetic fields. Now, scientists have shown that light that is reflected off a rotating surface is also Doppler shifted. They fired a laser at a plastic rotor, then used detectors to collect and filter the scattered light waves into two signals – those with positive (clockwise) OAM and those with negative (counterclockwise) OAM. They found that light with positive OAM experienced an increase in frequency, and light with negative OAM experienced a decrease in frequency. The magnitude of the changes allowed the researchers to calculate the rotation speed of the rotor.

**(f)** According to a survey sponsored by the American Society for Biochemistry and Molecular Biology, a growing number of scientists say they are having difficulty securing federal funds for their research. The survey included some 3700 respondents, from nearly all the STEM fields, including biology, chemistry, mathematics, and physics. Most said that despite spending more time writing grant applications, they are receiving less money. One reason is that over the past 10 years, federal funding has failed to keep up with inflation. And federal agencies have suffered additional funding cuts of $9.3 billion due to the 2013 sequestration. Nevertheless, nearly 95% of the participants said they want to continue to pursue careers as scientists; they cite the vast benefits of continued support for scientific research and the importance of encouraging the next generation of scientists. Although most respondents wanted to maintain the US's position as a world leader in scientific innovation and discovery, 18% said they were contemplating continuing their careers abroad.

**(g)** An international group of researchers has developed a nanodiamond biosensor that can determine the iron content in blood. The sensor uses defects in the tiny diamonds to detect a particular protein that stores iron in the blood and which is also found in many types of living organisms. The researchers hope to extend their sensor technology to allow it to detect other proteins. Iron abounds in most living organisms – and proteins containing the metal are found in everything from single-celled micro-organisms to human beings. In humans, iron deficiencies are mainly caused by malnutrition and can lead to anaemia, while an increased level of iron can indicate the presence of an acute inflammatory response. So, accurately measuring blood-iron levels is an essential medical diagnostic tool. Detecting specific single proteins in biological samples is no mean feat, however. Current methods either involve using organic markers – dyes and fluorescent proteins – or quantum dots. But the markers tend to bleach after being used for a while and quantum dots can degrade the sample.

**(h)** Researchers in the US claim that exposing a person to a magnetic field could reduce their risk of a heart attack by streamlining the flow of blood around their body. While the work currently remains just a proof-of-principle, the researchers believe that their technique could ultimately provide an alternative to drugs in treating a range of heart conditions. Heart attacks and stokes can strike for a variety of reasons. But research suggests that all such vascular conditions are linked by one common symptom – high blood viscosity. Drugs such as aspirin are frequently prescribed to help lower blood viscosity, but these can have unwanted side effects often related to irritation of the stomach. Now, an alternative to drugs may be at hand following recent work by Rongjia Tao at Temple University and his colleague Ke

Huang at the University of Michigan. In their experiment, Tao and Huang showed that applying a 1.3 T magnetic pulse to a small sample of blood can significantly reduce it's viscosity. About 8 ml of blood with a viscosity of 7 centipoises (cp) – above healthy limits – was contained at body temperature (37 °C) in a test tube.

**(i)** Sara Nichols of the University of California, San Diego, described how biophysics can speed up the drug discovery process, which has grown lengthier and more expensive in recent years. Her computational simulations flag parts of proteins that could be appropriate targets for drugs. Molecular simulations have become remarkably complex since the first simulation of a protein 36 years ago. One dynamic model shown by Nichols included all of the RNA, proteins, water molecules, and ions that make up the satellite tobacco virus, about a million atoms in total. Another revealed how a particular molecule latches onto a protein and snakes its way through the protein to its final binding site. The discovery through simulation of an unexpected binding site for HIV-1 integrase led to new drugs that inhibit the protein. Nichols wants to better understand how proteins bend, fold, and wriggle. She has found that some, such as HIV co-receptor CXCR4, have hinges. Blocking the hinge with a drug can prevent conformational changes. The most potent HIV reverse transcripase inhibitor developed to date works in this way.

**(j)** Viewing fine-art paintings in a museum usually first calls for letting your eyes adjust to dim lighting. That's because many historical works use pigments—including the bright red vermilion ($\alpha$-HgS) made from the mineral cinnabar—that degrade and darken irreversibly over time, and exposure to light can hasten the degradation. Vermilion's slow transformation from red to a dark gray presumably indicates that elemental liquid mercury is released, but the pathway has been unclear. An international team has now combined computational spectroscopy with high-resolution microscopic x-ray diffraction to shed new light on the processes involved. A mural sample from the Gothic Monastery of Pedralbes in Barcelona, Spain, was taken for x-ray analysis. The figure's inset shows a cross section of the sample in which the thick red layer is overlain by darker layers that contain, among other things, three different phases of the mineral corderoite ($Hg_3S_2Cl_2$). None of the compounds found in the x-ray analysis are intrinsically gray-black; being a liquid, Hg was invisible.

## ЧАСТИНА ІІ

## *ЛЕКСИЧНІ, ТЕРМІНОЛОГІЧНІ ТА ЖАНРОВО-СТИЛІСТИЧНІ ТРУДНОЩІ НАУКОВО-ТЕХНІЧНОГО ПЕРЕКЛАДУ*

**Task 1. Translate the text into Ukrainian, focusing on the special meanings of common lexis words in scientific and technical texts:**

Sandstorms are incredibly complex to model because of the number of sand grains they contain. A new model, created by Marcus Carneiro of ETH Zürich and his colleagues, that tracks just 4000 individual grains (less than a mouthful, according to Carneiro) is a major step forward in understanding the storms. Most models have not tracked individual sand grains and have ignored mid-air grain collisions because the effect of the collisions was thought to be negligible. Carneiro's model includes both. It measures storm strength as the number of grains moving through a given volume in a given time. By turning collision modeling on and off, the researchers were able to see the effect of collisions on storm strength. They expected that collisions would dissipate energy, but found instead that they increased the storm strength, sometimes even doubling it. Further examination found that when particles fell into an area of slow-moving sand near the ground, they created a splash, which kicked more particles up into areas of fast-moving winds. The kicked-up particles then collided with other falling particles, sending the falling particles back up into even faster-moving areas. The repeated process of falling and splashing and colliding feeds the strength of the storm.

**Task 2. Translate the text into Ukrainian, focusing on polysemantic words:**

Black holes have two fundamental characteristics – mass and spin. Mass is relatively easy to measure. Spin, a black hole's angular momentum, is much more difficult. The current technique involves evaluating the iron emission line present in x rays emitted by clouds of hot ionized gas that surround the black hole. Some of those x rays get reflected off the black hole's accretion disk and travel toward Earth, where they can be measured. The wider the emission line, the higher the black hole's spin. That higher spin allows the accretion disk to be closer to the event horizon, and thus the gravity of the black hole is more able to distort the emission spectrum. A new technique developed by Christine Done of Durham University, UK, and her colleagues measures lower-energy x rays emitted directly from the accretion disk. The spectra of those x rays provide the disk's temperature measurements, which can be correlated to the distance of the accretion disk from the event horizon. The black hole they measured had a spin of at most 86% the relativistic upper limit for black

hole rotation. The older method, which has not been used on their target, has only produced measurements of greater than 90%. The difference between the results suggests two possibilities: Either one of the methods is more accurate than the other, or a greater variance in black hole spin exists than previously believed.

**Task 3. Translate the text into Ukrainian, focusing on transcoding:**

Quantum cryptography applies principles of public-key cryptography to communications systems that transmit information encoded on individual photons. However, in 2010 it was found that the key-sharing signals could be intercepted and reproduced in such a way that the security was compromised without the sender or receiver knowing. Last year, Hoi-Kwong Lo of the University of Toronto and his colleagues proposed a system that prevents the interception: The sender and receiver send randomly polarized signals to a third party. The third party indicates whether the polarizations are at right angles. If they are, the receiver adjusts their polarization to align with the sender, forming the key. Neither the sender nor the receiver needs to measure polarizations on future messages, so any interception that measures the polarization would corrupt the signal. And now two independent groups led by Wolfgang Tittel of the University of Calgary in Canada and Jian-Wei Pan of the University of Science and Technology of China have demonstrated the third-party system's viability. Other solutions to signal interception have also been developed, but the fact that Lo's proposal is usable gives quantum cryptography systems another option to ensure their security.

**Task 4. Pre-test activity. Translate the text into Ukrainian:**

When slabs of continental lithosphere collide, interesting things happen. Most apparent is the uplift of a mountain range–like the Himalayas, where the Indo-Australian plate has been colliding with the Eurasian plate for millions of years. But less easily observable aspects of plate interactions also lead to some fascinating geophysical investigations. The collision process begins as thin, dense, oceanic crust – the outermost part of Earth's lithosphere that covers ocean basins and is made of basalt and other mafic rock – is slowly consumed beneath thick, buoyant continental crust, which is made of less dense rock, such as granite. Subduction involves both the crust and uppermost solid mantle. Normal subduction continues as long as the oceanic crust is exposed, but eventually the continental crust supported by the downwelling slab arrives at the subduction zone. Entering the oceanic trench, the slab collides with the other overriding plate and folds upward into mountains. That vertical movement is why marine fossils can be found in the Himalayas, where millions of years ago the Tethys Sea separated India from the rest of Asia. This

transition from oceanic subduction to continental collision is complex and diverse, and the fate of continental and previously subducted oceanic lithosphere may lead to several different subsurface scenarios.

**Task 5. Translate the text into Ukrainian, focusing on loan translation:**

Early in May, radio astronomers found something they've been longing for: a radio pulsar very close to the supermassive black hole (SBH) that marks the center of our Milky Way galaxy. Pulsars–rapidly spinning neutron stars–are precise celestial timers. At a distance of about half a light-year from the SBH, the new pulsar is not close enough to probe the strong distortion of spacetime expected within light-minutes. But it turns out to be close enough to yield the first direct measurement of the magnetic-field intensity *B* in the outskirts of the enveloping hot gas from which the SBH feeds. A team from the Max Planck Institute for Radio Astronomy in Bonn, Germany, has used the institute's 100-meter telescope (shown here) to make extensive measurements of the rotation of the polarization direction of the pulsar's radio emission. That Faraday rotation depends sensitively on *B* in the pulsar's immediate vicinity. They found that *B* is already quite strong (at least 8 milligauss) at the pulsar's distance from the SBH. That’s an important, previously unknown parameter for the simulation of the black hole's accretion dynamics. The team conjectures that the surprisingly large *B* at the outer limit of the accretion inflow might be responsible for the SBH’s puzzlingly anemic accretion rate, long known from the modest radio and x-ray emission coming directly from the galactic center. Having now found one radio pulsar in the galaxy's innermost precinct, the team expects to find more.

**Task 6. Translate the text into Ukrainian, focusing on contextual alternatives:**

The ability of wind turbines and solar power plants to generate energy depends on local conditions, and they sometimes are unable to produce enough electricity to meet demand. They are often paired with batteries or other systems, such as pumped-storage hydroelectricity and compressed air, to store energy produced during low-demand periods. A new study by Charles Barnhart of Stanford University and his colleagues suggests that using batteries to store extra electricity produced by cheaper energy sources, such as wind turbines, may not be worthwhile. Energy return on investment (EROI) is a way of determining whether the energy generation ability of a technology is efficient compared with the cost of creating the technology. Barnhart’s team found that even the most efficient lithium batteries scored two orders of magnitude lower in EROI than pumped hydro and compressed air storage. This means that for cheap-to-produce wind turbines, it is often more efficient to just build

extra turbines or more transmission lines than to add battery storage. For solar devices, which are more expensive to manufacture, battery storage can make the difference in cost-effectiveness. The study notes that many other factors can play into the overall viability of battery storage.

**Task 7. Translate the text into Ukrainian, focusing on antonymous translation:**

For condensed-matter physicists, the year 2011 was not an ordinary one. It marked the 100th anniversary of the discovery of superconductivity, one of the most fascinating topics in quantum physics and still one of the most studied. When certain materials – for example, aluminum and lead–are cooled to nearly absolute zero, they suddenly conduct electricity perfectly, with no resistance. Superconductors also expel magnetic fields, a property that causes magnets to levitate on top of superconductors. Even more fascinating, under certain conditions, the magnet becomes "pinned" to the superconductor. In that case, it can either levitate above the superconductor or remain suspended below it.

But it was not until the 1960s that the superconductivity kicking in at very low temperature was explained by John Bardeen, Leon Cooper, and J. Robert Schrieffer with what is now called the BCS model. However, more recently discovered families of superconductors conduct perfectly at temperatures up to 10 times that of the usual metals. The BCS model does not seem to apply to those high-temperature superconductors, hence the continuing research. Ultimately, physicists hope to discover a material that superconducts at room temperature.

**Task 8. Pre-test activity. Translate the text into Ukrainian:**

Unlike other primates, humans are able to throw objects with great accuracy at very high speeds. To determine the mechanics involved, Neil Roach of George Washington University in Washington, DC, and his colleagues used a 3D camera system to film a group of college athletes throwing baseballs. Computer analysis of the videos revealed that for fast throws, the shoulder appears to store and release energy in a manner similar to a slingshot. Roach's team believes that this slingshot-like ability comes from a combination of factors that they say did not appear in *Homo erectus* until 2 million years ago: A wider waist created a more flexible torso; realigned elbows increased energy storage in cocked arms; and broad shoulders increased the power capacity of shoulder and chest muscles. However, Susan Larson of Stony Brook University in New York says that no tendons in the shoulder are used for energy storage in the manner the video analysis suggests. She also says that the estimates of *Homo erectus* bone structure are inaccurate because they are based on partial fossils, and that other required characteristics weren't actually present in the

species. She believes that modern throwing ability first appeared much later, some 1 million years ago, in European hominids known as *Homo antecessor* and *Homo heidelbergensis*.

**Task 9. Translate the text into Ukrainian, focusing on descriptive translation:**

In medical cases where someone has suffered a traumatic brain injury (TBI) or has fallen into a coma, it is important to be able to determine what level of consciousness the person retains, if any. Currently, doctors are limited to attempting to stimulate the patient's senses and looking for slight movements of the eyes or fingers. But an estimated 40% of patients judged to have no consciousness are later found to have some level of it. Attempts to use brain imaging or monitoring of electrical activity have also been found to be unreliable. Now Marcello Massimini of the University of Milan in Italy and his colleagues believe they have found a viable method for measuring consciousness. An electroencephalograph (EEG) is used to measure electrical activity stimulated by pulses from a magnetic coil held to the skull, and a variety of characteristics of the EEG readings are used to rank the response on a scale between 0 and 1. The system was calibrated with healthy people fully awake, in deep sleep, and under different types of anesthesia. It was then tested on people who had suffered a variety of TBIs with relatively well-understood levels of consciousness. The system works without requiring any input from the patient, so it holds considerable promise as a diagnostic tool.

**Task 10. Translate the text into Ukrainian, focusing on translator's 'false friends':**

All light is affected by noise from quantum effects. At the low powers used by the lasers in many sensors, light fluctuations caused by noise can blur the classical light waves and thus limit the precision of measurements made using the light. "Squeezing" the light can reduce the noise, but only in one dimension–any change to the height of a light wave's peaks affects the distance between the peaks. Most light-squeezing work has focused on gravitational-wave detectors, where researchers have experimented with passing lasers through crystals. The researchers at the Laser Interferometer Gravitational-Wave Observatory (LIGO) have successfully squeezed light to achieve sensitivities better than the standard limit, but the process is difficult. Now, Oskar Painter of Caltech has developed a simple zipper-like device carved on a basic silicon chip that also squeezes light, albeit at higher frequencies than are useful for gravitational-wave detectors. When a laser passes between the two arms of the zipper, its photons bounce off the arms. The amount of noise in the light determines

how hard the photons push against the arms. By changing the angle of the arms, the frequency of the light can be tuned.

**Task 11. Translate the text into Ukrainian, focusing on realia:**

The supermassive black hole Sagittarius A*, at the heart of the Milky Way, is much fainter than a black hole of its size is expected to be. Observations of a recently discovered pulsar in orbit around Sagittarius A* have revealed that the black hole has a magnetic field 100 times as strong as Earth's. The surprisingly strong magnetic field would significantly reduce the speed of material falling toward the black hole's event horizon. Heino Falcke of Radboud University in Nijmegen, Netherlands, and his colleagues were using the 100-metre Effelsberg Radio Telescope near Bonn, Germany, to study a newly discovered magnetar – a rare type of pulsar with a magnetic field 100 trillion times the strength of Earth's. The magnetar appeared to be orbiting Sagittarius A*, and they hoped to use it to measure the black hole's gravitational effect on the curvature of space. They discovered that the magnetar was 20 000 AU away from the black hole, too far to measure relativistic effects. However, they found that the radio waves from the magnetar were twisted into corkscrew shapes by the black hole's magnetic field. Because the effect was different at different wave lengths, they were able to estimate the magnetic field strength.

**Task 12. Pre-test activity. Translate the text into Ukrainian:**

If the orientation is right, a planet orbiting a star blocks some of the light emitted in the direction of an observer. Those transits are one of the most common ways to detect planets around other stars. Now, looking at a known planetary system, Katja Poppenhaeger of Harvard University and her colleagues have observed the first planetary transit in the x-ray spectrum. Previous visible-light observations revealed the planet to be a hot Jupiter – a gas giant orbiting close to the star. The x-ray observations were harder to interpret because x-ray emissions are not evenly distributed across the surface of the star, so the planet's transit can be difficult to detect against the noisy background. Once the transit was detected, the researchers found that there was a difference between the amount of visible light and the amount of x-ray light that was blocked. They believe that the best explanation is that heat from the star has caused the planet's atmosphere to expand and allowed a layer of hydrogen gas to form far out from the surface. That hydrogen would absorb significantly more x-ray emissions than visible-light emissions. However, the extended layer of hydrogen would experience less gravity and thus probably evaporates away at a rate that Poppenhaeger's group calculated to be $10^9$ kg/s.

**Task 13. Translate the text into Ukrainian, focusing on proper names:**

In studying a chemical reaction on a surface, it's useful to know not only the identities of the desorbed products but also their angular distribution. Velocity-map imaging, a technique developed for gas-phase chemistry, can achieve that goal: The products are ionized and electrically accelerated toward a two-dimensional detector that incorporates a CCD camera. The products arrive at the detector at different times, segregated by their mass-to-charge ratio. But commercial CCDs are too slow to separately image each product in a single experiment. Over the past several years, chemists and physicists at Oxford University and the Rutherford Appleton Laboratory have developed a new ultrafast sensor–called PImMS, for pixel imaging mass spectrometry – that overcomes the CCDs' limitation. Now Michael White and colleagues (Brookhaven National Laboratory and Stony Brook University) have used PImMS to study the surface-catalyzed oxidation of 2-butanone on titanium dioxide. Previous studies of that reaction identified signals corresponding to the hydrocarbon fragments $C_2H_3$, $C_2H_4$, and $C_2H_5$. From their proof-of-principle PImMS data, shown in the figure, White and colleagues concluded that $C_2H_3$ and $C_2H_4$ aren't products of the surface reaction at all. Instead, they're formed in the ionizer, where some $C_2H_5$ fragments lose not only an electron but also one or two hydrogen atoms.

**Task 14. Translate the text into Ukrainian, focusing on anthroponyms:**

Numerically solving the Schrödinger equation for all *N* electrons in an atom or molecule is impractical: The computational effort required scales exponentially with *N*. So computational chemists must develop approximations. (See the article by Martin Head-Gordon and Emilio Artacho, *Physics Today*, April 2008, page 58.) The sticking point is in accurately treating the electron correlations: the difference between the true *N*-electron wavefunction and the antisymmetrized product of *N* single-electron wavefunctions. It's long been recognized that electron correlations are mostly local–two widely separated electrons are unlikely to be significantly correlated–and several groups have been working to exploit that locality to develop a faster version of coupled cluster theory. Now Frank Neese and colleagues at the Max Planck Institute for Chemical Energy Conversion have done it. Using a so-called domain-based local pair natural orbital (DLPNO) approach, they've implemented a coupled cluster method that scales nearly linearly with *N*. Neese and colleagues then used their new method to calculate the electronic energies of the linear hydrocarbon $C_{150}H_{302}$ and the 644-atom protein crambin. The crambin calculation took 30 days; a standard coupled cluster calculation on the same molecule would have taken many thousands of years. (C. Riplinger et al.)

**Task 15. Translate the text into Ukrainian, focusing on abbreviations and acronyms:**

A wealth of early sound recordings made by Alexander Graham Bell and his assistants in the late 19th century have long remained "mute artifacts" because the method of playing them back was unknown. Now more than a century later, Bell's voice has been heard for the first time. Researchers at the Smithsonian's National Museum of American History, which holds a cache of more than 400 of Bell's wax-and-cardboard disks and cylinders, teamed up with researchers at the Library of Congress and Lawrence Berkeley National Laboratory (LBNL). To create digital audio files of Bell's recordings, LBNL researchers used the optical measurement technique they had developed to align the silicon detectors in the ATLAS experiment at CERN. They took multiple high-resolution images of the soundtracks, moving the camera in a spiral pattern to follow the path of the grooves, then used a computer to calculate the sound pressure waveform and used the data to create the audio file. The result was the sound of muffled voices reciting Hamlet's soliloquy, number sequences, and "Mary Had a Little Lamb." By deciphering notes scratched in wax on one of the disks, dated 15 April 1885, they discovered a recording of Bell himself. Perhaps reminiscent of Bell's father, who was a renowned elocution teacher, Bell can now be heard making the ringing declaration, "In witness whereof – hear my voice, Alexander Graham Bell."

**Task 16. Pre-test activity. Translate the text into Ukrainian:**

**(a)** "Despite the continued increase in atmospheric greenhouse gas concentrations, the annual-mean global temperature has not risen in the twenty-first century," according to a recent study by Yu Kosaka and Shang-Ping Xie of the Scripps Institution of Oceanography in San Diego, California, which appears online in *Nature*. Many natural causes for the temporary global-warming hiatus have been proposed, including a buildup of aerosols in the atmosphere, volcanic eruptions, a lull in solar activity, and heat absorption by Earth's oceans. To find out how much ocean surface temperatures in the eastern equatorial Pacific affect global atmospheric temperatures, Kosaka and Xie ran a series of experiments called POGA (Pacific Ocean–Global Atmosphere). They found that recent cooling in the Pacific lowered global mean temperatures by 0.15°C relative to the 1990s. Nevertheless, they say, the effect is only temporary – the climate is going to continue to warm due to increasing greenhouse gas concentrations.

**(b)** A pair of researchers in Canada have found that birds are adapting to vehicle traffic on roadways by using the average speed limit to determine when they need to take flight. Pierre Legagneux of the University of Quebec in Rimouski and Simon

Ducatez of McGill University in Montreal studied data on the distances and times between oncoming cars and birds' points of flight. From 134 measurements across 21 species, the researchers found that flight initiation distance increased with the roadway's established speed limit. The higher the limit, the sooner the birds took flight upon spotting an oncoming car. Interestingly, the birds' behavior appeared not to be affected by the actual speed of the car. The researchers say that such behavioral responses help species survive in habitats that have been modified by humans. Earlier this year, another study found that cliff swallows living near highway overpasses in the US Midwest were developing shorter wings, which allow them greater maneuverability around speeding traffic.

**(c)** The larva of *Calindoea trifascialis*, a species of moth native to Vietnam, wraps itself in a leaf, drops to the ground, and then spends three days hopping around blindly until it finds a suitable spot to pupate. Although it cannot see through its leafy cover, the insect instinctively avoids sunlight by jumping along until it finds a shady spot. To see exactly how the insects move, Kim Humphreys of the Royal Ontario Museum in Canada and colleagues designed transparent leaf rolls from plastic. According to their study published in *Biology Letters*, the caterpillars were observed to anchor their rear end to the floor of their shelter and lower their head, then jerk their front end backward, causing them to leap up and back. The researchers think the caterpillars drop to the ground to avoid predators, but then are vulnerable to overheating by the Sun and must seek shade. "Perhaps there are interesting aspects of the biology of other larvae that are remaining to be discovered," said Humphreys.

**(d)** Ground levels are known to drop in areas of extended oil drilling, as in Houston, Texas, and groundwater pumping, as in Bangkok, Thailand. A new study of China's Yellow River delta has identified a major side effect of subsidence. Stephanie Higgins of the University of Colorado Boulder and her colleagues examined satellite-radar images of the region. By using the roofs of farmhouses as a reflective surface, they were able to determine the changes in ground height. Water pumping for fish farms appears to have caused ground levels to drop by as much as 0.25 m per year in the area. And because the delta empties into the sea, the subsidence has caused local sea levels to rise 100 times as quickly as the global average. The connection between aquaculture and local sea levels is a new concern for both industry and researchers. The Yellow River delta is particularly vulnerable to shoreline and ground height changes, despite major projects to reduce erosion. Understanding the impact of fish farming could help control future damage.

**(e)** In the late Pleistocene about 12 000 years ago, 97 genera of large animals went extinct, primarily in the Americas and Australia. The loss had a large impact on plant life, which depended on vital nutrients distributed via the animals' dung. In a paper published in Nature Geoscience, researchers describe how they developed a mathematical model to calculate the impact on the ecosystem nutrient

biogeochemistry. They found, for example, that the extinctions resulted in a 98% reduction in the dispersal of phosphorus, a key mineral for both animals and plants. Even today, the Amazon basin has less phosphorus than other areas, which, the researchers say, may be "partially a relic of an ecosystem without the functional connectivity it once had." Why the animals became extinct is unknown, but it could be due to any of several causes, including human hunting, climate change, disease, or Earth's colliding with an asteroid. The researchers say that their model could also forecast the consequences of large-animal extinctions today.

**(f)** The use of quantum entanglement to transmit information via quantum teleportation is a major area of experimentation. Two experiments have presented major steps forward in teleportation's potential usefulness. In the first, Andreas Wallraff of ETH Zurich in Switzerland and his colleagues have created a solid-state device that teleports quantum information between entangled microwaves on a pair of circuits. Changing the state of the signal on the first circuit let them evaluate the second signal to determine the original state of the first signal. The system's transmission rate is nearly 10 000 events per second, with a very high success rate. In the second experiment, Akira Furusawa of the University of Tokyo and his colleagues showed a transmission success rate nearly 50 times higher than current teleportation systems. Teleportation without noticeable loss of signal and the ability to manufacture solid-state, computer-chip-like components capable of teleportation will be necessary for the development of quantum computers and communications.

**(g)** MIT technology review: modified crystal shows potential for solar-cell efficiency. Perovskite solar technology has reached efficiencies in four years that took more than a decade to reach using silicon and cadmium telluride solar cells. Andrew Rappe of the University of Pennsylvania and his colleagues have developed a new perovskite material – a class of compounds characterized by a specific crystalline structure – with properties that suggest it could be used in solar cells to convert 50% of the energy in sunlight into electricity. That would be more than twice as effective as the current best conventional cells. The material is the first to combine the ability to generate an electric current without the presence of an electric field with a high responsiveness to visible light. Rappe's team also demonstrated that the structure can be modified to respond to other wavelengths. However, the material has not been tested in an actual solar cell yet, and the amount of current it produces is much lower than conventional materials.

**(h)** Researchers in Australia have built an electric motor just 250 μm wide that could be used to power tiny robots narrow enough to be injected into the human bloodstream, making new kinds of surgery possible. The motors work by converting the vibrations of a piezoelectric material into rotary motion that could then be used to drive whip-like structures called flagella – mimicking how some bacteria and other

micro-organisms swim. The team claims that their piezoelectric motor is the first such device to be smaller than 1 mm and – with some improvements – could be powerful enough to drive a robot against the flow in the human bloodstream. The team was able to operate the motor at 1295 revolutions per minute at a torque of 13 nNm – which is a swimming power of about 4 μW. This power could then be used to propel the motor through a fluid by attaching a whip-like structure called a flagellum to the rotor. Calculations done by the team suggest that the motor can only deliver about one-fifth of the power needed to drive a tiny robot against the flow in a small human artery – however, the team are hopeful that the power could be boosted in the future.

**(i)** Classified documents released by former National Security Agency contractor Edward Snowden have revealed that spy organisations have cracked the encryption used to protect the privacy of emails and medical records, and the security of online financial transactions. Can physics stop snoops where maths fails? Much web traffic, such as email and payments for goods and services, is sent over a secure protocol, meaning that its contents are encrypted before being transferred. Commonly used methods of encryption are based on pure maths. They convert the plain-text message into "ciphertext" – a version that appears garbled – by substituting characters for other characters. If the message is intercepted, it will read as nonsense unless it's decrypted. Decoding a message needs the encryption key – i.e., the way in which text is converted between plain text and ciphertext. Encryption using a one-time pad can't ever be broken provided that the text of the pad is truly random, at least as long as the plaintext message, only used once – and never shared or intercepted. That's where physics comes in – specifically, quantum mechanics.

**(j)** Researchers in Australia have built an electric motor just 250 μm wide that could be used to power tiny robots narrow enough to be injected into the human bloodstream, making new kinds of surgery possible. The motors work by converting the vibrations of a piezoelectric material into rotary motion that could then be used to drive whip-like structures called flagella – mimicking how some bacteria and other micro-organisms swim. The team claims that their piezoelectric motor is the first such device to be smaller than 1 mm and – with some improvements – could be powerful enough to drive a robot against the flow in the human bloodstream. The team was able to operate the motor at 1295 revolutions per minute at a torque of 13 nNm – which is a swimming power of about 4 μW. This power could then be used to propel the motor through a fluid by attaching a whip-like structure called a flagellum to the rotor. Calculations done by the team suggest that the motor can only deliver about one-fifth of the power needed to drive a tiny robot against the flow in a small human artery – however, the team are hopeful that the power could be boosted in the future.

## *РЕКОМЕНДОВАНА ЛІТЕРАТУРА*


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## ЗМІСТ

Навчальне видання

**Каминін Ігор Миколайович**

**Осінська Марія Сергіївна**

# МЕТОДИЧНІ ВКАЗІВКИ ТА ЗАВДАННЯ ДЛЯ САМОСТІЙНОЇ РОБОТИ СТУДЕНТІВ З ПРАКТИКИ ПИСЬМОВОГО АНГЛО-УКРАЇНСЬКОГО НАУКОВО-ТЕХНІЧНОГО ПЕРЕКЛАДУ

Для студентів 3 курсу
факультету іноземних мов

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