

SCIENCE FOR THE BENEFIT OF MANKIND

FANVA TURMUSH

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PEARL OF NEW
UZBEKISTAN

- What are semiconductors?
- History of viticulture
- 60 years since the Tashkent earthquake
- Features of urbanization

The defensive wall of the Hazratgah fortress,
BC VI-IV c



EDITORIAL

Dear reader!

Spring has come to our land once again... Nature is awakening... Renewal is underway in all areas of life. Everyone has new plans, new dreams...

Every day of the New Uzbekistan brings us great changes in all areas, including science. Reforms in science continue unabated. This is evidenced by the Decree of the President of the Republic of Uzbekistan “On measures to improve the activities of the Academy of Sciences of the Republic of Uzbekistan” dated December 27, 2025.

This Decree places great importance on international cooperation in science and the training of young scientists. In this regard, the visit to Uzbekistan of Mr. B. Bradshaw, Vice-Rector for International Cooperation at the University of Guelph, one of Canada’s leading universities in the field of agriculture, to establish comprehensive scientific contacts was a significant event. You can learn more about the activities and plans for cooperation at the University of Guelph in an interview with Mr B. Bradshaw, which he gave exclusively to our magazine.

The first section features an article by A. Saidov and Sh. Usmanov entitled “What are Semiconductor Solid Solutions?”, the title itself captivating the reader’s interest in this paradoxical combination. It not only explains the terms but also reveals the innovative developments being made by Uzbek scientists in this field.

This year marks the 60th anniversary of the tragic event – the 1966 Tashkent earthquake, which brought pain, loss, and destruction. On the other hand, it served as a lesson for society and forced a new perspective on the problem of seismic hazard in Central Asia. All this can be read in the article by S. Mirzaev, Vice President of the Uzbekistan Academy of Sciences, written in a lively and engaging manner.

Readers will also find an interesting article by Z. Buriev, Director of the Centre for Genomics and Bioinformatics of the Uzbekistan Academy of Sciences, on the history and modern varieties of Uzbek grapes. We would also like to remind you that, thanks to the unique flavour qualities of our grapes, Uzbek wines made from them have received high international recognition.

The reforms initiated in New Uzbekistan are already bearing fruit, with ambitious plans and unique projects being implemented. For example, the idea of creating a Centre of Islamic Civilisation, proposed by the President of our country in 2017, was successfully implemented, and this unique Centre was officially opened on March 17, 2026. Academician A. Khakimov’s article is dedicated to this landmark of New Uzbekistan.

The editorial board will continue to publish relevant and interesting articles in other thematic sections. Among them are articles by S. Beknazarova, “Metaverse: Science Fiction or a New Social Reality?”; Sh. Babajanov, “The Palace Chef of Emir Alimkhan”; Z. Mukhsinova, on the artistic metalwork of the Sasanian Empire; as well as articles by young scholars on various processes in the social sciences and humanities and the cultural life of Uzbekistan.

Dear reader, we wish you pleasant reading and a spring mood!



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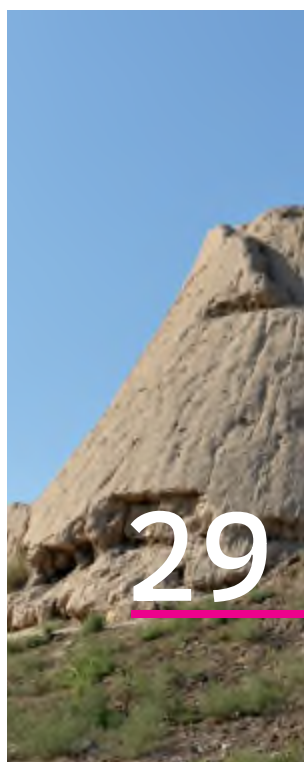
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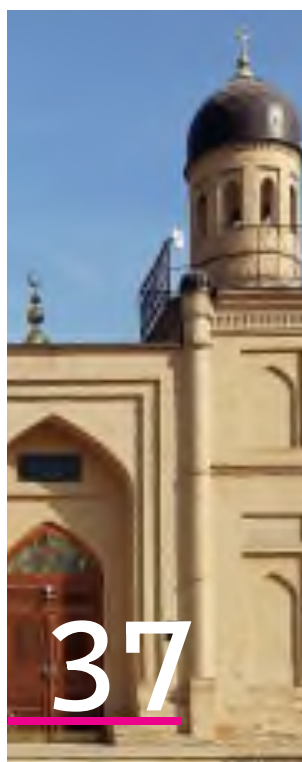
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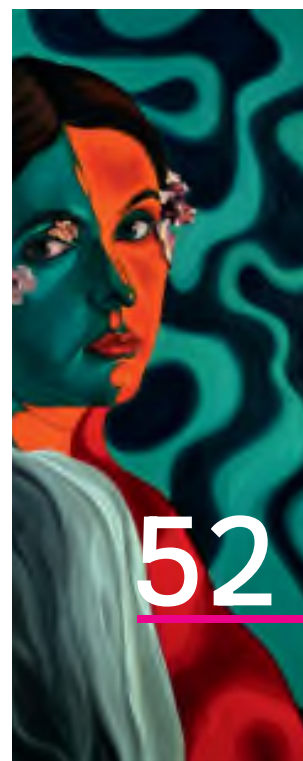
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The Pearl of New Uzbekistan

Akbar Khakimov,
Academician

The year 2025 was marked by significant transformations and remarkable achievements in many areas of Uzbekistan's socio-economic, political, and spiritual life. One of the most significant and global events of the past year was the completion of the unique building of the Centre of Islamic Civilization in Uzbekistan in Tashkent. The idea for its creation belongs to the President of Uzbekistan, Shavkat Mirziyoyev, and he first voiced it at the UN General Assembly in 2017.

The establishment of the Centre of Islamic Civilization was one manifestation of the President of Uzbekistan's broad strategy and political program aimed at reviving, promoting, and nurturing the rich cultural and spiritual heritage of the Uzbek people. This well-considered political doctrine places particular emphasis on promoting and studying the invaluable legacy of Uzbekistan's Islamic civilization. A key aspect of this concept is the promotion of the humanistic values of Islam through extensive educational and research activities.

Over the past eight years, a tremendous amount of work has been accomplished to implement this mega-project—from the Centre's architectural design to the development of its scientific and educational program, from staffing to the concept of an impressive exhibition space. Nearly all of the country's ministries and agencies, scientists and museum professionals, designers, and specialists in modern media technologies were involved in the project. Particularly noteworthy is the role of the Uzbekistan Academy of Sciences and leading scientists, who actively participated in developing the Centre's scientific concept and promising areas for its future implementation and development.

The Centre became a national project, with strategic leadership directly provided by the President of Uzbekistan himself. Throughout its construction and development, he visited it repeatedly, expressing valuable suggestions, fundamental comments, and instructions. Each year of the Centre's development is significant, representing the next stage of the tireless work of a vast number of talented architects, engineers, and builders, folk artists, leading scientists, and museum staff.

From July to November 2024, a series of large-scale national and international forums were held to improve and optimize the scientific concept of the Centre's exhibition space, involving a large number of scholars and specialists. Based on their results, the following structure of the exhibition halls was adopted: 1) the Hall of the Quran; 2) the Hall of Pre-Islamic Civilization; 3) the Hall of the First or Eastern Renaissance (9th-early 13th centuries); 4) the Hall of the Second or Timurid Renaissance with subsections on the Baburid Era and the Period of the Uzbek Khanates; 5) the Hall of the Third Renaissance – as the ideological platform of the New Uzbekistan.

The content of the exhibition was proposed to be considered in the context of the semantic triad "Civilizations – Personalities – Discoveries".

In 2025, approximately 800 scientific and innovative projects were developed and implemented within the framework of this concept. A significant increase in the number of domestic and international scientists, experts, and specialists from various fields involved in the creation of the Centre's museum exhibition played a significant role in this. 516 local and 111 international scientists and scholars were involved in the implementation of these projects. The project results had both informational and practical value – they served as accompanying materials and verbal artifacts for the exhibition, as well as scripts for a large number of accompanying videos, mappings, and documentaries.

Large and renowned international and domestic construction and design companies were engaged to develop the design and modern media technologies for the Centre's exhibition space. Their talented creative solutions imbued the exhibition and the Centre's overall appearance with a harmonious blend of unique oriental flair and contemporary technological style. Uzbek calligraphy masters played a significant



The Center for Islamic Civilization in Uzbekistan. Tashkent





"Pre-Islamic Civilizations" Section

The "Kokand" Portal

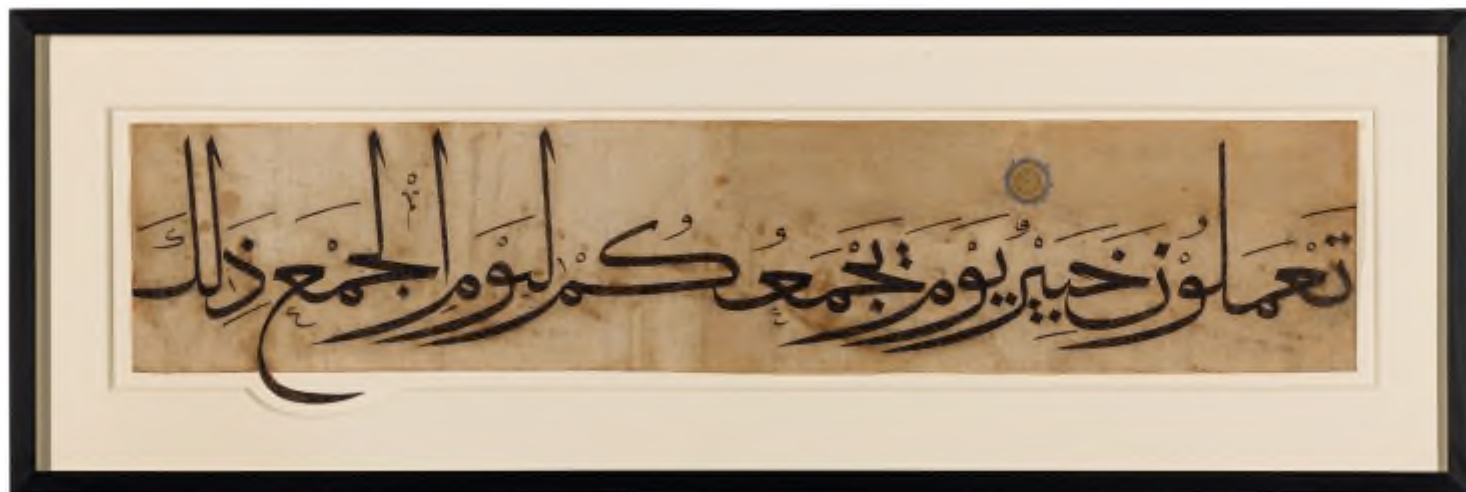


role in the artistic design of the Centre's space, adorning the exterior walls, the niches of the arches and the four main portals, as well as the interior walls and surfaces of the Centre with elegant inscriptions from the Quran and hadith.

The masterful work of the silk carpet weavers in the Quran Hall deserves special mention. These beautiful panels undoubtedly represented a verbal and decorative revelation for the hall's designers, emphasizing the sacred and majestic pathos of the Quran Hall. This 64-meter-high hall, magnificently decorated with glass mosaics and coloured gems and crowned

and figures of the progressive Jadid movement. Thus, a panorama of impressive images and ideas unfolds before the viewer, which they will explore in greater depth during their visit to the Centre's main exhibition halls.

In the Centre's halls, prominent Uzbek artists have also created a series of large monumental paintings on themes of the First Renaissance and the Timurid Renaissance, which beautifully convey the atmosphere of these eras and the greatness of the individuals who made an invaluable contribution to the creation of these civilizations.



A verse from the Baysungur Quran. The Quran was commissioned by Amir Temur. 1400. Samarkand

with a huge spherical dome, is the dominant feature and core of the entire complex. It was here that one of the oldest and most significant manuscripts of Islam, the Quran of Uthman, was ceremoniously enshrined in November 2025.

In 2025, thanks to the intensification of work, not only were previous projects by Uzbek monumental artists completed, but several new large wall panels were also begun and successfully completed, some of them in the style of oriental miniatures.

Of particular significance are the 14 panels, each approximately 9 meters high and over 2 meters wide, created using a complex mosaic technique of small, fine fragments of coloured stone. Placed vertically around the perimeter of the vast, rectangular vestibule hall, these panels create a unique impression. They depict great scholars, philosophers, and artists—from Al-Khwarizmi, Ibn Sina, Al-Biruni, and Al-Farghani to the astronomer and ruler Mirzo Ulugbek, from the brilliant poets Jami and Navoi to the incomparable artist of the East Kamaliddin Behzad. The compositions also reflect images of religious figures from Maverannahr recognized throughout the Islamic world, including Al-Bukhari, Al-Maturidi, At-Tirmizi, Naqshbandi, and others. Among the outstanding rulers, military leaders, and statesmen, the images of Manguberdi, Amir Temur, and other rulers of the Timurid dynasty are embodied in metaphorical and vivid artistic language. Several panels are dedicated to educators of the period of Uzbek khanates

By early 2025, despite the Centre's efforts, the need to replenish the exhibition with true masterpieces and valuable artifacts from the pre-Islamic and Islamic periods had become particularly pressing. For example, there were essentially no gold and silver metalwork items from the ancient and medieval periods related to Uzbekistan's cultural heritage, neither in the Centre's collections nor in the collections of other domestic museums. Our museums did not possess a single example of *zandanechi* silk fabrics, produced in the 6th-8th centuries in Sogdiana, nor was there a single exhibit for the special section «The Baburid Era», etc. At the same time, these artifacts were abundantly available in foreign museums and private collections.

Under these circumstances, the President of the country made a historically unprecedented decision: he allocated the necessary funds to acquire and repatriate masterpieces of Uzbekistan's cultural heritage through procurement. To this end, throughout 2025, the Centre of Islamic Civilization in Uzbekistan conducted trips to London to purchase artifacts at auctions and from private galleries related to Uzbekistan's cultural and artistic heritage. During these trips, medieval manuscripts, Koranic pages, miniature paintings, toreutics, ceramics, and artistic textiles were purchased.

One of the most significant events in the acquisition and return of national heritage artifacts was the return to Uzbekistan of a fragment of a unique Quran,



Bronze bird-shaped incense burner. 11th century.
Maverannah or Khorasan



Bronze mace—a symbol of royal authority. 11th–12th centuries.
Maverannahr or Khorasan

copied by the great calligrapher Umar Aqta at the personal request of Amir Timur around 1400 in Samarkand. This extremely rare artifact, long considered the largest copy of the Holy Quran in the world, symbolizes the flourishing of calligraphic art and spiritual culture during the Timurid era and underscores the continuity of the great traditions of Islamic civilization in Uzbekistan. This artifact was purchased at a Sotheby's auction. Of particular significance was the series of calligraphic Quranic texts on individual pages acquired at auction, covering various regions of the Islamic world—from Egypt, Syria, Tunisia, Yemen, and even Spain. This material is essential for the exhibition halls dedicated to the evolution of Quranic calligraphy and the dissemination of Islamic teachings.

During a study of private collections and art dealers in the UK, a unique bronze statuette of a deer with large, crescent-shaped antlers, depicted at the moment of roaring, was discovered. Western scholars and researchers have repeatedly studied this artifact and have come to the same conclusion: the figurine is of Central Asian origin and belongs to the territory of modern-day Uzbekistan. This masterpiece was also purchased and is now the pride of the Centre's exhibition.

Of exceptional value from a scientific, artistic and material point of view are the Central Asian gold scabbard of the Achaemenid period with the image of

a griffin's head (4th century BCE), a pair of gold bracelets with tops in the form of ram's heads (6th century BCE), a Greco-Bactrian gold pectoral (torc) with tips in the form of a bull's head (2nd-1st centuries BCE), and also a series of silver gilded dishes of Sogdian-Sasanian origin (6th-8th centuries).

A rare silver vessel for the period, depicting peacocks, a figure on horseback, and a fox against a background of swirls, was acquired at a Sotheby's auction. The vessel's decoration is masterfully executed. A unique masterpiece is the gold hoard from the Seljukid era of the 11th-12th centuries, which was acquired at the Sotheby's auction as a single lot. However, this hoard contains over 130 different gold jewellery and objects—various earrings, chains, bracelets, clasps, and rings with turquoise and pearl stones, crafted with virtuoso craftsmanship. Given that Khorezm was part of the Seljukid Empire, the presence of this hoard in the exhibition of the Centre of Islamic Civilization was considered a legitimate acquisition.

A rectangular silver salver purchased in London bearing the name of one of the last rulers of the Samanid dynasty, Amir Abu Mansur bin Sabutin, is significant both as a remarkable work of craftsmanship and as a valuable historical document. There are fewer than a hundred exquisite silver pieces from this period in the world, which undoubtedly lends special museum significance to this masterpiece at the Centre.

Samples of artistic textiles, unique in our own museums, were also acquired at auctions and from private galleries in London. These include approximately 20 fragments of Sogdian silk samit fabrics from the 7th and 8th centuries, the earliest Islamic embroidery from the Sam Fogg collection, examples of silk robes from the Ghaznavid, Seljuk, and Temuri periods, and other artifacts. Among the embroideries, five unique suzani from Pskent, Bukhara, Shakhrisabz, Kerman, and Kattakurgan of 18th- late 19th centuries, purchased at a Sotheby's auction, from the collection of the renowned Italian collector Ignazio Vocca are noteworthy. Of particular importance among the arti-



A silver tray with gilding bearing the name of the Samanid ruler Abu Mansur. 10th century, Bukhara



Bronze jug, 11th century. Maverannah

facts acquired in London are examples of miniatures, embroidery, and magnificent weapons related to the legacy of the Great Baburids —descendants of Amir Timur.

In addition to the exhibition space, extensive work was undertaken in 2025 to create a library within the Centre, for which dedicated spaces and equipment were allocated. The Centre will house offices for various international organizations and companies, and a school of ceramics and calligraphy will be opened. The Centre also places special emphasis on restoration, establishing modern restoration laboratories equipped to international standards. These laboratories are designed to preserve ancient manuscripts, restore artifacts, and conduct scientific analysis of materials.

It is safe to say that the Centre is becoming not only a scientific, educational, exhibition, and training

platform, but also a professional base for preserving Uzbekistan's cultural heritage, which is truly of global significance.

*Prepared within the framework of project No. AL – 9524115095 “Creation of a platform covering the stages of formation and development of Islamic art in Uzbekistan”

The new kingdom

What are semiconductor solid solutions

Amin Saidov,
Professor, Doctor of Physical and Mathematical Sciences,
Shukrullo Usmonov,
Doctor of Physical and Mathematical Sciences

The science of electronics, which studies the generation of electric current in solid-state semiconductor materials and their use in microelectronic devices, microchips, and sensors, began developing in the 1930s. The first experiments with semiconductor materials were conducted approximately 100 years earlier, in the 19th century. Many discoveries made over the past nearly 200 years by scientists around the world in the development of the fundamentals of microelectronics and semiconductor technology have essentially revolutionized our lives. Today, humanity cannot imagine its existence without the use of a wide range of diverse microelectronic semiconductor devices, mobile telephony, information technology, artificial intelligence, and other methods.

It should be noted that in recent years, scientists and specialists in the fields of semiconductor physics, materials science, and electronics have increasingly focused on the development of micro- and nanoscale technologies for the synthesis, modification, and control of the properties of binary and multicomponent semiconductor materials and systems based on them.

This is driven by growing demands on the functional materials that underlie modern, advanced solid-state electronics and optoelectronics devices, including devices for converting radiant and thermal energy into electrical energy.

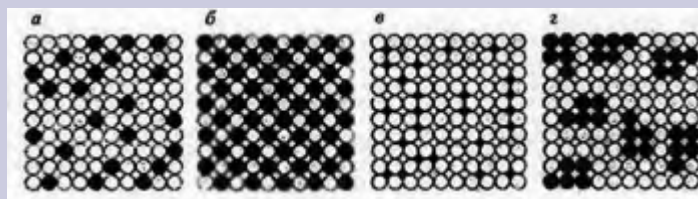
Of particular interest is the development of efficient next-generation semiconductor materials with tailored electronic and optical properties. The operating parameters and properties of these semiconductor structures are achieved through targeted control of their elemental composition, doping levels with various impurities, size effects, defects, and crystal-chemical structural features. For example, multicomponent solid solutions and nanostructured semiconductor materials allow for the variation of their lattice constant, band gap, electron energy level positions, and charge carrier type. This opens up opportunities for the efficient absorption and conversion of electromagnetic radiation across a broad spectral range of wavelengths from ultraviolet to long-wave infrared.

Solid solutions are homogeneous solid-state materials consisting of atoms of two or more chemical elements, the contents of which may vary, and which are located in a common crystal lattice without changing its type and structural parameters. In general, the atoms of the elements that make up solid solutions, including semiconductor ones, do not enter into chemical bonds with each other; therefore, solid solutions are not chemical compounds. The properties of solid solutions can differ significantly from the properties of their individual components, which determines their importance in the creation of new semiconductor materials. There are three main types of solid solutions, depending on the physicochemical nature of their components and the external conditions that ensure the dissolution of atoms of element A and element B in the crystal lattice, including:

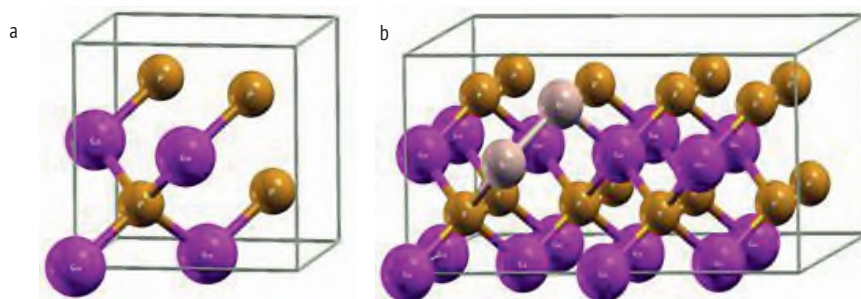
- Substitutional solid solutions that are formed on the basis of a basic crystal lattice when some of the atoms of its main chemical element A are replaced by atoms of a similar size of another chemical element B.

- Interstitial solid solutions, which are formed when there is a significant difference in the sizes of the atoms of elements A and B, with the smaller atoms of element B being located (interstitialized) within the base crystal lattice between the atoms of its main chemical element A.

- Solid solutions of subtraction, the formation of which is accompanied by the appearance of free



Various types of solid solutions: a – substitution solid solution; b – ordered solid solution; c – interstitial solid solution; d – clusters in a substitution solid solution;



a. Unit cell of a GaP solid solution
b. Crystal structure of $(\text{Si}_2)_x(\text{GaP})_{1-x}$
($x = 0.0625$)

vacancies directly in the nodes of the basic crystal lattice of the main chemical element A, which are replaced by atoms of the chemical element B.

The ability to form solid solutions is inherent to all crystalline solids. Essentially, all crystalline substances, even those considered “pure,” are solid solutions with very low impurity content. From a fundamental physics perspective, such semiconductor materials are interesting because they exhibit new quantum-based effects and alter the mechanisms of charge carrier (electron and hole) transport. They also enhance the influence of localized electron energy states on their electronic and optical properties.

In this regard, the development of methods of semiconductor photovoltaics and thermovoltaics, as well as the improvement of technologies for producing high-quality epitaxial heterostructures based on semiconductor solid solutions with controlled parameters, are of particular relevance.

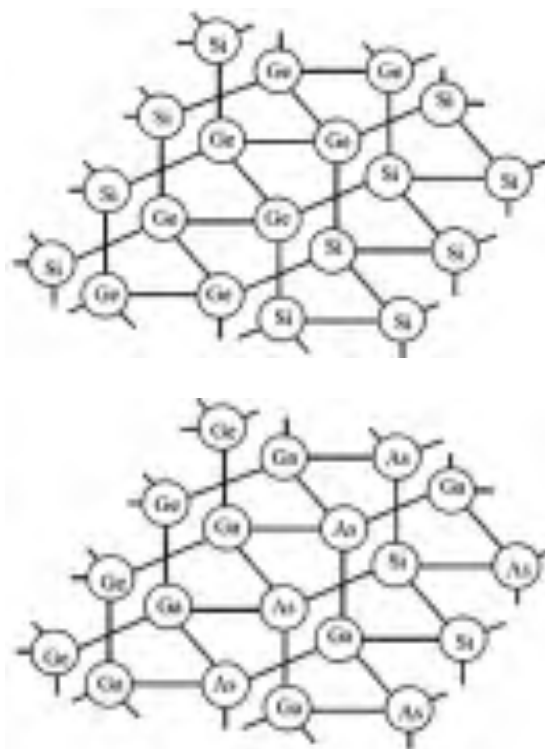
In modern micro- and optoelectronics, the production of thin epitaxial films of semiconductor materials on native or alien substrates plays a crucial role. These films are the basis for the operation of most electronic and optoelectronic devices—from microchips to lasers and LEDs. The quality of the epitaxial layer largely determines the efficiency and reliability of the devices.

Semiconductor solid solutions are of particular interest because varying their composition allows for control of the material’s electrical and optical properties. This makes it possible to create structures with predetermined characteristics adapted to specific applications. Therefore, epitaxial growth technologies for thin semiconductor films remain a key area of development in modern microelectronics and optoelectronics.

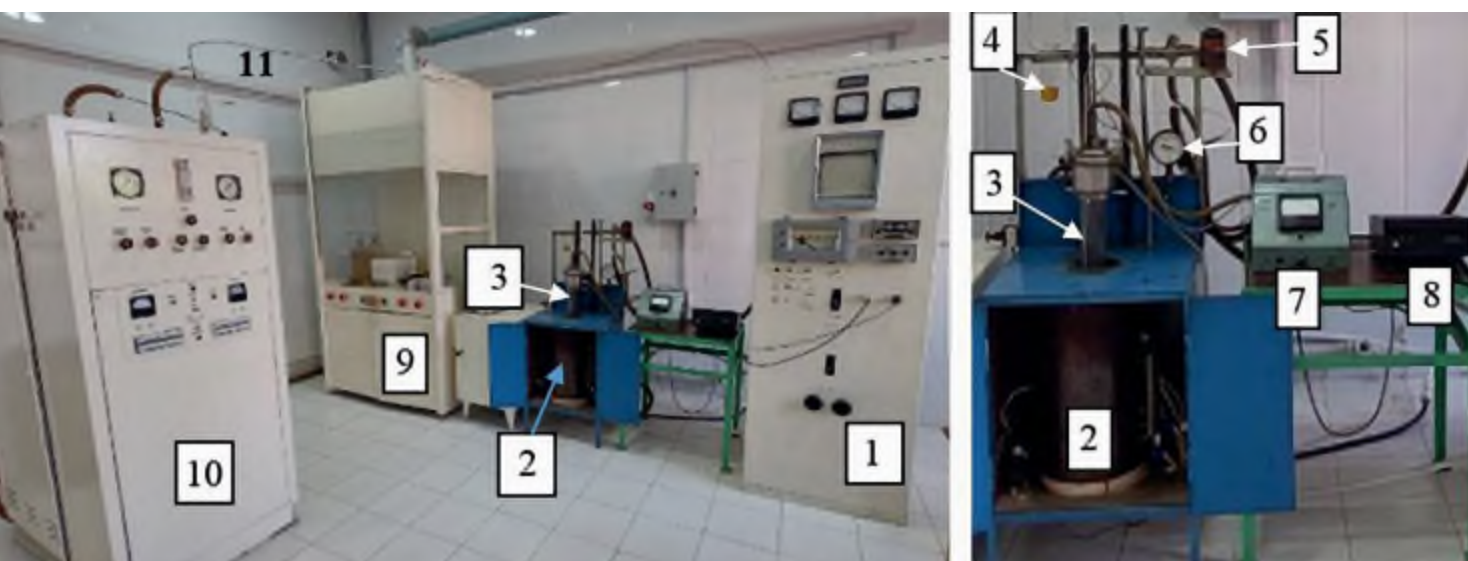
The epitaxial growth process of semiconductor layers involves the deposition of atoms of the growing material onto the substrate surface, resulting in the formation of a layer whose crystal structure matches that of the substrate. Since the epitaxial layer (EL) reproduces the substrate lattice, it also inherits its structural defects. Therefore, the purity and crystalline perfection of the substrate material are crucial for obtaining structurally perfect ELs with minimal

defect density. This plays a key role in the creation of reliable and highly efficient semiconductor devices based on epitaxial films.

Given the active commercialization of such device structures worldwide, particular attention is being paid to developing ways to integrate traditional silicon technology with technologies for producing semiconductor binary compounds of the $\text{A}^{\text{III}}\text{B}^{\text{V}}$ and $\text{A}^{\text{II}}\text{B}^{\text{VI}}$ types. This combination is strategically important, as it significantly reduces the cost of producing high-efficiency photovoltaic and optoelectronic devices while improving their performance. The most promising direction in this area is the synthesis of solid solutions of elemental semiconductors (e.g., Si-Ge, Si – Sn, Ge – Sn) and heterosystems based on binary compounds of chemical elements of the Periodic Table of the $\text{A}^{\text{III}}\text{B}^{\text{V}}$ and $\text{A}^{\text{II}}\text{B}^{\text{VI}}$ types on silicon substrates.



Structures of binary $\text{Si}_{1-y}\text{Ge}_y$ alloys (A) and complex solid solutions $(\text{Si}_2)_{1-y}(\text{Ge}_2)_y(\text{GaAs})_z$ (B).



General view of the LPE unit: 1 – control unit; 2 – heating unit; 3 – reactor; 4 – bubbler; 5 – electric motor; 6 – pressure gauge; 7 – vacuum gauge; 8 – temperature sensor; 9 – chemical cabinet; 10 – palladium hydrogen purification system

Integrating such materials with the silicon electronics platform poses a number of fundamental and technological challenges related to the alignment of silicon crystal lattices with binary compounds and structural defects. In this regard, optimizing the epitaxial growth conditions of thin-film semiconductor structures, which are solid solutions, as well as developing buffer layers and stress relaxation methods in the resulting semiconductor structures, are particularly important.

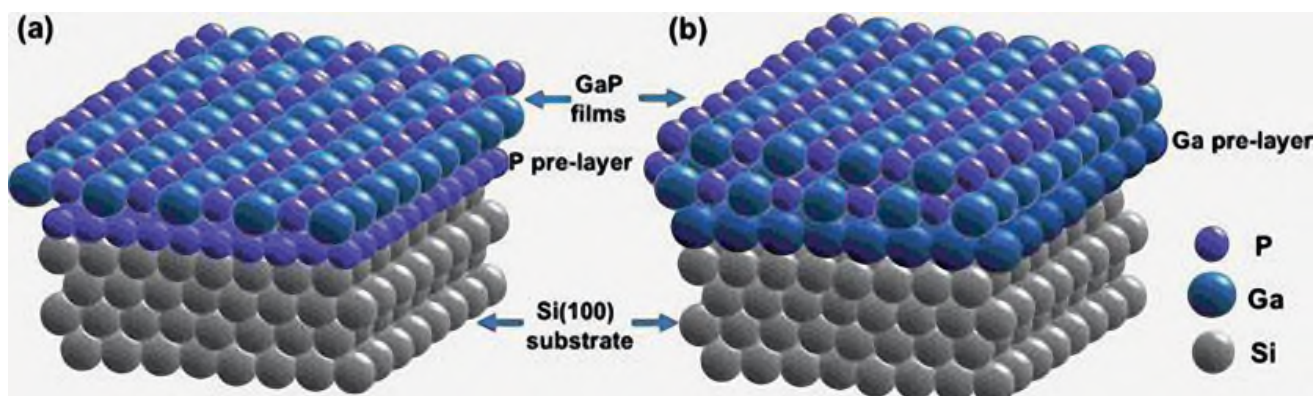
Thus, the development of scientifically sound approaches to producing solid solutions of elemental semiconductors and binary compounds of the $A^{III}B^V$ and $A^{II}B^{VI}$ types on silicon substrates, as well as a comprehensive study of their properties, represents one of the highest priority areas of modern semiconductor science and technology. On the other hand, this determines progress in the creation of new generations of photo-, thermo-, and optoelectronic devices, paving the way for the creation of next-generation monolithic photonic and electron-photonic integrated circuits.

Representatives of this class of solid solutions are increasingly finding application in various types of device structures. In particular, solid solutions with smoothly varying compositions are used as buffer layers. Such layers allow for the gradual “alignment” of the crystal lattices of different materials, thereby compensating for misalignment. This makes it possible to grow semiconductor films of other materials on a silicon substrate without significant defects, ensuring high-quality epitaxial layers.

In addition, solid solutions are also used directly as active semiconductor materials to create a wide range of device structures from photoconverters and infrared detectors to high-speed transistors, emitters, sensors, and even elements of powerful electronics.

Significant advances have been made in the creation of high-quality semiconductor device structures based on arsenides, phosphides, nitrides, sulfides and selenides, integrated with silicon technology.

Thus, semiconductor solid solutions based on Si with additives of CdS, ZnS, SiC, GaP and GaAs, possessing increased thermal stability, are recommended



Fabrication of thin GaP epitaxial films on a silicon substrate

for the development of solar photocells, multifunctional optoelectronic sensors and radiation detectors and spectral converters operating effectively at elevated temperatures, including diodes, photodiodes and elements of power and high-frequency and nano-electronics.

According to the Straits Research reports that the global semiconductor materials market has grown at an annual rate of approximately 6% in recent years. The steady increase in demand for these materials is driven by their widespread use in high-tech industries, including communications systems, optical data transmission lines, power and high-frequency electronics, solar energy, luminescent and sensor structures, radiation detectors, and others.

The structural features, interatomic distances, and valence states of atoms in elementary semiconductors (silicon, germanium) and $A^{III}B^V$ and $A^{II}B^{VI}$ compounds provide the basis for the formation of a wide range of substitutional solid solutions. Scientists at the S.A. Azimov Physical-Technical Institute of the Uzbekistan Academy of Sciences (PTI UAS) have developed a theoretical framework for creating substitutional solid solutions based on crystal chemistry concepts, taking into account the geometric dimensions and charge states of the atoms and molecules of their components. According to the scientists, more than 200 potentially stable systems are known. This diversity allows for targeted selection of material combinations for the development of multifunctional heterostructures with specified optical, electrophysical, and photoelectric parameters.

Thus, the authors of this article grew epitaxial films of semiconductor solid solutions with different compositions using a setup with a vertical quartz reactor, developed at the Semiconductor Crystal Growth Laboratory of the PTI UAS. This setup produces epitaxial semiconductor solid solutions (Fig. 2) using liquid-phase epitaxy (LPE). LPE is based on the deposition of a solid crystalline layer from a supersaturated melt solution onto a crystalline substrate with a lattice parameter close to that of the layer being deposited, and this process is automated using software.

Thus, further research into semiconductor solid solutions of elementary semiconductors and binary compounds $A^{III}B^V$, $A^{II}B^{VI}$ and their integration with silicon technology, actively developed today by scientists at the PTI UAS, represents a highly promising and practically significant area of semiconductor materials science, capable of ensuring significant progress in the creation of new generations of semiconductor materials and devices.

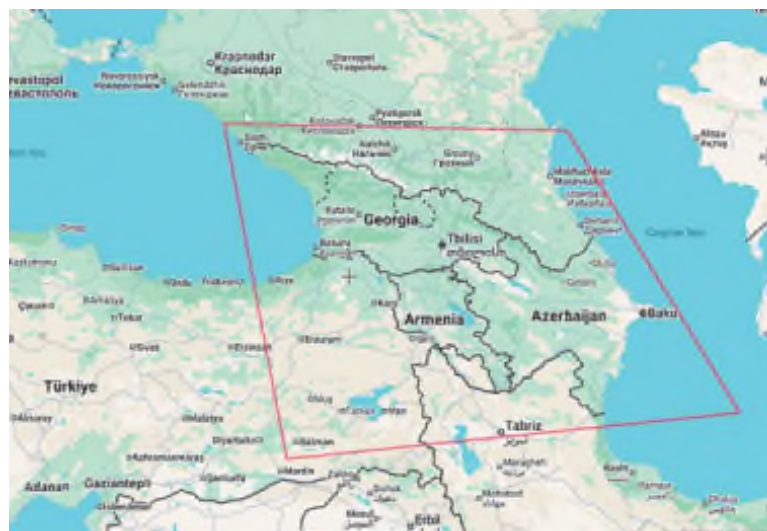
II. THE NATURE AND MAN

Do you know the history of grapes?

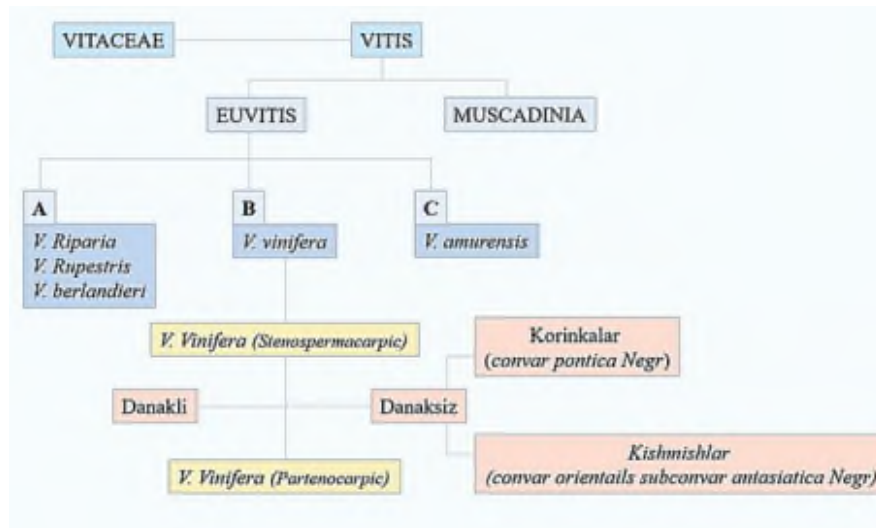
Zabardast Buriev,
Doctor of Biological Sciences,

Grapes, olives, pomegranates, and figs are among the oldest fruits, widely cultivated from ancient times to the present day. Grape varieties (*Vitaceae*) are divided into three groups based on their origin, botanical, morphological, and other characteristics: Eurasian (containing only one species, *V. vinifera* L.), East Asian (containing 30 species), and American (containing 28 species). Grape varieties belonging to the species *Vitis vinifera* ($2n=38$, 500 Mb) are the most widespread worldwide and are of great importance in production. Grapes are rich in antioxidants, particularly resveratrol, and the structure of chemicals isolated from grapes shows that they are closely related to their antioxidant properties.

It is known that the concentration of antioxidant compounds in plants varies under the influence of a number of physiological and environmental factors.



The South Caucasus was the first region where grapes were domesticated (6,000–8,000 BCE)



Taxonomic classification of certain families of vines:

A) Species native to the Americas; B) Species native to Eurasia; C) Species native to Asia

These include fruit ripeness, variety selection, climatic conditions, agricultural practices, disease and pest infestation, fruit ripening stage, and postharvest storage duration. Changes in berry size, sugar content, and the transition of the reproductive system to self-pollination were important factors in the domestication of grapes. In this context, it is important to identify similar factors in wild grape species and use them to select resistant plants.

Crop domestication is a major genetic process of targeted selection that transforms wild forms into cultivated plants by altering their morphological and genetic characteristics. Grapevines (*Vitis vinifera* L.) belong to the family Vitaceae and are one of the oldest and most widespread fruit crops among approximately 70 other species, making them an interesting subject for evolutionary studies. According to archaeological evidence, grape domestication began 6,000–8,000 years ago in South Caucasus, between

the Black Sea and Iran, with populations of *V. vinifera* subsp. *sylvestris* (Fig. 1). From this center, cultivated varieties were initially disseminated by human activity through southern Greece into the Mediterranean. This domestication model has recently been supported by molecular data, but some authors suggest that localized and limited secondary domestication occurred in other regions.

During domestication, humans selected plants with high productivity and short maturation periods, which led to an involuntary loss of hardiness. The origins of a number of these plants have been studied, and some taxa have been used to develop new varieties that are resistant to pathogens, produce high-quality fruit, and are tolerant of biotic and abiotic stresses.

However, some interesting questions remain unanswered regarding where, when, and how domestication occurred, as they often underwent introgression and admixture with local wild populations. A full



Grape vineyard

understanding of the domestication process requires adequate genomic studies that include both local varieties and wild populations.

The grapevine (*Vitis vinifera* L.) is one of the most widely cultivated fruit crops in the world and, at the same time, a fascinating subject for historical and evolutionary research. Most industrial (wine), food, and raisin grape varieties grown worldwide belong to the species *Vitis vinifera*. Varieties belonging to this genus can be divided into two types: seeded and seedless. *Vitis vinifera* L., in turn, is divided into stenospermacarpic and non-productive parthenocarpic classes, and there are differences in their flowering biology.

There are two groups of stenospermacarpic *Vitis vinifera* varieties: currants (*Vitis vinifera* convar *pontica* Negr), which have no seeds at all, and sultanas (*Vitis vinifera* convar *orien* subconvar *antasiatica* Negr), which have rudiments in their fruits. In different countries, they are called currants, seedless sultanas, and sultanas. However, the sultana group also includes seedless varieties bred in the USA, Canada, and Turkey, which are also called seedless sultanas. According to the International Organization of Vine and Wine, there are 10,000 grape varieties in the world, of which only 150 are registered as seedless.

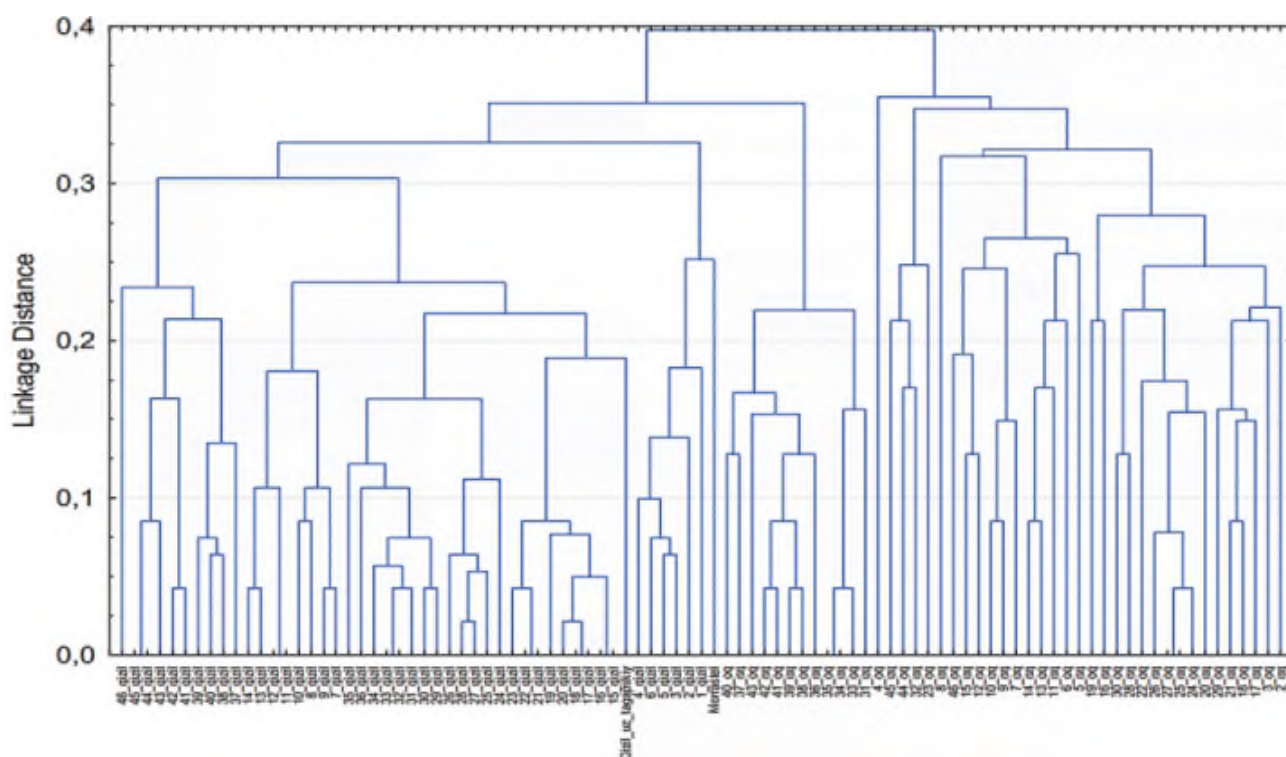
The name **Vitis** for grapevine was first introduced into science by Tournefort in the 1700s. Later, after a thorough taxonomic analysis, Planchon divided this genus into two subgenera— **Vitis muscadinia** and **Vitis euveitis**. They were found to differ from each other in morphological characteristics, biological properties, and cytological structure. The chromosome count of the genus **V. euveitis** was found to be $n=19$, while the chromosome count of the genus **Muscadinia** was $n=20$.

Although these two karyotypes differ from each other, they can be crossed to produce F1 genotypes. However, due to the high sterility of F1 hybrids, there is a high probability of producing forms with ungerminated seeds or seedless ones altogether. This is believed to be due to the phylogenetic closeness of the two subfamilies, confirmed by chloroplast genetic markers.

The species *Vitis vinifera*, native to the Eurasian region, is divided into two subspecies. The first, *V. vinifera* subsp. *vinifera*, is widespread and cultivated worldwide. The second, *V. vinifera* subsp. *silvestris*, is considered the wild ancestor. It has been noted that the morphological structure of their flowers varies and, morphobiologically, belongs to three distinct classes. Grape flowers are morphologically divided into three types: bisexual hermaphrodites, unisexual functional male flowers, and unisexual functional female flowers (Fig. 2).

One of the things Central Asia has been renowned for since time immemorial is its fruits and melons. Our gardeners are especially unrivaled in viticulture. To date, nearly one hundred grape varieties have been developed, primarily for table grapes, dried grapes, and winemaking. The «Rizamat» grape variety, named after the father of Uzbek grape breeding, Rizamat-ata, is literally the crown jewel of these varieties.

However, in recent years, thanks to technological advances, scientists from many developed countries have conducted in-depth analyses of existing varieties and molecular studies. As a result, many varieties originally native to our country are being promoted as new varieties with some characteristics modified. This creates the need to import these varieties into



Determining the phylogenetic relationship among varieties using a bioinformatics program algorithm

our country using foreign currency. Therefore, molecular studies of local varieties and the creation of new varieties using modern methods are becoming a pressing issue today.

The government's increased attention to this sector in recent years demonstrates the promising potential of viticulture. Specifically, the Centre for Genomics and Bioinformatics of the Uzbekistan Academy of Sciences has been tasked with conducting genetic analysis of grape varieties grown in the vineyards of the Khatyrchi district using modern genomic technologies.

In this regard, the Centre's scientists visited the villages of Altynsay, Uchkara, and Akmal Ikramov in the Navoi District and learned about grape cultivation. They spoke with farmers and *dehqans* (peasants) to understand the challenges they face. They also visited households and farms where local grape varieties are grown. As a result, leaf samples from the oldest grape variety, "Oq Dum," grown in the region since the time of Amir Timur, and the popular "Qizil Dum" variety were collected and delivered to the Center.

The accuracy of DNA sequence-based markers used in molecular phylogenetic analysis, exceeding 90%, increased the efficiency of the research, and a range of reliable and accurate data was obtained during taxonomic studies. This included work on the gene map of varieties, phylogenetic trees, genetic relationships, their genetic distances, the genetic stability of heritable traits, disease resistance and associated loci, allelic segregation, and variety identification. The high accuracy of the molecular markers used is due to their ability to obtain precise information on the DNA sequence of a variety's genome. This is considered a major achievement in molecular biology.

For molecular studies, genomic DNA was isolated from these samples and then analyzed using micro-satellite markers to determine its genotype, other department staff isolated plant parts from the samples for in vitro propagation. The sultana grape variety "Tagapsky" and the well-studied genetically diverse wine variety "Morrastel," developed in Italy, were used as control samples.

The analysis revealed that these two local grape varieties are distinct, and that diversity is observed within both. Specifically, the ancient Oq Dum grape variety was found to possess high genetic diversity (up to 25%) and the presence of unique genotypes. This, in turn, means that the purity of the Oq Dum variety is 75%. The genotypic diversity of the Qizil Dum grape variety was found to reach 20%, and the purity of the variety is 80% (Fig. 3). A study of the phylogenetic proximity of the varieties using a bioinformatics algorithm revealed that the Oq Dum variety is divided into two groups: one group is close to the Qizil Dum variety, while the other has a long history. For the Qizil Dum variety, the samples also divided into two groups: one group is a close relative of the Tagapsky grape variety, while the second group is significantly different. The results showed that the Oq Dum variety has a long ancestral history and exhibits significant convergence distance compared to the control vari-

eties. The purity of the Qizil Dum variety was higher than that of the Oq Dum variety. However, both varieties exhibited a high degree of diversity, meaning the presence of different traits on similar chromosomes.

Grapevines grown in a special nutrient medium were cleared of viruses and other infections and restored to a healthy state. Healthy plants were cultivated using specialized nutrients, and by April 2019, 1,000 seedlings were delivered and planted in the Khatyrchi district. Importantly, these plants were grown in Uzbekistan for the first time using modern in vitro methods. We hope that vineyards like those being created today will grace our people's tables for many years to come.

* **Reminder – Qizil_uz_tagapskiy** - Raisin grape variety «Tagapskiy» (control sample),

Morrastel – Wine variety "Morrastel" (control sample), **1_qizil-46_qizil** – samples of the "Qizil dum" variety;

1_oq-46_oq – samples of the "Oq Dum" variety.



A classic bunch of grapes

The 1966 Tashkent Earthquake: A Look Through the Lens of Decades

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At 5:23 a.m. on April 26, 1966, the city of Tashkent was shaken by a powerful earthquake. The ground trembled for only a few seconds, but that was enough to devastate large areas of the city. Thousands of buildings were severely damaged, and hundreds of thousands of residents were left homeless. For the people of the capital, it was a tragedy. For the science of seismology in Uzbekistan, it became a turning point.

Tashkent 1966 – Destruction and Reconstruction

Magnitude: 5.2–5.3

Focal depth: 8–10 km

Intensity: up to IX (MSK scale)

Consequences: more than 30,000 buildings damaged; around 300,000 residents left homeless

Reasons for destruction: shallow focus, proximity of the epicenter, vulnerability of buildings, and local soil conditions

Tashkent, view of a mahalla after the 1966 earthquake



Reconstruction: the city was largely rebuilt using modern earthquake-resistant technologies

Scientific lesson: development of a seismic station network and modern earthquake-resistant construction methods

(INSERT PHOTOGRAPHS OF TASHKENT, 1966)

At that time the Institute of Seismology of the Academy of Sciences was also established. Instrumental geophysical observations in the region began much earlier. It is worth noting that the Tashkent Physical Observatory, founded in 1868, became one of the pioneers in the development of both fundamental and applied geophysics. One of the key objectives of the early stage of geophysical research was the establishment of a network of geomagnetic observation stations and the organization of permanent monitoring of the Earth's magnetic field. Instrumental observations of seismic activity in the territory of Uzbekistan began in 1901. Since then, many strong earthquakes have been recorded worldwide, some of which are presented in the table below.

The Tashkent earthquake forced scientists to reconsider the problem of seismic hazard in Central Asia. The earthquake of 1966 not only caused wide-

Tashkent, a destroyed building, 1966



The Most Devastating Earthquakes of the 20th and 21st Centuries

Year	Location	Damage and Casualties
1906	San-Francisco (USA)	Magnitude M=7.8. A large part of the city was destroyed; about 1,500 people died.
1908	Messina (Italy)	Magnitude M=7.5. Severe destruction; about 87,000 people died.
1948	Ashgabat (Turkmenistan)	Magnitude M=7.3. The city was almost completely destroyed; about 175,000 people died.
1960	Chile	One of the strongest earthquakes in history (M=9.5). Several cities were destroyed; about 10,000 people died.
1995	Kobe (Japan)	Occurred on 17 January 1995, M=7.3. 6,434 people died; more than 150,000 injured; over 200,000 buildings destroyed. Economic damage about 102.5 billion USD.
1976	Tangshan (China)	Occurred on 28 July 1976 (M=7.5–8.2). One of the largest disasters of the 20th century; more than 242,000 people died.
1988	Spitak (Armenia)	Magnitude M=7.3. Several towns and villages destroyed; more than 25,000 people died.
1990	Iran	Magnitude M=7.4. Strong earthquake caused about 50,000 deaths.
2004	Indian Ocean	Magnitude M=9.3. Undersea earthquake triggered a massive tsunami; about 300,000 people died.
2005	Kashmir (Pakistan)	Magnitude M=7.6. Comparable in strength to the 1906 San Francisco earthquake; about 86,000 people died.
2008	Sichuan (China)	Magnitude Mw=7.9. 69,197 people died; about 18,000 missing; more than 288,000 injured.
2010	Haiti	Occurred on 12 January, M=7.0. 222,570 people died; 311,000 injured.
2011	Sendai–Fukushima (Japan)	Magnitude M=9.1. Strong earthquake and tsunami caused more than 15,000 deaths.
2023	Turkey and Syria	Twin earthquakes of M=7.8 and M=7.5 on 6 February. Over 45,000 deaths in Turkey and more than 8,000 in Syria.
2024	Japan (Ishikawa Prefecture)	Earthquake on 1 January 2024 with magnitude M=7.6. 202 people died; about 200 missing.

spread destruction but also vividly demonstrated the courage and solidarity of the people of Tashkent. In the very first days after the disaster, residents supported one another despite enormous difficulties, clearing debris and beginning the work of restoring normal life. Together with specialists, builders, and volunteers who arrived from different regions, construction of a new Tashkent began within a short time. Thus, the city was not only restored but rebuilt according to modern principles of earthquake-resistant architecture.

In the first years after the disaster, large-scale studies of geological processes in the region were

launched, building codes were revised, and the city itself was essentially rebuilt in accordance with seismic safety principles. Today, six decades later, Tashkent has become one of the largest cities in the world constructed with strict consideration of earthquake-resistant design requirements.

Since 1900, more than 60 strong earthquakes with magnitudes greater than 5 have occurred in the territory of present-day Uzbekistan. Dozens of small tremors occur in Uzbekistan every day, although most go unnoticed and are detected only by sensitive instruments. Yet the key question that continues to concern humanity remains the same: can earthquakes be predicted in advance?



Global seismic belts and lithospheric plate boundaries

How earthquakes form

Geological fault scheme



1. Accumulation of Tectonic Stress

Lithospheric plates continuously move at a rate of several centimeters per year. Along geological faults, blocks of the Earth's crust gradually shift; however, frictional forces prevent their free movement. As a result, tectonic stresses accumulate in the rocks.

2. Accumulation of Elastic Deformation

As stress increases, rocks in the fault zone deform and store elastic energy. This process may continue for decades or even centuries.

3. Rock Rupture

When the accumulated stress exceeds the strength of the rocks, a sudden rupture occurs along the fault plane. Blocks of the Earth's crust shift relative to one another.

4. Focus and Epicenter

The focus (hypocenter) is the point deep within the Earth's crust where the rupture begins. The epicenter is the point on the Earth's surface located directly above the focus.

5. Propagation of Seismic Waves

The released energy propagates as seismic waves: P-waves (primary, longitudinal waves) and S-waves (secondary, transverse waves). After the main shock, aftershocks-repeated tremors that gradually decrease in intensity-often occur.

Diagram of earthquake formation at a geological fault

The Earth's surface is not as stable as it may appear. Our planet consists of giant lithospheric plates-massive blocks of the Earth's crust tens of kilometers thick. These plates move only a few centimeters per year-roughly the same rate at which human fingernails grow. However, on geological time scales, this motion leads to enormous changes. Where plates collide, mountain systems form. The Himalayas, for example, emerged as a result of the collision between the Indian and Eurasian plates. In other places, plates diverge, forming oceanic ridges. Sometimes they slide past one another along faults, accumulating enormous stresses. When the accumulated stress exceeds the strength of rocks, blocks of the Earth's crust suddenly shift. Energy is released, seismic waves propagate-and an earthquake occurs.

A look at the global seismicity map makes it clear that a large proportion of powerful earthquakes occur in Asia. This region contains some of the planet's most active tectonic zones. To the east, the continent is surrounded by the Pacific "Ring of Fire"-the most seismically active region on Earth. To the south, the collision of the Indian and Eurasian plates continues, uplifting the Himalayas and generating numerous earthquakes. Meanwhile, in Central Asia the mountain systems of the Tien Shan and the Pamirs continue to form. For this reason, countries of the region, including Uzbekistan, belong to areas of elevated seismic hazard.

At first glance, forecasting an seismic event might seem straightforward. We know the regions with increased seismic activity and understand the general mechanisms of underground shocks. However, determining the exact time of the next earthquake is much more difficult. The main reason is that the processes leading to earthquakes occur deep underground-at depths of 10-30 kilometers. Direct observation of these processes is impossible. Scientists can only detect indirect indicators: weak microearthquakes, slow deformations of the Earth's surface, and changes in geophysical fields. These signals suggest that stress is accumulating in the Earth's crust, but they do not provide an exact answer to the question of when rupture will occur.

Occasionally unusual observations attract attention. One of the most famous examples is the Haicheng earthquake in China in 1975, when residents reported strange animal behavior prior to the event: snakes leaving their burrows and domestic animals showing signs of anxiety. However, the decisive role was played not by these observations but by data from seismic stations. Instrumental monitoring made it possible, for the first time in world practice, to issue an official short-term forecast and evacuate part of the population. Observations of animal behavior were considered only an additional sign, not a primary method of prediction. In other cases-for example during winter earthquakes in China-no such "biolog-

ical signals" were observed at all, since animals were in hibernation.

Among the possible factors influencing the timing of rupture, processes in the upper atmosphere have also been discussed. After powerful solar flares, streams of charged particles reach the Earth, causing magnetic storms and disturbances in the geomagnetic field. Some studies suggest that such disturbances may act as a kind of "trigger," initiating an earthquake in zones where stress has already reached a critical level. It is possible that certain animals respond to these magnetic field changes. However, for such a scenario to occur, too many conditions must coincide.

The main difficulty lies in the fact that the lithosphere is an extremely complex system. The preparation of each seismic event involves many factors, and their combination never repeats exactly. In this sense, the process can be compared to a giant spring slowly compressing within the Earth's crust: we see that stress is increasing, but we cannot say precisely when it will release. This is why accurate short-term earthquake prediction remains one of the most challenging problems in modern geophysics. The most reliable tool today is not assigning a date for a future event, but assessing seismic risk based on long-term observations and statistics.

Recognition of this complexity has gradually changed the approach of scientists. Today the emphasis is placed not on attempting to "set a date" for future earthquakes, but on estimating probabilities. For this purpose, seismic hazard maps are created that show the probability of strong earthquakes over decades. Such maps form the basis of building codes in many countries around the world. Thanks to these calculations, engineers can design buildings capable of withstanding strong ground shaking. As a result, even powerful earthquakes do not always lead to catastrophic destruction.

In Uzbekistan, seismic safety receives particular attention. Scientists at the G.O. Mavlonov Institute of Seismology of the Academy of Sciences of Uzbekistan study processes occurring in the Earth's interior, while specialists at the M.T. Urozboev Institute of Mechanics and Seismic Stability of Structures investigate the resilience of buildings and engineering structures.

While precise short-term prediction remains a scientific challenge for the future, reducing earthquake consequences is already a realistic and achievable goal. Modern seismic isolation methods, foundation damping systems, and new construction materials significantly reduce the impact of seismic waves on buildings. For Uzbekistan, located in the active Tien Shan zone, the development of earthquake-resistant construction is a strategic priority.

Sixty years after the Tashkent earthquake is a time to summarize the past and look ahead. Asia remains a continent of high seismic energy, but it is also here that advanced approaches to risk management

are emerging. Science does not promise quick solutions. But it provides the most important things: understanding of processes, tools for assessing hazards, and the ability to save lives.

It is important to understand that modern science already provides reliable long-term forecasts for decades ahead. These are seismic zoning maps that reflect the probability of strong earthquakes over periods of 20, 30, or even 100 years. Essentially, they represent scientifically grounded assessments of seismic hazard. Uzbekistan has a national system of seismic zoning with regulatory status. These maps directly determine mandatory requirements for earthquake-resistant construction and for the design of residential buildings, industrial facilities, and infrastructure. In this way, scientific calculations become part of legislation and an instrument for protecting the population. Improving seismic zoning maps remains one of the key tasks for the country. Considering that Uzbekistan lies within the active Tien Shan zone, where mountain building and stress accumulation continue, constant updating of monitoring data and improvement of models is not only a scientific task but also a strategic national priority.

In recent years, new seismic hazard and microzonation maps have been developed for major cities and regions of Uzbekistan. They take into account geological structure, soil properties, and possible shaking intensity. These data are used in designing new buildings, constructing infrastructure, and planning urban development.

As a country located in a seismically active region, Uzbekistan consistently implements large-scale reforms aimed at reducing earthquake risks and ensuring the safety of the population and infrastructure. Within this framework, comprehensive measures are planned before, during, and after seismic event. The main goal is to minimize potential losses, protect human life and property, and create conditions for rapid and effective recovery.

One of the most promising directions is the development of computer models for simulating earthquakes. At the Institute of Seismology, a digital model of Tashkent has recently been created that includes parameters of buildings, their structural characteristics, and soil properties. Such models make it possible to simulate various seismic event scenarios and assess potential consequences in advance. This helps emergency services plan response actions, design evacuation routes, and identify high-risk zones.

Today, great expectations are associated with the use of artificial intelligence and big data analysis. Modern algorithms are capable of processing enormous volumes of information: data from seismic stations, satellite measurements, and geophysical parameters. It is possible that the combination of human expertise and machine computing power will reveal patterns that previously remained unnoticed. However, most researchers remain cautious in their

predictions. The deeper reason is that the development of each earthquake resembles a chess game—with an opening, a middle phase, and a final stage—yet no two games unfold in exactly the same way. Even the most powerful algorithms cannot change the fundamental complexity of the processes occurring within the Earth's crust.

Seismology is one of those fields of science where results require decades of observations. If strong earthquakes in a region occur once every 20–40 years, that is exactly the time needed to accumulate statistically significant data. Therefore, the development of seismic networks and monitoring systems is of crucial importance. Uzbekistan plans to significantly expand its network of seismic stations, which will improve monitoring of geodynamic processes.

Uzbekistan's achievements in seismic safety are gaining increasing international recognition. In particular, the 16th General Assembly of the Asian Seismological Commission—one of the largest scientific forums in this field—will be held in Tashkent in April 2026, bringing together leading scientists from around the world.

The Tashkent earthquake of 1966 was a tragedy, but at the same time an important lesson. It showed that natural disasters cannot be completely prevented. However, their consequences can be significantly reduced through the development of science, engineering, and sound public policy. And the more deeply we understand the processes occurring within the Earth, the safer life becomes on its surface.

Metaverse: Science Fiction or New Social Reality?

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The metaverse is increasingly being mentioned as the next stage in the development of digital technologies and social interactions. The concept of the metaverse entered popular culture from science fiction, where virtual worlds were often depicted as a fully-fledged alternative to real life. However, in recent years, the term has increasingly been used in scientific, technological, and public discourse, extending beyond literature and film.

The development of virtual and augmented reality, high-speed internet, and online gaming platforms has created the technical foundation for the emergence of sustainable digital spaces. These spaces already allow people to work, study, communicate, and even earn money in virtual environments. Major tech companies such as Meta, Microsoft, and Epic Games are investing significant resources in the development of virtual worlds, positioning them as the “next-generation internet.” This is fueling public interest while simultaneously raising questions about the real necessity and implications of such technologies.

We view the metaverse not as an abstract idea, but as a socio-technological phenomenon in the process of formation. Everyone is interested in the question: is it becoming a new form of social reality or will it remain an experiment accessible only to a limited number of users?

The main problem with discussing the metaverse is the gap between expectations and reality. Promises of full immersion, a universal digital space, and new forms of social interaction are currently facing technical, economic, and psychological limitations. It’s not entirely clear whether the metaverse will become a mass phenomenon or remain a niche product for gamers, developers, and corporate users. Many users still prefer traditional forms of digital communication—social networks and messaging apps. There’s also a social issue: the widening digital divide. Access to the metaverse requires modern equipment and a stable internet connection, which could widen the gap between different population groups. Finally, questions of privacy and the psychological impact of prolonged exposure to virtual environments remain

The Metaverse: Almost Real Sensations. aimagazine.com





AI: How to Create It. GETTY (forbes.com)

open, making the topic of the metaverse not only technological but also socially significant.

Optimists view the metaverse as a natural continuation of the internet's evolution from text to images, from video to full immersion. They believe virtual worlds will open up new opportunities for education, medicine, and culture. Skeptics believe the metaverse concept is largely a marketing ploy used to attract investment, citing low user engagement and the lack of diverse applications. A moderate position suggests that the metaverse will develop fragmentedly: not as a unified space, but as a collection of specialized virtual environments for work, learning, and entertainment. Opinions on the metaverse range from a revolutionary breakthrough to a temporary technological trend, reflecting the uncertainty of its current stage of development.

According to open analytical reports, the number of VR platform users is growing, but remains significantly lower than that of traditional social networks. Most activity is concentrated in gaming and educational projects. Research shows that users value social interaction and collaboration in virtual worlds more than graphics. This brings the metaverse closer to the concept of a "social internet." Economic data indicates growing investment in VR/AR technologies, but many projects face challenges in terms of profitability and user retention. Empirical data confirms the metaverse's potential, but also points to its early stages of development and the instability of its business models.

The metaverse can be viewed as an experimental social laboratory where new forms of communication, identity, and economics are being tested. In this sense, it is of scientific interest regardless of its commercial success. It is important to understand that the metaverse does not replace the real world, but rather

complements it, creating hybrid forms of interaction between physical and digital reality. Of particular importance is the issue of digital culture and rules of conduct in virtual spaces, which are still being developed and require public debate.

The future of the metaverse will likely depend less on technology than on social needs and society's willingness to embrace new forms of reality. The metaverse currently straddles the line between science fiction and social practice. It hasn't yet become an everyday reality, but it's already influencing ways of thinking about the future of the internet and digital society. The metaverse will likely not be realized as a single virtual world, but will instead develop into a multitude of specialized digital spaces. As such, it could become an important element of 21st century social reality if its development is supported by responsible scientific and societal approaches.

Moreover, the discussion of the metaverse shows that the key factor in its successful development will not be the speed of technological progress, but rather the meaningful participation of society in shaping these digital spaces. Issues of accessibility, data security, and user well-being must be considered alongside technical innovation. Only with such a balance will the metaverse be able to transform from a catchy idea and marketing slogan into a sustainable and socially useful form of digital reality, reflecting real human needs and values.

Big data technologies and artificial intelligence

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According to generally accepted ideas, the term or concept of «Big Data» is used to describe the vast volumes, arrays, and diversity of statistical, informational, and other data that have become an alternative to traditional database management systems. The term «Big Data» has gained widespread popularity due to the rapid development and widespread use of modern technologies and tools in programming, information and communication, and digital spheres, as well as in artificial intelligence programmes.

The term “Big Data” primarily refers to data processing methods and technologies that incorporate high-speed computing, predictive analytics, mathematical modeling, consumer behavior analysis, and

complex statistical research. The term also refers to data sets that are so large or complex that traditional software can no longer handle them. Specifically, challenges arise in collecting, storing, analyzing, cleaning, searching, exchanging, transmitting, visualizing, updating, and securing multi-source information, as well as formulating appropriate search queries in databases. Therefore, specialized tools (such as *the Hadoop framework*) have been developed to process Big Data; they help divide the tasks of data storage and analysis across multiple computer clusters.

In practice, there is no specific quantitative threshold or level beyond which data is considered big. Traditionally, the term «Big Data» covers information volumes from several terabytes (1 TB = 1000 GB) to many petabytes (1 PB = 1000 TB). However, in parallel with the progress taking place in computing technology, this limit on the quantitative volume of big data is constantly expanding. Some organizations are already technologically so well-equipped that they are able to process hundreds of terabytes of big data themselves without the use of software tools or the *Hadoop framework* platform, developed for distributed storage and processing of large volumes of data.

Advertising poster “Hadoop framework” for working with big data

The information included in integrated big data can be structured, semi-structured, or unstructured, with the latter typically accounting for the largest share. For example, this could include numerous user responses to energy or transportation companies on social media or presentations on relevant topics on various online forums. The defining characteristics of big data are its «three Vs»: - volume (in the sense of the size of their *volume*); speed (*velocity*, reflecting the rate of data growth, as well as their high-speed processing and obtaining results); - and diversity (*variety*, in the sense of the ability to simultaneously process different types of big data).



Promotional poster for the “Hadoop framework” for working with big data



Clifford Lynch, editor of "Nature" magazine and its special issue on "Big Data"

The set of these three VVV characteristics (*volume, velocity, variety*) was developed and proposed for use by the international company Meta Group in 2001. Moreover, in connection with the growing popularity of the concept of a central data warehouse for enterprises and organizations, the equivalence of data management issues in the context of all three named aspects was noted. Recently, the set of characteristics describing big data has expanded to five, including such qualitative properties as the heterogeneity of the data set (*variability*), which complicates their analysis, as well as *veracity* - the reliability of both the data itself and the sources from which it was obtained.

The widespread introduction of the term «Big Data» for use is associated with the name of Clifford Lynch, editor of the leading international scientific journal «Nature», which was published on September 3, 2008, a special issue of this journal on this new topic was published, with the expansive title «*How Can Big Data Technologies Impact the Future of Science?*». This issue collected materials on the phenomenon of the explosive growth in the volume and diversity of processed data, as well as the technological prospects for processing and analyzing it within the paradigm of the expected, priority, leap-forward transition «from quantity to quality.» The term «Big Data» itself, coined in this context, was suggested by analogy with the concepts of «*big oil*», «*big ore*» accepted in the English-speaking business community and others.

Clifford Lynch, editor of the journal "Nature" and its special issue "Big Data"

Although the term «Big Data» was initially coined in the academic scientific community, primarily addressing the growth and diversity of scientific data, it soon became widespread in the business community, beginning in 2009. By 2011, most major information technology providers, including IBM, Oracle, Microsoft, Hewlett-Packard, EMC, and others, were incor-

III. THE WORLD OF ENGINEERING AND INFORMATION TECHNOLOGY



porating the concept of big data into their strategies and operations, and were conducting specialized research based on the new concept.

Further, in 2011, the famous American research and consulting company «Gartner», specializing in global information technology markets, identified «Big Data» as the number two trend (after virtualization) in the entire information technology infrastructure. At the same time, a forecast was made that the implementation of big data technologies would have the greatest impact on information technology in healthcare, manufacturing, public administration, trade, business, and other sectors where many different resources are used and their analytical processing is required. On this basis, a new scientific field was formed - «Data Science».

As a result of the widespread adoption of this term, starting in 2013, «big data» became a required academic subject in modern university programmes in data science, as well as in courses in computer science and engineering. Big data technologies subsequently migrated into specialized courses in university courses in advanced analytics and data science, data analysis, information management, information infrastructure, and other required subjects.

Currently, the Internet of Things and social media are classic sources of big data. Examples of sources of big data include continuously incoming data from measuring devices, radio-frequency identifiers, event message streams from social networks, meteorological data, Earth remote sensing data, and others. The

development and widespread use of these sources are initiating the penetration of big data technologies into scientific research and public administration, as well as into the commercial and banking sectors and other areas of economics and business.

The most common analytical methods and techniques used in big data operations today include the following:

- methods of the class «Data Mining», including learning association rules, and classification of new data based on principles previously applied to existing data, their cluster and regression analysis;
- Crowd sourcing is the categorization and enrichment of data through the efforts of a wide, often undefined circle of people participating in the process on the basis of a public offer, but without entering into an employment relationship;
- data blending and integration is a set of techniques that allow integrating heterogeneous data from various sources for in-depth analysis and digitalization;
- *Machine learning*, including supervised and unsupervised training of neural networks and artificial intelligence platforms, as well as «*Ensemble learning*»
- the use of models built on the basis of certain base models;

Diagram of the components of Data Science (Data Science) and Machine Learning (ML)

- artificial neural networks, network analysis, optimization, including genetic algorithms;
- pattern recognition;
- predictive analytics;
- simulation modeling;
- spatial analysis – using topological, geometric and any geographic information;
- statistical analysis, A/B testing and time series analysis;



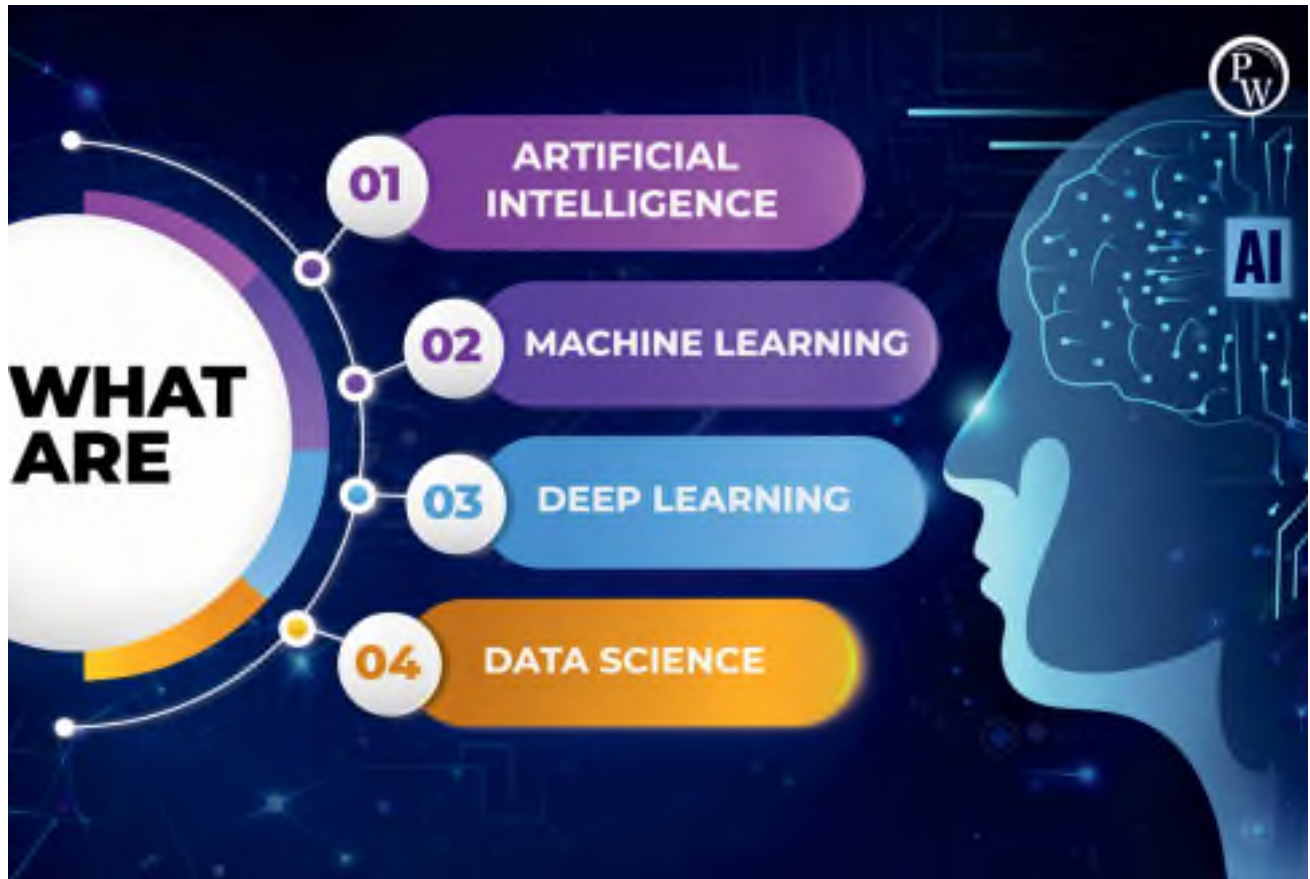
An overview of the components of Data Science and Machine Learning (ML)

- visualization of analytical data - presentation of information in the form of drawings, diagrams, and charts for further analysis.

The most commonly used principle for processing big data is horizontal scalability, which enables processing of data distributed across hundreds and even thousands of computing nodes without degradation of their performance.

And by 2007, the volume of digital data exceeded the volume of analog data by almost 15 times, amounting to 280 exabyte of digital data compared to 19 exabytes of analog data. Thus, the early 21st century ushered in the era of digitalization, based on diverse big data arrays and high-speed processing technologies used for machine learning and the development of artificial intelligence (AI).





Examples of big data science for deep learning, machine learning, and the development of AI methods

Machine learning based on big data

Machine learning using big data is based on the premise that a developed algorithm can learn to perform a task without explicitly programming each step. Instead of manually writing rules, operators show the algorithm examples and allow it to discover certain patterns on its own. Machine learning of an AI model is based on mathematical modeling and a mathematical model defined by a function with adjustable parameters. The process of training an AI model involves selecting parameter values that yield the most accurate predictions. An optimization algorithm gradually improves the parameters, minimizing the error between the model's predictions and known answers. The quality of the AI model is assessed based on data not used during model training. It should be noted that machine learning is not the same as programming. The goal of machine learning is to teach an AI model to find and generate solutions on its own.

Examples of Big Data Science for Deep and Machine Learning and Artificial Intelligence Development

Machine learning AI models enable the creation of computer technologies and AI programmes that think like humans. However, unlike humans, they don't tire, are less prone to error, can work with any amount of data, and evaluate it impartially. This opens up vast possibilities for artificial intelligence. Machine learning can be used to create a wide range

of AI services and models. These range from the simplest ones we use in everyday life—navigators, search engines, cameras with facial recognition, recommendation services—to complex tools increasingly needed in industry, energy, space exploration, agriculture, healthcare, geology, ecology, natural resource and water management, and more.

Thus, the journal's readers are shown, using specific examples, the complex and rapid transition from big data analysis to machine learning technologies and artificial intelligence models.

The «impregnable» fortress – Khazarasp

Durdona Muradova,
Candidate of historical sciences

People preserve various legends and tales about ancient cities. One such city, whose history is rich in legends, is Khazarasp, an ancient city in the Khorezm oasis. The first written mentions of the city appear in the works of medieval Arab travelers and geographers. Tabari mentions Khazarasp among three cities that existed in Khorezm in the early 8th century CE.

The Arab historian and geographer Al-Istakhri, in his work “Kitab al-masolik wa-l-mamolik,” provides interesting information about the location and landscape of the city. According to him, Khazarasp is mentioned among a number of large cities of Khorezm, including Dargan, Khiva, Khushmisan, Kardar, and

Jurjaniya. A source describing settlements along the Jayhun (Amu Darya) River particularly emphasizes the vastness of Khazarasp’s territory. Among the information provided by Istakhri, it is noted that the name Khazarasp referred not only to the city, but also to a large canal suitable for navigation (Yakut Hamawi wrote that Khazarasp was a beautiful city, surrounded by water, with developed markets and trade, and a prosperous population. He also describes the city as a powerful and “impregnable” fortress (Materialy po istorii turkmen i Turkmenii. - M., 1939. - p.438.).

According to Ibn al-Athir, Khazarasp was a densely populated and strategically important city of Khorezm, under the control of the central government and playing a significant role in historical and political events. Later sources containing information about Khazarasp can be roughly divided into four groups. These include:

1. Russian diplomatic and military sources (17th–18th centuries): the first geographical information about Khazarasp is contained on the map “Book of the Great Drawing” of 1627. Later, in 1697, important notes on the fortress were contained in N.V. Kalachev’s document “Road to Khiva.” Maps compiled in 1717 by the Bekovich-Cherkassky expedition first showed the strategic location and area occupied by Khazarasp in the Amu Darya basin.

2. The works of the khans and historians of Khiva, including “Shajara-i tarokima” and “Shajara-i turk” by Abulgazi Bahadur Khan, “Firdavs ul-ikbal” by Munis and Agahi, “Shajara-i Khorezmshahi” by Bayani, provide valuable information about the internal life of the city.

3. Observations of foreign travelers and researchers – M. Ivanin emphasizes that Khazarasp was the permanent residence of the khan’s elder brother (the heir to the throne) and the inaks (courtiers). A. Vamberi (1863) writes of the beauty of Khazarasp’s gardens, particularly the unrivaled taste of its apples and



Khazarasp Fortress. 7th century BCE – 19th century CE.



Khazarasp Fortress. 7th century BCE – 19th century CE.



Khazarasp Fortress. 7th century BCE – 19th century CE.

pomegranates, as well as the city's developed sericulture and cotton production. MacGahan (1873) compares the fortress's mighty walls to the famous Windsor Castle in Great Britain. F. Baziner noted that the city had a developed weapons industry (in 1838, one of the khanate's two leading weapons masters lived here).

4. Archival documents and scientific research – the Khiva Khanate archive: 11,000 pages of archival materials, studied by P.P. Ivanov and M. Yuldashev, shed light on the socio-economic life of Khazarasp in the 19th century. The waqf documents of Nuriddin Bobo: this nine-volume collection, dating from 1506 to 1907, is a unique source of information on land ownership, water use, and property relations in the region. V.V. Bartold and N.I. Veselovsky, in their research and articles, revealed aspects of the history of Khazarasp during the Islamic and medieval periods.

Among other interesting facts about Khazarasp, it's worth noting that legends associated with its name still persist. One of the researchers of the Khorezm oasis, Academician Yahya Gulyamov, cites a legend that the Khazarasp fortress was built by a huge *div* (legendary giants). According to legend, the *div* cut off the wings of a thousand winged horses that came to the castle to drink water and tamed them. The fortress became famous for the uniqueness of this breed of horses and was named "Khazarasp"—"Thousand Horses."

The scholar cites another popular legend about the Khazarasp fortress. According to it, the fortress was built with the underground water supply from the Amu Darya in mind. Supposedly, there was a «secret connection» (*obi duzd-yashirin*, a secret waterway) with the river, through which wells inside the fortress were supplied with water. However, the scholar emphasizes that this information is not sufficiently substantiated from a scientific perspective.

The role of Khazarasp as a fortress in the political events that unfolded in Khorezm was particularly noted. Throughout history, Khazarasp played a role as an important military and political center. It is reported that in 1147, during Sultan Sanjar's third campaign in Khorezm, Khazarasp was captured after a two-month siege. This demonstrates that the fortress's strength was demonstrated not only by its fortifications but also by the importance of its water supply for long-term defense.

The city's name has also intrigued many researchers, and various scientific hypotheses have been put forward. Some researchers explain the city's name by dividing it into the parts «Khazar» and «Asp.» While ethnographers associate this name with the tribal name «Khazar-as» (As tribe), another group of scholars argues that the name is derived from the ethnonym «Khazar» and a plural suffix. However, Pro-

Southeastern corner of Khazarasp. Devsolgan Hill.
Photo by V. Shevchenko





Khazarasp Fortress. 7th century BCE – 19th century CE.

fessor M. Iskhaqov linked the toponym to Zoroastrian traditions and explained it with the ancient term “Aturaspant,” meaning “place of the sacred fire.”

Given that the first records of the city of Khazarasp date back to the Middle Ages, archaeological research allows us to draw precise scientific conclusions about the city’s origins and the socioeconomic and cultural life of its first inhabitants. Work on this subject began in the 1930s. The first archaeological excavations in the city were conducted by Academician Yahyo Gulyamov, who confirmed that the Khazarasp fortress was built in the 4th–3rd centuries BCE. Research conducted by the Khorezm Archaeological and Ethnographic Expedition led by S. P. Tolstov in the 1960s confirmed that life in the city began in the 5th–4th centuries BCE.

Interest in studying the city’s history grew even stronger during the years of Uzbekistan’s independence. Research in 1996–1997 was continued by scholars such as Sh. Matrasulov, M. Mambetullaev, and S.R. Baratov. During excavations conducted by S. Baratov in 2002–2003 in the northwestern corner of the fortress, the remains of the first adobe walls were discovered. Archaeological research in the city has focused primarily on its defensive system and adjacent areas. Within the city, due to the high density of residential structures, only a few pits have been dug. The greatest challenge to the archaeology of Khazarasp is the high groundwater level. This situation has always prevented scholars from fully exploring the lowest, or first, cultural layers upon which the city’s foundations were laid.

Archaeological research in the city was conducted in 2024 after a 20-year hiatus. The discovery of ceramics dating from the 4th–3rd centuries BCE, the 2nd–3rd centuries CE, and the 18th–19th centuries during excavations indicates that urban life in the central part of this ancient site was active at various stages of its existence.

Today, this monument holds special significance among the unique historical cities of Uzbekistan, which have been inhabited for thousands of years and have not lost their significance to this day.

Palace chef of emir Alim khan

Shavkat Babajanov
Doctor of Philosophy (PhD)

The people of Bukhara possess a rich material and spiritual culture. Of particular note is the art of culinary arts, which is passed down from generation to generation. Bukhara boasted many skilled cooks and chefs, and the best of them were invited to the palace, where they served the emir and his family. Although written sources provide little information about the cook, or *bakavul*, one of the people close to the emir of Bukhara, folk tales contain a lot of information about him. Information about the emir's palace, palace life, courtiers, and service to the ruler can be found in the works of Rahmatullo Vazekh, A. Fitrat, M.S. Andreev, and L.I. Rempel¹.

In the Bukhara Emirate, there were several positions of responsibility for the emir's meals, food, and beverages. For example, the emirate included *the sharbatdor*, responsible for preparing and delivering various drinks; *the gulobchi*, who served gulob (rose water); *the tamakiso*, who prepared tobacco; *the otashbardor*, who lit the *chilim* (shisha); and *the far-roshboshi*, the head chef of the emir's kitchen. The *toksaba* carefully set the emir's table and poured him *sherbet*, *ayran*, and *yahob*.

In Bukhara, the person in charge of the palace kitchen and the emir's meals was called a *bakavul*. The

bakavul occupied one of the most trusted and important positions in the emir's palace, performing duties directly related to his personal security. This position primarily involved managing the palace kitchen, organizing meals, and serving at table.

The main objectives of the *bakavul* were as follows:

Control over the dishes served to the emir. All food prepared for the emir was inspected by the *bakavul*. He monitored the quality, cleanliness, and timeliness of the food. He supervised the work of the cooks and servants.

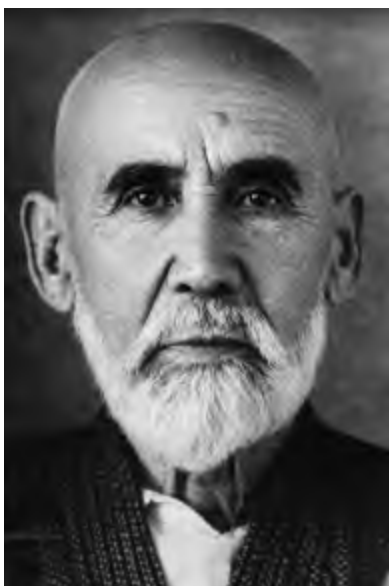
Preventing the risk of poisoning. Due to frequent assassination attempts on the emir's life, the *bakavul* checked food for poison or harmful substances. Some sources claim that the *bakavul* or his men tasted food before serving it. Thus, the *bakavul* was not just a cook, but a trusted palace official who protected the emir's life. He served as the emir's shield against palace intrigue.

The renowned chef Abdurasul Bakavul served the last Manghit emir of Bukhara, Seyid Alim Khan, from 1917 to 1920. Abdurasul Bakavul's father, Mukhtar Bobo, was a chef and prominent merchant. His son, Abdurasul, took up his father's profession and mastered the culinary arts. Although Mukhtar Bobo died suddenly of illness in 1873, his son upheld his father's professional honor and continued his work. Therefore, Abdurasul Bobo experienced no humiliation; on the contrary, he earned the people's respect.

The *bakavul* was considered the head of all palace cooks. The kitchen staff included individual cooks who prepared *shashlik*, *manti*, and soups, while the *bakavul* exercised overall oversight over their activities. When the emir was not in the capital but was



¹ Vozhekh R. The Source of Pleasure and the Sacrifice of Good (The Source of Pleasure and the Sacrifice of Good). Bukhara Museum-Reserve. Manuscript Department. Manuscript 23056/11, 1298/1880; Fitrat A. Amir Olimkhonning hukmronlik davri. – Tashkent, 1992. – 64 b; Andreev M.S., Chekhovich O.D. The Ark (Kremlin) of Bukhara in the late 19th – early 20th in. – Dushanbe: Donish, 1972. – 217 p.; Rempel L.I. Far and Near. Pages of Life, Everyday Life, Construction, Crafts and Art of Old Bukhara. Bukhara Records. – Tashkent: Gafur Gulyam, 1981. – 304 p.



Abdurrasul Bakavul – the famous chef of Emir Seid Alim-khan (1917–1920)

visiting other cities, such as Samarkand, Karmana, Karshi, Charjui, and Kerki, the *bakavul* was included in the emir's caravan.

According to the wishes of the emir, his menu consisted of 2–4 courses. The emir often began his meal with pilaf. Typically, pilaf was served 2–3 times a day. Before pilaf came *kabobi. tanuri (tandoor) kebab*. The dish consisted of chopped lamb, dredged in flour, and baked in a tandoor. Sometimes the emir would feel a desire to try *kalla-pocha* and would ask if the kitchen had it. Usually, this dish was always available in the emir's kitchen and served at the table. The *kalla-pocha* broth was considered the best dish for cleansing the stomach and intestines². Sometimes, by order of the emir, «*boyimjon kabob*» (*eggplant kebab*) was prepared for lunch, made from meat and fried eggplant.

After Asr prayer, comparatively fewer dishes were served. Typically, they served roast meat and even fish—*mayi kabob (fish kebab)*. The fish was caught in the muddy waters of the Amu Darya and delivered to the emir as an offering from the *khokim* of Charjui³.

The Emir of Bukhara, Seyid Alim Khan, ordered the preparation of a special dish using the *peshnab* (flank) of a Hissar ram from the Surkhan oasis. First, a layer of chopped tail fat was placed in the pan, followed by a layer of chopped onions, and then a layer of chopped lamb flank. The ingredients were layered in this manner up to three times.

Emir Alim Khan had a habit of eating *maskhichiri* before heading out to hunt in the steppe or desert. He greatly enjoyed this mung bean dish. Abdurasul Bakavul learned the emir's favorite foods and times, how

² Fayzullaeva M. Ozbek milliy taomlari va tanovul madaniyati (Surkhon voqasi materiallari asosida). – Tashkent: Tafakkur avlodi, 2021. – B.128.

³ Charjui is a historical administrative and political region that existed in the middle reaches of the Amu Darya River in the 19th century, one of the important beyktivs of the Emirate of Bukhara. It was of great importance as a trading and military post on the Amu Darya. It is currently part of Turkmenistan.

IV. SOCIETY, HISTORY, CULTURE

to serve them according to his mood, and how to prepare his favorite dishes. The dishes, prepared with his skillful hands, delighted not only the emir but also the palace's inhabitants⁴. *Bakavul*, who had earned the deep respect of the palace staff, personally received a gold pocket watch from Emir Alim Khan as a token of gratitude. This gold watch is now kept by his descendants. The date on the watch is 1882.

Bakavul skillfully prepared *kobuli osh* in a copper pot. Not every cook would attempt this dish in a copper pot. The reason is that one must be extremely careful to prevent the dish from burning. Another difficulty is that oil cannot be overheated in a copper pot. In cast-iron pots, oil is overheated. At every wedding Abdurasul Bobo prepared pilaf, people flocked there. This was because, firstly, *osh sofi* and *osh kobuli* are not always prepared, only at weddings, and secondly, they wanted to see the famous *bakavul* Abdurasul Bobo and receive his blessing.

As Abdurasul Bobo told his students, this dish was very nutritious and widely consumed in Bukhara. It was often prepared in wealthy families. Due to excessive consumption of this dish, the population began to suffer from obesity. High blood pressure also arose. When this emerging public health problem reached the emir, cooks and doctors were summoned to the palace for consultations. The ruler, fully aware that he could not forbid people from eating this dish, ordered its ingredients changed to ones that would not pose a health risk. Then, *oshi sofi* was created—a dietary dish that is easy on the stomach and has a therapeutic effect. In this type of pilaf, all the ingredients are boiled and steamed, without frying. Salt is not added to *oshi sofi* at all. It is naturally present in cooked rice and meat. We also know that salt is released from boiled water. Therefore, out of concern for public health, special attention was paid to reducing salt consumption. To add flavor to this dish, raisins were always added.

There were many types of pilaf. *Oshi kobuli (pilaf in Kabul style)*, *oshi bekhigi (pilaf with quince)*, *oshi naboti (pilaf with navvat)*, *oshi tograma*, *khalta pilaf*, and so on.

Quince pilaf was distinguished by its abundance of ingredients and sweet flavor. Before lighting the fire under the cauldron, *navvat* (crystalline sugar) was added to the oil. After the oil heated up, the sugar rose to the surface and was removed with a ladle (similar to how onions float to the surface after frying). Therefore, the addition of raisins and quince to this dish imparted a pleasant flavor. The addition of instant sugar to pilaf gave it a light red color and a beautiful appearance. This was reminiscent of the time when dried apricots are just beginning to acquire a reddish tint. When some wedding hosts requested this dish, it was obligatory to prepare it. However, this type of pilaf also has health-damaging properties. It can worsen a chronic cough. This type of pilaf also causes stomach problems. The burning of sugar in fat is a direct chem-

⁴ *Dala yozuvlari*. Samarkand region, Samarkand shakhri. Suzangaron mahallasi. 2025 Yil, July.

ical process. For this reason, culinary masters forbade their students from preparing such dishes.

To enhance the appeal of pilaf, they used other methods that weren't harmful to human health. For example, frying the bones and marrow in oil changed the color of the pilaf, giving it an appetizing appearance. The rice changed from white to the color of navvat (Tajik: *rangi nabboti*).

Bakavul also perfected the technique of making minced meat *shashlik*. The *shashlik* was prepared according to a special recipe. The lean meat was first thoroughly minced in a meat grinder, allowing it to release its juices. The meat was then skewered in four pieces. Next, the meat was sprinkled with cumin and grilled. The fried minced meat was removed from the skewer and kept in hot tail fat. The dish, thus prepared, was served to the emir (Tajik: *amirba peshkash mekardagi*)⁵.

If *kebab* was being prepared, the lamb was slaughtered the day before. To cool the meat and ensure proper cooking, the lamb's fat tail was first melted. Then, it was melted again until it smoked. This process lasted for 5-6 hours over low heat. The kebab was cooked in this fat. An important property of this type of *kebab* is that it prevents heartburn. Conversely, if cooked in raw fat tail, it will cause discomfort.

Abdurasul Bakavul had many students, one of whom, Shirinboy *oshpaz*, specialized in making *kebabs* (*shashlik*). Since ancient times, *shashlik* was made exclusively from lamb. From a 25-kilogram lamb, 5 kg of the most tender meat was selected for *shashlik*, with the rest reserved for other dishes. It's worth noting that Shirinboy *oshpaz* was a well-known *shashlik* maker in Bukhara until 1960.

Not everyone could master the profession of a chef. The reason is that to understand that it is a sacred, honorable, and responsible profession, one must be worthy of it and strictly adhere to its requirements and rules.

The first requirement was cleanliness and tidiness. After the cooks finished preparing the plov, they

⁵ *Dala yozuvlari*. Bukhoro viloyati, Bukhoro shakhri. Chorbogikhossa mahallasi. 2025 Yil, August

washed themselves and changed into clean clothes. They donned clean caps and special clothing, and only then served the food.

The second requirement is honesty and responsibility. Having received an order and promised to cook pilaf at a wedding, even if a much wealthier person offers a larger order and a higher fee, one should decline the offer. Strict adherence to this rule is recommended. When this rule was violated by one of the cooks, the opinion of the Sheikh of Chefs prevailed, leading to unpleasant consequences. The goodness and profitability of his profession abandoned him. One should not seek to profit at the expense of others. Ingredients for dishes were specified based on the wealth of the wedding hosts. For example, they could provide as much meat as they could afford. This was because meat was not a significant component of pilaf. Therefore, the cook had to demonstrate their skill and prepare a delicious dish from what was available⁶.

The third requirement is agreement with the proposed fee. The wedding host must estimate the cost of the work themselves.

The cooks, fully aware of their responsibility to ensure that the food they prepared met expectations and was enjoyed by everyone, offered prayers to the patron saint of cooks, Hazrat Jabrail, Piri Pukhta⁷. They then recited verses from the Quran. They asked Allah to bless their work so that the ceremony would proceed as expected and the pilaf would be delicious. They began their work with the words, «May Hazrat Piri Pukhta and Hazrat Jabrail help us» (Tajik: *Hazrat Piri Pukhta yor shavan, Hazrat Jabrail madadkor shavan*).

Calligrapher Abdulgafar Razzaq Bukhari, a teacher at the Mir Arab madrasah in Bukhara, recalls the following about Abdurasul Bakavul: "All of Bukhara knew 86-year-old Bakavul Bobo, who cooked *balazanokhat shurva*. Ten munshi didn't possess the knowl-

⁶ *Dala yozuvlari*. Bukhoro viloyati, Bukhoro shakhri. 2025 Yil, August.

⁷ Kurbonova M. Bukhoro voxasi yzbek va tozhiklarining ananaviy taomlari. (XIX asr ohiri va XXI boshlari): Tarikh fanlari nomzodi diss. – Tashkent, 1994. – B.47.



Bukhara. 1885–1892. The Emir's harem in the Sherbudun Palace. Author: Orde N



Old Bukhara. A pilaf feast at the Bukhara Emir's palace in Karmana



Old Bukhara. The Palace Arch

edge he possessed. The soup prepared by my grandfather, who knew every gram of the ingredients and preparation techniques for all Bukharan dishes, was gone within an hour. I also tried this pea soup; it was delicious, like sherbet. Its ingredients: Bukhara water, carefully grown peas, meat from a cow raised and slaughtered in Bukhara, and medicinal herbs. As for preparation, the peas should be soaked in salted water and not touched frequently. After a while, they are removed from the salted water and thrown into a boiling cauldron along with 4.5 kg of beef, after which “The pilaf is cooked over low heat from sunset to sunrise. Master Abdurasul Bobo was a very strong man. Everyone was amazed to see how the 86-year-old man prepares pilaf⁸.“

Oral accounts of the lives and activities of palace officials and the emir’s confidants are well preserved in the memories of Bukhara’s residents. This valuable oral information was passed down from generation to generation. Although there are still few people left who met and interacted directly with the emir’s *bakavul*, their descendants and chefs’ apprentices preserve this memory as a valuable information. By

reconstructing the memory of the historical figure Abdurasul Bobo, we can shed light on questions related to the social status, social relations, and economic life of Bukhara at the time. The activities of the palace cook also allowed for the collection and scientific analysis of a range of ethnographic data, such as the inner workings of the palace, the art of cooking, and the traditions of the mentor/apprentice relationship.

⁸ *Dala yozuvlari* . Bukhoro viloyati, Bukhoro shakhri. Chorbogikhossa mahallasi. 2025 Yil, August

Urbanisation: a problem or a solution for the modern world?

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Successful urban development and aesthetically expressive architecture are signs of the development and progress of a country as a whole. History shows that the power of empires that ruled for centuries was largely reflected in the grandeur of cities and the harmony of unique architectural ensembles.

When constructing modern residential buildings, administrative, public, and scientific institutions, cultural centres, entertainment venues, and, of course, when developing transportation and communications

infrastructure, it is essential to consider such crucial factors as the convenience and comfort of city residents. As a result of intensified globalisation and increased urbanisation in the 20th century, a significant portion of the world's population began to migrate to large cities in search of better income and a better standard of living.

Viewed in a broader context, the transition to new urban development models has become a global challenge and a new trend, proposing urban models such as “smart city,” “eco-city,” and “eco-mega-city.” This is achieved through urban redevelopment. For this reason, large metropolitan areas typically develop vertically due to limited land space. Ecological zones and water basins are located on the floors or roofs of high-rise buildings.

If we consider the experience of developed megacities such as Tokyo, Shanghai, or Doha, we see that the level of urbanisation in these cities is also growing due to immigrants and migration from the regions to the cities.

Shanghai is China's largest city and a major financial hub, and its population continues to grow, increasing by more than 690,000 people in the last year alone. Modern buildings and high-tech structures harmoniously coexist here. For example, a building that housed a butcher's shop until the 1980s has now been converted into the “1933 Old Millfun” shopping centre. Remarkably, this building is listed as a cultural heritage site. The building's exterior has been fully preserved, featuring textured concrete and intricate architecture, while the interior is equipped with modern technology. The Shanghai Tower, completed in recent years, is the second-tallest building in the world (632 meters). This tower features a unique curved design that reduces wind impact and improves energy

Tashkent City, Congress Hall





Arifjanbay Mosque. Tashkent City Complex

efficiency. The tower's interior houses offices, retail space, and an observation deck with panoramic views of the city.

The next megacity, Tokyo, is the largest city in the world, with a population four times larger than London's. Tokyo is among the rapidly developing "smart cities" in recent years. Services in consumer services, transportation, and cultural centres are automated. Due to a lack of living space, public services have been relocated to public centres. For example, small, cost-effective centres with fast service times have been created, including food service establishments, baths, and laundries. However, as noted above, due to low immigration, limited housing, limited jobs, financial problems, and declining birth rates, Tokyo is home to the world's oldest population. Furthermore, Tokyo's population is projected to decline sharply in the coming years. There are concerns that the metropolis's population will halve over the next 90 years and that the ageing working-age population will negatively impact Tokyo's appeal as a major international metropolis.

Among Arab countries, Qatar stands out for its economic growth and status as a regional power. Its gross domestic product has grown faster over the past 20 years than any other country in the world during the same period. This economic growth has been driven by natural gas production. At the same time, Qatar's population has tripled, primarily due to the influx of foreigners.

The country's capital is Doha (Ad-Dawha), located on the east coast of the Arabian Peninsula. It was once the centre of pearl production, and much of the country's population earned their living from

the pearl trade. Modern Doha, as a metropolis, combines ancient architectural structures with new office buildings, shopping malls, and high-rise buildings. For example, the architectural concept of the Qatar National Museum building may, at first glance, appear futuristic, although the design is inspired by the most common mineral in the region, "desert rose." The building's rounded elements are interconnected to avoid sharp angles. The system of interconnected disks appears to have been created naturally. It includes elliptical exhibition spaces surrounding a central courtyard. The sand-colored concrete pavement blends harmoniously with the surrounding environment. The garden, composed exclusively of native plants and trees, features large lawns, perfect for evening strolls. The city has created favourable conditions for people of various nationalities to live, work, and run their own businesses. It welcomes international companies and banks and hosts international cultural, sporting, and educational events. As a result, it has become one of the most convenient metropolises for business and tourism.

Our capital, Tashkent, is a city with a centuries-old history. Thanks to a steady population growth, it has developed socioculturally, economically, and architecturally. In 2016, proposals for the creation of the Tashkent City International Business Centre were first announced. A site in the Almazar and Ukchi mahallas, covering a total of 80 hectares, was selected for the construction of this complex. Work on the concept for the International Business Centre took eight months. Two of the seven concepts submitted formed the basis for the project. Ultimately, the concept proposed by the Turkish architectural firm Tabanlıoğlu Archi-

jects was selected. Domestic and foreign investors were attracted. The complex includes the Congress Hall, the Hilton Hotel, the tallest residential building in Tashkent, Nest One, and a large shopping centre, Tashkent City Mall. The newly constructed complex includes a kindergarten, swimming pools, a sports and entertainment complex with a sauna and fitness cafe, and supermarkets.

The Congress Hall building, unlike the typical “constructivist” architecture, is designed in a fluid, flowing style. The architects successfully achieved this by carefully designing the façade. Indeed, the most striking design element of the Congress Hall is its façade, which combines modern features with traditional Eastern architectural heritage. The open-work patterns of the exterior appear light and create a sense of tranquility. The lighting concept was developed to highlight the expanse of the façade even at night, creating balance and harmony between the two dominant buildings with their distinct architectural features.

Another unusual building in Tashkent is “Nest ONE.” Situated on a four-storey shared podium, it includes retail space, a hotel, and amenities and is flanked on both sides by office and residential buildings. Nest One, which combines elements of Art Deco and Classicism, is currently one of the tallest buildings in Central Asia, reaching 266.5 meters.

The ground floors of the elite, high-tech residential buildings, seven and nine-storey high, with Smart



Miraykan – National Museum of New Technologies and Innovations

Home technology, are being used for retail space. An artificial lake was created in the centre of the complex. The Arifjanbay Mosque, built in the 20th century and located within the complex, was restored. It now houses a small museum exploring Uzbek culture and history.

The construction of the complex has opened up opportunities for Tashkent to provide high-quality services for international events, forums, and confer-





ences. Foreign investors and brands have begun to arrive in the country. Entertainment venues have been built for residents and visitors of Tashkent, undoubtedly contributing to an international-level improvement in the quality of life and services.

However, it should not be forgotten that urbanisation, along with its many benefits, can also generate a number of challenges. These include environmental issues. These include waste disposal issues due to the disproportionate increase in waste volume; increased air pollution in the metropolis; overloaded sewer and energy systems; vehicle exhaust fumes and traffic congestion; a growing need for housing due to the continuous growth of the urban population, and more.

To address these issues, it is necessary to increase green space, expand the city's territory, and increase capacity for processing solid household, liquid, and construction waste. Plans must be developed to increase the use of clean energy sources and to conduct public awareness campaigns on the rational use of natural resources.

Work is underway on a major new urban development project, "Yangi Toshkent." We hope that the above-mentioned issues will be taken into account during the implementation of this ambitious project, which should lead to thoughtful and harmonious solutions for the architectural design of New Tashkent.

* Developed as part of Project No. AL-9524115095 "Creating a Platform Covering the Stages of Formation and Development of Islamic Art in Uzbekistan"

How do soap operas influence us?

Mokhinur Akhmetjanova,
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The television series (a.k.a. soap opera) is a format that has attracted attention as a research subject in film studies and other related fields, and is distinguished by its significant psychological influence in the media world. It is no coincidence that this format is used as a tool of «soft power» in countries with a developed television series industry. Depending on the scale of their psychological impact, television series can shape identification (identification with the character), evoke an emotional response, and modify social behavior.

In the last decade, television series have become an independent and leading form of audiovisual art. Especially long-running television series in the drama genre are becoming a cultural phenomenon, exerting a strong and lasting influence on the psychology of viewers. In this process, television series serve not only as a storytelling tool but also as a platform for

psychological experimentation. The long-running narrative style of television series creates a deep psychological connection (parasocial relationship). The higher the level of psychological realism, the greater the impact. Overall, television series creators were among the first to understand the unique power of narrative style and were able to skillfully exploit it. Thus, television series became an on-screen continuation of the literary novel.

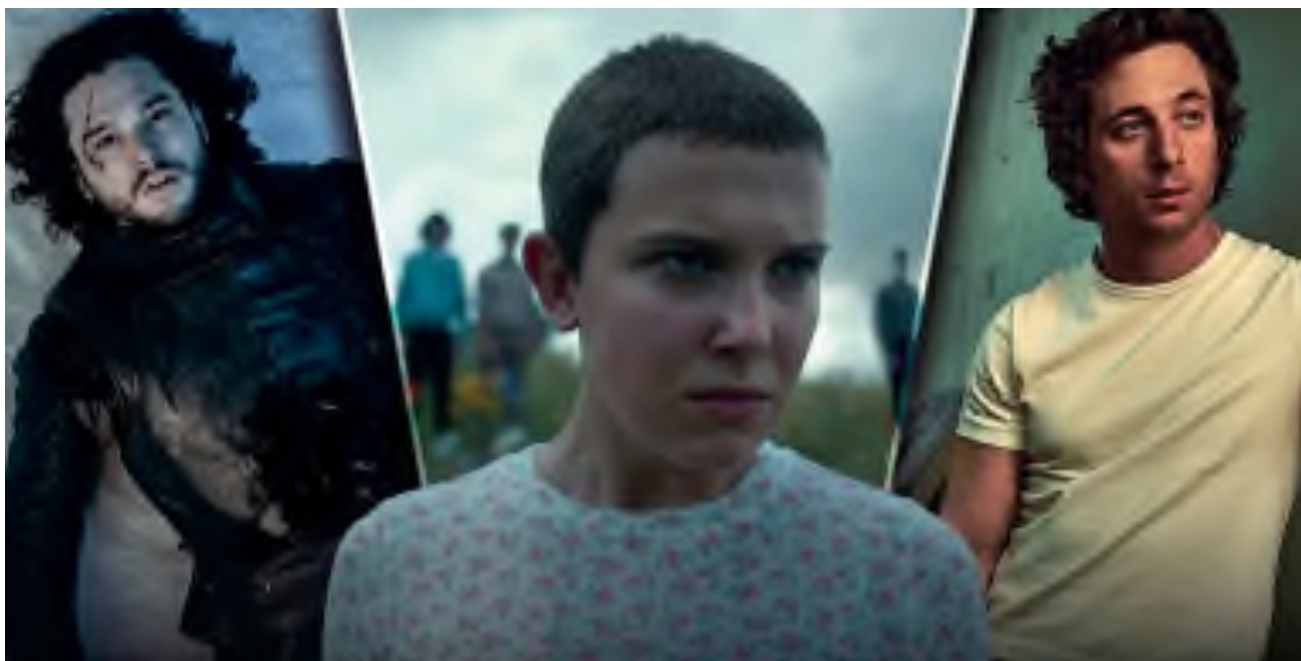
The process of shaping the psychology of television series viewers is complex and multifaceted, occurring simultaneously through narrative structure, audiovisual expression, psychological identification, and socio-cognitive mechanisms. The primary mechanism of television series' psychological impact is linked to narrative continuity and duration. The series format divides the story into episodes, creating an unfinished, intriguing cliffhanger¹ at the end of each episode. This method creates a state of cognitive dissonance in the viewer: that is, the fact that the story has not reached its conclusion creates discomfort in the mind, «forcing» them to watch the next episode. As a result, the series becomes part of the viewer's life, intertwining with their time frame and psychological needs.

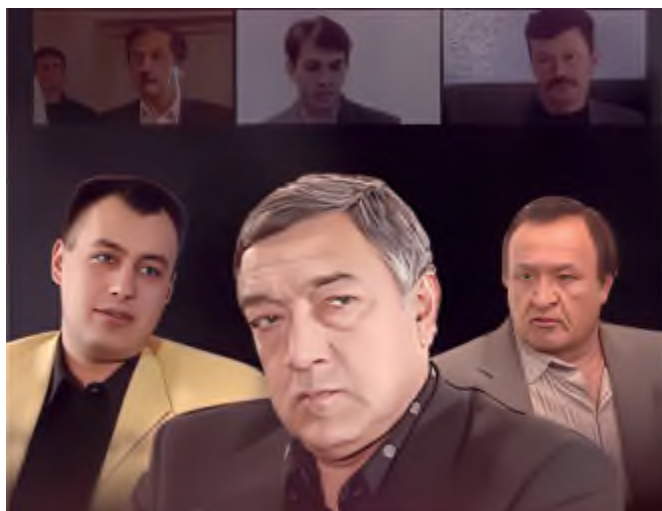
Television series have a profound impact on viewers through mechanisms of identification and empathy. Viewers consciously or unconsciously compare themselves to the characters' personalities, their life problems, and their social roles. This is especially evident in long-running series, where the characters' psychological evolution is shown step by step, and the viewer begins to perceive them as «real people.» This situation gives rise to the phenomenon of parasocial relationships, where the viewer establishes a one-sided but emotionally powerful connection with the on-screen image.

Television series exert psychological influence through social modeling. According to Albert Bandura's social learning theory, people learn behavior patterns through observation. The behavior, moral dilemmas, and conflict resolution methods repeatedly demonstrated in a series become normalized in the

¹ cliffhanger – dramatic knot

Cliffhanger: Game of Thrones / Stranger Things / The Bear





Shaytanat (TV series), 1999

viewer's mind. As a result, the series becomes not just a means of entertainment but also a factor in shaping social norms and values.

The impact of television series is enhanced by the mechanism of emotional resonance. Music, color, rhythm of editing, and acting directly influence the viewer's affective state. This prolonged emotional experience strengthens psychological attachment, transforming the series into a means of satisfying the viewer's emotional needs. In this case, watching a series serves as a stress reliever or a temporary distraction from the problems of real life.

Television series shape psychology through the mechanism of constructing worldviews and social reality. As media texts, television series interpret specific social issues, gender roles, family relationships, or images of power. Because these interpretations are regularly repeated, they become firmly ingrained in the viewer's mind as a «normal» and «acceptable» model of life. This process is explained by George Gerbner's cultivation theory, which posits that prolonged screen exposure shapes a person's perception of social reality.

To summarize, television series shape viewers' psychology simultaneously through narrative, emotional, cognitive, and social mechanisms. Thanks to this multi-layered influence, television series in contemporary audiovisual culture appear not only as entertainment but also as a powerful cultural phenomenon, reproducing consciousness and worldview.

This raises the question: «How does a TV series' narrative influence the viewer's thinking?» A TV series' narrative exerts a long-term, systematic, and multi-stage influence on the viewer's consciousness. This influence is not limited to a single emotional reaction, but rather shapes the viewer's perception, their interpretation of events, and their understanding of social reality. This process can be scientifically explained by the following key mechanisms. A TV series' plot is imprinted in memory thanks to its long-term and consistent narrative structure. Unlike a film, TV series breaks the plot into fragments, creating

a recurring connection over a long period of time. This repetition leads to events and images becoming stable cognitive patterns in the viewer's mind. As a result, the viewer perceives the story not as an outside observer, but as a psychological process close to their own life experience.

The narrative of a television series penetrates deeply into the mind through the mechanism of identification. Because the viewer identifies with a specific character, they internally «validate» their choices and decisions. The long-running plot demonstrates the character's evolution, forcing the viewer to adapt to their mental state and moral dilemmas. Thus, the series' narrative restructures the viewer's moral sensitivity and capacity for empathy. This effect can be both positive and negative.

The plot of a television series shapes emotional memory. Certain scenes, conflicts, or dramatic plot twists are associated with the viewer's emotional experience and remain long-lasting in their memory. This emotional encoding imprints the narrative in the mind not simply as information, but as a psychological experience. As a result, the events of the series indirectly influence the viewer's emotional reactions in real life.

The plot of a television series functions to shape and reinforce social meanings. The conflicts, values, and ideological emphases presented in the plot compel the viewer to accept a certain worldview as the norm. Recurring narrative patterns legitimize certain forms of social relations, thereby guiding the viewer's social consciousness. The narrative influences the viewer's consciousness through cognitive internalization, emotional connection, and the formation of social meanings. For this reason, the series' narrative emerges as a powerful discursive mechanism shaping consciousness in contemporary popular culture.

A character's psychology is imprinted on the viewer's consciousness through the mechanisms of identification and internal adaptation. By observing the psychological state, motives, and decision-making style of a particular character, the viewer begins to transform them into models of their own possible behavior.

The assimilation of a character's psychology is reinforced by repeated observation and normalization. In a TV series, the same psychological reactions, decisions, and behavioral elements are repeated from episode to episode. As a result, specific behavioral patterns are formed in the viewer's mind, perceived



as the «acceptable norm» rather than the «exception.» This situation is explained by the fact that, in social cognitive theory, behavior is learned through a model. This situation can also have negative consequences, such as the infiltration of alien ideas from «popular culture» into the viewer's consciousness.

A character's psychology influences viewer behavior through emotional response. If the viewer strongly empathizes with a character's emotional experiences, these emotional states may also be reflected in the viewer's real-life reactions. For example, if a series encourages an aggressive or conciliatory approach to conflict, this behavioral model becomes ingrained in the viewer's mind as a strategy that yields positive results. Immersion in a character's psychology occurs through the shifting of moral boundaries. In television series, complex and contradictory characters often justify their actions with psychological reasons. By accepting these principles, the viewer becomes more tolerant of previously rejected behavior patterns. A character's psychology is transmitted to the viewer through parasocial connections. An image observed over a long period of time becomes a reliable «psychological companion» in the viewer's mind. As a result, the viewer may consciously or unconsciously draw on this character's thinking when making decisions.

The series' aesthetics act as a system that synchronously controls the viewer's psychological perception at the levels of sensation, emotion, and thought. It's not just a visual embellishment or stylistic choice, but a psychological mechanism that controls how the viewer perceives, feels, and interprets the narrative.

The aesthetics of a television series direct the viewer's attention through perceptual orientation. Shot composition, color palette, lighting, and camera movement direct the viewer's gaze toward a specific object or emotional state. For example, while tight

shots and shadows can heighten psychological tension or internal conflict, open spaces and bright colors can create a sense of safety and stability. Thus, aesthetics predetermine the emotional perspective from which the viewer perceives reality.

The aesthetics of a television series serve as an emotional modulation. Music, audiovisual sound design and rhythm of editing gradually alter the viewer's affective state. Aesthetic elements do not evoke emotions directly, but rather «create the conditions for experiencing them.» As a result, the viewer feels as if they are freely adding their own emotions to the story, although in fact these emotions are predetermined by the aesthetic structure. While the aesthetics of a television series provide psychological immersion, the coherence of visual and audiovisual elements creates the effect of «transferring» the viewer from real life to the world of the series. The higher the level of this immersion, the more the viewer loses the ability to think critically and perceives the narrative as an emotional experience rather than a rational analysis. In this situation, aesthetics becomes the central regulator of psychological perception.

The series' aesthetics act as a means of guiding the process of meaning-making. Colors, symbolic details, and recurring visual motifs create hidden layers of meaning in the viewer's mind. The viewer may not consciously analyze these signs. However, they influence the overall psychological mood and moral interpretation of events. In this regard, aesthetics are not independent of the narrative content, but rather function as a discursive tool that deepens it.

The aesthetics of the series activate a mechanism for forming and managing psychological expectations. Specific visual and audio codes create a sense of anticipation in the viewer of a predetermined emotional or dramatic outcome. When these expectations match the course of events,



Breaking Bad – an American crime neo-western series created by Vince Gilligan for AMC

psychological satisfaction occurs, and when they do not, a strong emotional reaction occurs. In both cases, the aesthetic structure actively guides the viewer's psychological experience.

A series' aesthetics govern the viewer's psychological perception, guiding their reactions, modulating emotions, deepening immersion, and shaping their interpretation of meaning. For this reason, aesthetics are not a secondary embellishment of a series, but rather a key psychological mechanism determining how the narrative is «perceived» by the viewer.

Currently, there are many television series being produced around the world that clearly demonstrate all aspects of the aforementioned impact on the viewer's psychology. "Breaking Bad" (2008-2013, directed by Vince Gilligan) is one of the most striking examples in contemporary television series of narratives about psychological transformation. The series stands out not only as a crime drama, but also for its gradual visual and dramatic depiction of the process of moral decay of the human mind. From a film studies perspective, the series' main strength lies in its narrative structure, which forces the viewer to identify psychologically with the characters for a long time.

In the character of Walter White we see him transform from an «ordinary man» into an «antihero.» The psychological evolution of Walter White's character closely resembles the model of a classic tragedy, in which the viewer initially sees a socially disadvantaged, internally repressed man who feels worthless. A cancer diagnosis and a premonition of impending death serve as the impetus for change.

The viewer sympathizes with the hero and tries to justify his initial mistakes. The protagonist's desire for control and power, his justification: «I'm doing this for my family,» is his internal psychological transformation.

When discussing the television series format, it's important to remember that their current reach and reach have significantly exceeded the notion of them as unprofessional works for amateurs, as was the case in the second half of the last century. Concurrent research into the impact of television series on human psychology, conducted by film scholars and psychologists, along with the further development of this format in the future, will contribute to limiting screen works that promote certain negative ideas and foster ideological immunity in viewers.

Spirituality is the most important foundation of any education

Abduvali Lutfullaev,

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In Uzbekistan, nurturing a spiritually mature and well-rounded individual is one of the state's primary goals. Of particular importance is the revival of our nation's national spirituality of our people, a thorough study of the rich historical heritage, the preservation and enrichment of national traditions, as well as the comprehensive development of culture and art, science and education. The main goal of education is to cultivate a thinking, free, knowledgeable, and, overall, comprehensively developed individual. Today, Uzbekistan is setting itself important goals, relying on its multinational people and youth, who are our **hope** and support. Reflecting on the happiness and well-being of our dear children and grandchildren, and looking with hope to the bright future of the country and its people, the state and civil society set themselves ambitious goals in the area of further development of education.

Spirituality is a set of philosophical, legal, scientific, artistic, religious, and other ideas that define human existence, activity, and behavior. Education is the process of imparting comprehensive positive skills that reflect each person's intellectual potential, as well as the knowledge acquired throughout life. Since the state has decided to build a New Uzbekistan, it must rely on two strong pillars. **Firstly**, it is a strong economy based on market principles. **Secondly**, it is a strong spirituality based on the rich heritage of our ancestors and national values. Humanity is nature's greatest gift. It is endowed with such remarkable qualities as intellect and insight, which can be honed and developed through upbringing and education.

Intellectual education is a multifaceted process encompassing spiritual, moral, creative, and cultural development that shapes all human activity, identity, and creativity. Human freedom and independence are



Schools must adopt a new approach to education, upbringing, and spiritual development.

Photo: Press Service of the President of Uzbekistan

linked to freedom of thought and autonomy. Humans are distinguished from all other living beings by their ability to think. People also differ from one another in their unique thoughts, observations, conscious activity, and ability to think independently. The well-known word “*tafakkur*” comes from the Arabic word “*mutafakkir*” and signifies the ability to think deeply.

The great thinker, scholar and poet Alisher Navoi writes about this:

“If a man takes up a task,
He needs to think it over.”

Abdulla Avloni, a writer and educator who made a significant contribution to the development of Uzbek pedagogy, in his work “*Turkiy Guliston yohud axloq* (The Turkic Garden or Morality)” examines the development of human thought and emphasizes the following: “Intellectual education is essential. It is a sacred duty entrusted to teachers and entrusted to their conscience. Thought can glorify a person and infuse them with energy... Although there is a slight difference between teaching and education, they are inseparable, just as the soul and body are connected.”

Dwelling on the foundations of intellectual education, he emphasized that this is a sacred task, dependent on our teachers and mentors, requiring their assistance and entrusted to their conscience. Thus, the issue of shaping the thinking of the younger gen-

eration of Uzbek citizens places serious and responsible responsibilities on educators, teachers, and mentors.

Intellectual education opens the door to happiness and shows a person their path in life. Today, it is especially important to respect and value people, instill intelligence, good manners, and morality in the younger generation, and facilitate their development into adulthood. Human intelligence is the ability to learn, comprehend, think logically, adapt to new conditions, and effectively solve problems. It includes mental processes such as memory, attention, imagination, creativity, and other human qualities. Simply put, intelligence is a person’s ability to understand mundane and vital truths. Thanks to intelligence, a person can distinguish between black and white, good and evil. Without intelligence, their manners will be superficial and artificial.

Labour education plays a particularly important role in shaping a well-rounded and mature gen-



Continuous spiritual education



Spiritual education in preschool

eration. A person's lifestyle is closely linked to their work. Labour is a necessary condition of human life. It is not only a material or social need, but also a spiritual and moral one. Labour education is largely realized within the family. The collaboration between family heads and children creates enormous opportunities in a person's life. A love of one's profession, knowledge, and skills related to one's specialty are formed through labour education throughout one's life.

Physical education, in addition to ensuring healthy development, promotes mental and spiritual maturity. It's no wonder they say, "A healthy mind resides in a healthy body." Physical education improves people's health, increases their productivity, and promotes longevity. A healthy generation is unimaginable without physical education. It's especially important to implement the recommendations of modern sports medicine, pedagogy, and psychology in every family to ensure the proper development of young people, both physically and spiritually.

Traditional national institution—the mahalla—has played a crucial role in preserving national and spiritual values, strengthening peace and prosperity for the people and the country, as well as in the spiritual education of youth and their comprehensive development as individuals. It is significant that the mahalla's aksakals (elders) and the gray-haired women, who have seen much in life, use their life experience to spiritually nurture and educate the youth, preserving and continuing folk traditions.

When speaking about the uniqueness of spiritual education, taking into account its connection and interdependence with other forms of education – moral, artistic and aesthetic, religious, legal and political – one should pay attention to the following:

1) spiritual education is broader and deeper in content and essence than other forms of education.

2) it is wrong to limit spiritual education to the framework of only moral education (such cases occur), since moral qualities are only one aspect of the content and essence of spirituality.

3) spiritual education in a certain sense performs an integrative function in relation to other forms of education, that is, the results achieved in each area of education ultimately enter into the content of the individual's spirituality and enrich it.

The system of subjects of spiritual education includes:

1. Personality (individual). The primary focus of spiritual education is the individual. Individuals develop their spirituality through their activities, actions, and self-improvement. They actively participate in the process of spiritual education through self-awareness, self-analysis, and self-improvement.

2. The family. It is the primary and most important entity in spiritual education. Parents and other family members play a decisive role in shaping a child's spiritual qualities. Through the family, spiritual values, moral and ethical principles, and national and cultural traditions are instilled and transmitted.

3. Educational institutions: – Preschool educational institutions contribute to the development of children's initial moral and spiritual understanding of collective behavior. Schools, gymnasiums, and colleges play an important role in spiritual development. Spiritual values are instilled in students through thematic lessons and extracurricular activities. – **Higher education institutions**, along with teaching fundamental knowledge, instill basic professional skills



Raising a well-rounded generation capable of self-development and possessing social skills

and promote the development of students' spiritual and moral maturity.

4. Teachers and educators are the direct agents of spiritual development, organizing the moral and educational process that guides the development of the younger generation as spiritually mature individuals. Their personal example, teaching methods, and the subjects they teach have a significant influence on the spiritual development of students.

5. Society and the social environment. The overall level of spirituality in society directly influences an individual's spiritual development.

The social environment (people around us, friends, colleagues), as a significant factor, plays a vital role in the formation of a person's moral and spiritual qualities. The values, norms, and cultural traditions that exist in society determine the spiritual development of the individual.

Government organizations, in particular bodies in the field of education and culture, develop and implement policies for spiritual education.

Public organizations conduct various events and implement projects aimed at the spiritual development of youth. Religious organizations and religious figures are important actors in spiritual education.

Religion helps a person to form moral principles, understand the meaning of life and acquire spiritual values.

Spiritual education is carried out in a special way through mosques, churches and other religious institutions.

6. Cultural institutions — theaters, museums, libraries, art galleries, cinemas, community centers, and other cultural institutions—are also instrumental in spiritual education. Their influence helps develop

aesthetic taste, respect for national and cultural values, and a love of art. Fiction, music, visual arts, and other creative activities play an important role in enriching a person's spirituality. Books, films, and performances help shape life values and moral qualities.

7. Mass media and popular culture — television programs, radio, the Internet, the press, and other media have a great influence on a person's spiritual development. With the help of the media, one can promote people spiritual values and form moral standards.

Spiritual education encompasses many different aspects. In spiritual education, each symbol that promotes national ideals and national pride serves as an excellent textbook and a powerful educational tool. Furthermore, celebrating the birthdays of great ancestors also has spiritual and historical significance. Thus, the subjects of spiritual education exert varying influence on a person's spiritual development. This process requires a healthy moral and spiritual environment, such as collaboration between the family, the mahalla, educational institutions, society and the state, and the media. The success of the spiritual education of the country's citizens depends on the active participation and cooperation of all the aforementioned actors.

Sassanid toreutics: ideology imprinted on metal

Zebiniso Mukhsinova
PhD in Art History

The new kingdom founded by the descendants of Sasan (Sasson) on Iranian soil brought with it a tremendous cultural upsurge. The architectural forms with their characteristic domes, monumental paintings, and unique musical heritage of that era remain objects of profound study and admiration in the global scholarly community to this day. In this article, we will discuss the distinctive features of Sasanian art, its role in state symbols, and its contribution to global cultural heritage.

Sassanid art is more than just a monument to the past; it is living history etched in stone, aristocratic

luxury reflected in cast silver vessels, and exquisite taste embodied in magnificent silk fabrics. The art of this period, with its monumental appearance, reflects the political power of the empire, while its exquisite detail reveals the spiritual wealth of the people. Majestic rock-cut complexes such as **Tok-i Bustan** and **Naqsh-e Rostam** are considered the pinnacle of Sassanid art. They skillfully depict coronation ceremonies of rulers, victorious battles, and scenes of magnificent hunts. Every line, every fold of clothing, and the musculature of horses are depicted with such precision that they evoke a sense of movement and vitality in the viewer. These works are not simply images, but a visual philosophy demonstrating the harmony of royal power with divine will.

The Sasanian Empire also developed its own school of jewelry and applied arts. Silver and gold vessels depicting royal hunting scenes, created by Sasanian artisans, were considered the most valuable gifts in diplomatic relations in the ancient world. Their intricate reliefs and gilded patterns testify to the development of technologies of the time. Moreover, the styles created by Sasanian artisans, which served as a cultural bridge between East and West, knew no boundaries. Their artistic traditions and aesthetic principles left a noticeable and indelible mark: - in Islamic art: the use of *ganch* (stucco) in the decoration of mosques and palaces (the first manifestations of arabesque) and in the form of terraces; - in the Byzantine Empire: in the decoration of imperial clothing and ceremonial design; - in medieval Europe: in images of mythical animals (griffin, senmurv), as well as in Romanesque church architecture and the symbolism of chivalry.

The toreutics of Sasanian Iran (3rd–7th centuries CE) are not only an outstanding example of artistic excellence in the Ancient Middle East but also a complex visual-narrative system that served as the foundation of state ideology. Silverware of the Sasanian period, especially ceremonial dishes, was the empire's prima-



A silver dish depicting Varahran hunting a boar.
390s–420s. State Hermitage Museum



"The Royal Hunt of Khosrow": Late 6th – early 7th century CE.
Located in the National Library of France in Paris



Silver plate with Pegasus, Sassanid, c. 4th or 5th century, Iran



Silver royal (court) dish with gilding, "The Enthronement," ca. 6th-7th centuries

Sassanid-style dish depicting a hunting scene from the tomb of Feng Hatu. Late 3rd–4th centuries CE. Today, the objects found in the tomb are part of the collection of the Shanxi Museum in Taiyuan, the provincial capital



ry “visual code,” expressing the concept of the divine nature of the power of the *shahanshah*—the “king of kings.” Within the framework of art historical analysis, these artifacts should be viewed as tools linking local political reality with Zoroastrian metaphysics. At the centre of this system lies the image of the ideal monarch, endowed with a mystical blessing—*xvarno* (Avestan: *xvar ə nah*), confirming the legitimacy of the reign of the *shahanshah* of the Sasanian dynasty. In religion, silver is associated with purity and light, and the use of gilding created a visual equivalent of royal divine light.

The main iconographic subject, which has a canonical appearance, is the royal hunt scene. In academic discourse, this scene is interpreted not as an ordinary everyday scene, but as a sacred ritual and a heroic victory over the forces of chaos (entropy). The *Shahanshah*, occupying a central place in the composition, is portrayed as a defender of world order. His victory over a wild animal—a lion, a boar, or a goitered gazelle—symbolically represents the victory of Ahura Mazda over Ahriman.

Strict rules governing the depiction of these ceremonial plates allowed them to be used as official documents. The individual crown (*tāi*) served as the primary symbol for identifying a particular ruler. According to palace etiquette, each ruler had his own crown, adorned with symbols of patron deities: the wings of Verethragna, the god of victory; the rays of Mithras; or the symbols of Anahita. Comparing these skillful pieces with the coins of the Sassanid kings, one can unmistakably recognize the monarch depicted on these metalworking pieces. Masters of toreutics also achieved high mastery in conveying dynamics: the techniques of “flying gallop” (a horse’s fast run) and “Parthian archery” (shooting a bow while galloping with a turn) expressed the ruler’s extraordinary dexterity and courage.

Sassanid metalworking technology attests to its high level. Unlike the simplified techniques of later periods, the classic Sassanid dish was created in a complex technical style. Figures were applied to a base made of high-quality silver using a deep carving technique. Analysis shows that the most voluminous



A silver-gilded dish depicting the Sassanid ruler Ardasher I hunting a wild boar. Late 4th or early 5th century. Discovered in Afghanistan. Shelby White Collection

details were often cut from a separate metal plate and welded to the surface of the silver dish using a special technique, creating a two-dimensional appearance. The final step was treatment with gold water and selective mercury (amalgam). The artisans left part of the silver background untreated, thus creating a striking contrast with the gilded figures. The play of light in the lamps in the palace halls gave the images a mystical dynamism, visualizing the “divine light” characteristic of the *Shahanshah*.

Surviving monuments allow us to trace the evolution of imperial style in detail. For example, a gold-plated silver dish from the Bibliothèque Nationale de France (Paris), presumably dating to the reign of Khusrav I or Khusrav II Parviz, is of significant importance for analysis. It embodies the ideal of symmetry and compositional balance, depicting the king wearing a regal crown with the wings of Verethragna as the center of the universe, symbolizing the stability and power of the empire.

The attribution of a dish found in Afghanistan and housed in the Shelby White Collection (late 4th-early 5th century CE) requires reconsideration. However, the connection of this dish's subject to the reign of Ardashir I lacks scholarly justification in terms of the history of clothing and crown shapes; stylistically, it is closer to the period of Varahran IV or Varahran V (Bahram Gur). The boar hunt motif here has symbolic significance: the boar is a symbol of the god of victory, and victory over it signifies the ultimate military triumph. This same motif reaches its apogee in a masterpiece depicting Varahran's boar hunt, housed in the State Hermitage Museum in St. Petersburg. Here, the detailed weaponry and the anatomical accuracy of the animal's depiction indicate that toreutics had reached a stage of high mastery.

The connection between Sassanid Iran and Islamic art was most clearly evident in metalwork: Muslim craftsmen not only adopted the techniques of fine chasing and niello but also preserved the favorite themes of the Persian kings. The famous silver dishes in the Hermitage collection, featuring images of hunting or the mythical *Simurgh* bird, became the benchmark for later Eastern pieces. In this continuity, ancient Zoroastrian symbols gradually evolved into elegant arabesque patterns, harmoniously complemented by austere Kufic script. The combination of Persian monumentality with the Islamic fashion for gold and silver inlay on bronze created that recognizable style that still fascinates us in the treasures of the East. Sassanid traditions are clearly evident in a bowl depicting the “Great Royal Hunt” (5th-6th centuries CE), housed in the Museum of Islamic Art in Berlin. Despite the shift in religious paradigm, the image of the ruler as the ideal warrior remained significant and became the ideal of chivalry in the medieval East. Of particular interest is a dish found in the tomb of the Chinese official Feng Hetu (Shaanxi Provincial Museum, Taiyuan). This find, dating back to the Northern Wei period, demonstrates that, thanks to the Silk Road, Iranian aesthetics were adopted by the Chinese elite as a sign of high status.



A hunting bowl depicting the great Sassanid king, 7th century CE, is housed in the Museum of Islamic Art in Berlin, Germany

The geographic distribution of Sassanid silver finds is paradoxical. A large number of various silver dishes have been discovered in the Urals and Kama regions. As part of the “Fur Route,” merchants of the Russian Empire exchanged the precious furs of northern peoples for valuable vessels made by Sassanid artisans. For the Finno-Ugric tribes, these dishes were considered sacred artifacts; they were used in rituals and carefully preserved, which saved these masterpieces from being melted down in subsequent centuries. Thanks to this, today the State Hermitage Museum in St. Petersburg possesses the world's largest collection of Sassanid toreutics.

Sassanid toreutics represents a unique synthesis of art, technology, and political philosophy. It is not only a monument to material culture but also a utopia of just and eternal monarchical rule, captured in metal. Every line and shimmer of gilding on silver objects still conveys the grandeur of a civilization that served as a model for subsequent generations of artists in both the East and West, creating a universal language of luxury and power embodied in the themes on these pieces. As evidenced by monuments from Paris to Taiyuan, Sassanid toreutics remains an unrivaled example of how an art form became a sublime expression of state ideology.

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ERROR 404: Art not found. The art of Yigitali Sattorov

Aziza Sharopova,
Ph.D. student

On November 29, 2025, the Tashkent House of Photography hosted the opening of a solo exhibition of the young contemporary artist Yigitali Sattorov's exhibitio, titled "ERROR 404: ART NOT FOUND," featured over 100 paintings and graphic works created by the artist over the past few years.

In recent years, a new generation of young artists has emerged in the country, for whom art is becoming

not only a form of self-expression but also a tool for critically understanding reality. These artists strive not only to create new works but also to transform the very concept of art's role in society. In this context, the work of the "rebel" artist Yigitali Sattorov occupies a special place.

Yigitali's Sattorov's creative path (born 1992 in Kashkadarya region, Uzbekistan) represents a complex process of rethinking artistic heritage and searching for an individual means of self-expression. Born to the renowned artist Azamat Sattorov, he showed an interest in art and drawing from an early age and grew up immersed in the artistic environment. In 2010, he entered the Karshi College of Culture, where he majored in graphic design. In 2015, he completed his bachelor's degree at the Kamoliddin Bekhzod National Institute of Arts and Design., and in 2017, he received a master's degree in "Artistic Design of Film".

From 2021 to 2023, Sattorov completed an internship at the art workshop of the Academy of Arts of Uzbekistan under the guidance of the master of Uzbek painting, People's Artist, Academician Javlon Umarbekov, where he gained a strong foundation. This period became an important stage in his professional development, contributing to the formation of a mature authorial style.

It was during the internship period (2023–2024) at this reputable art studio that the artist Yigitali began his active exhibition activities. Sattorov participated in group and international exhibitions, biennials, art festivals, and residencies in Uzbekistan and abroad, as well as in environmental and intercultural initiatives, such as the Stihia Art Festival. During this same period, the artist also completed a number of significant



"Carnival" 140x140. Oil
on canvas. 2025



"Uzbek Madonna" 110x90. Canvas, oil, 2022

solo projects, such as "Cow in Shock" (Bonum Factum Gallery, Tashkent, 2023), "This is You" (Ilkhom Theatre, Tashkent, 2024), "Past, Present and Future" (French Alliance, Tashkent, 2024), "Who is Human?" (Kashkadarya Gallery of the Academy of Arts, Karshi, 2024), "Error 404: Art not found" (Tashkent House of Photography, Tashkent, 2025). Such exhibition activity cements Sattorov's status as one of the most prominent representatives of the generation of young artists in contemporary Uzbekistan.

Yigitali Sattorov's writing style can be characterized as a synthesis of neo-expressionism, cubism, and abstraction. His works are distinguished by a rich, sometimes deliberately aggressive color palette, dominated by localized hues. In Sattorov's work, colour serves a semantic rather than decorative function. Bright, localized spots and contrasting combinations of red, blue, black, and yellow create powerful emotional tension. As noted in colour theory, such decisions activate the viewer's perception, evoking anxiety, excitement, or internal dialogue. The works "Strong Surprise" (2019), "Witnesses" (2025), and "Girlfriends" (2024) demonstrate a tense palette and localized colour blocks that enhance the emotional impact on the viewer.

Compositionally, the artist actively utilizes a cubist fragmentation of space: forms are simplified, figures often lack anatomical precision, yet retain expressive gestures and poses. The painting's space

sometimes becomes unstable. In works such as "I Have No Idea!" (2024) and "Monkeys" (2025), the figures lack anatomical precision, fragmented, and disintegrated into colour segments, drawing on the Cubist tradition. The artist himself defines his approach to creativity as follows: "For me, painting is a silent conversation between my imagination and reality, my mind and feelings, where colours speak louder than voices."

For over 17 years (since 2009), Sattorov has worked as a production designer and decorator, creating large-scale scenographic designs for major national and international festivals, such as the International Arts Festival (2018) in Karshi, the Bakhshi Art Festival in Termez (2019), and the Navruz festival. This work with stage, light, and large spaces has left a profound imprint on his easel painting, lending it a monumental scale. Some of his works reach large sizes, such as "Witnesses" (250x170 cm) of 2025 or "I Have No Idea" (220x170 cm) of 2024.

In his work "Uzbek Madonna" (2022), the artist turns to the classic European motif of the Madonna, but interprets it through the prism of national identity. The image is stripped of traditional sacred attributes and presented as a modern Uzbek woman—restrained and focused. The woman in the painting was inspired by a black-and-white photograph of the real artist that he saw online. Colour plays a symbolic role here: the contrast of red and green creates a tense emotional field, and the fragmentation of the face into colour zones enhances the image's internal duality. The figure is frontal, but lacks canonical softness—it is imbued with psychological wariness. Thus, the artist combines Western religious tradition with the local cultural context, creating an image that balances between the sacred and the modern.

Sattorov's landscapes demonstrate a different side of his work. In works such as "Crimson Winter" (2022), "Dream" (2018), and "Magic Night" (2020), space is constructed through generalized colour planes that form a structural, planar composition. The architectural forms are simplified, and the mountain ranges and buildings are devoid of realistic modeling, lending the compositions a conventional and symbolic quality. Colour, meanwhile, becomes a vehicle for the landscape's emotional state: the crimson sky, intense blue, and contrasting yellow facades create a sense of unsettling beauty. These works do not so much capture a natural motif as convey a psychological perception of space, transforming the landscape into a metaphor for an internal state.

The artist's thematic range is remarkable. His work includes: socio-philosophical reflections ("Image of Society", 2022; "Eclipse of Reality", 2024), existential and psychological motifs ("Carnival", 2025; "Grievance", 2025), mythological and symbolic images ("Resentment", 2025; "Rites of the Desert", 2022), and environmental issues (installation "Where is the Water?", 2025).

Thus, Sattorov doesn't work within a single theme, but rather creates a holistic artistic system in which



"Dream of a Dead Ship"
160x140. Canvas, oil. 2023

the personal, social, mythological, and philosophical coexist. His paintings encompass both intimate psychological states and global contemporary issues, demonstrating his conceptual maturity and a stable artistic stance. As the artist himself writes, "We find ourselves in an eternal dance between light and darkness, form and emptiness, beauty and corruption."

The exhibition "Error 404: Art not found" is structured as a sequential system of visual states, constructed as a form of personal expression. Each work functions as a record of a specific stage of internal transformation—from doubt and anxiety to acceptance and awareness. This structure aligns with the tradition of artistic self-analysis, in which a work serves not as an illustration of an event, but as a testimony to an internal process. In this sense, the exhibition takes on the character of an autobiographical statement, but transcends personal experience, becoming a universal model for experiencing crisis.

The spatial organization of the four halls of the Tashkent House of Photography enhances the effect of progressive immersion. The viewer not only moves from work to work, but experiences a shift in emotional registers and semantic accents. Painting and drawing form a unified artistic environment, in which visual media serve as a means of understanding the artist's personal experience.

The exhibition title refers the viewer to the common internet error code *404 Not Found*, indicating the absence of the requested page. In Sattorov's interpretation, this technical signal becomes a philosophical metaphor for loss, disruption, and internal failure. As the artist himself shared, over the years he has experienced many "mistakes" in his life, both in personal relationships, friendships, and creative work. These life

"mistakes" and crises were a blow to him during these years, but also a source of growth. "I am grateful to them. They made me a better person," the artist says. Thus, "Error 404" becomes not only a metaphor for loss and disruption but also a symbol of the search for a new direction and a rethinking of his artistic stance.

Over the past two years, Yigitali Sattorov has undergone a significant personal and creative transformation. This is my second time working with the artist—in 2023 at the Bonum Factum Gallery hosted his exhibition "Cow in Shock." And today I see a completely different Yigitali. If he used to be a rebel, acutely reactive to the world, distrustful, and always ready for a fight, now he's become more flexible, insightful, and attentive to himself and his surroundings, as well as his creative processes. His rebellious energy hasn't disappeared—it's been transformed and is always present in his paintings.

Project "Error 404: art not found" demonstrates that crisis can be a productive state of artistic consciousness. Sattorov transforms personal experience of loss and doubt into a method, offering the viewer an unfinished answer and a space for participation in the search. In this way, the exhibition affirms art as a form of dialogue—between artist and viewer, between personal experience and the collective experience of the era.

In the context of contemporary art in Uzbekistan, creative works by Yigitali Sattorov is of interest as an example of the formation of a new type of artistic thinking, in which digital codes of modernity, existential reflection and visual expression are combined into a holistic authorial system.

Important interview: horizons of cooperation between Uzbekistan scientists and a leading Canadian university

In early 2026, Benjamin Bradshaw, Vice President of the University of Guelph, Canada, visited Uzbekistan on a business visit. The purpose of his visit was to establish business ties between the University of Guelph and its sister institutions in Uzbekistan in the field of agriculture, a priority area of education and research for this leading Canadian higher education institution. During his visit, Bradshaw met with

representatives of the Presidential Administration of Uzbekistan, the Minister of Agriculture, I. Yu. Abdurakhmanov, and representatives of other relevant departments and institutions.

A meeting and detailed discussion also took place at the Uzbekistan Academy of Sciences with the President of the Uzbekistan Academy of Sciences Sh. A. Ayupov. The Uzbek side was represented at the discussion by the First Vice President of the Uzbekistan Academy of Sciences Sh. Sh. Sagdullaev, Vice-President of the Uzbekistan Academy of Sciences Sh. U. Turdykulova, Director of the Centre for Genomics and Bioinformatics of the Uzbekistan Academy of Sciences Z. T. Buriyev. Both sides expressed their readiness for cooperation and outlined plans for future contacts and agreements. Mr. B. Bradshaw also visited the editorial office of the journal *Fan va Turmush* and learned about the activities of the Centre for the Promotion of Science of the Uzbekistan Academy of Sciences.

Given the importance of international relations for stimulating the scientific activity of scientists and training highly qualified specialists in the field of agriculture in Uzbekistan, and in order to gain a more complete understanding of the activities of the University of Guelph, the editorial board of *Fan va Turmush* journal asked Amonulla Khakimov, the University's International Relations Coordinator, who accompanied Mr. B. Bradshaw, to conduct an interview



President of the Uzbekistan Academy of Sciences Shavkat Ayupov and Vice President of the University of Guelph in Canada Benjamin Bradshaw



Participants in the meeting on cooperation between the Uzbekistan Academy of Sciences and the University of Guelph (Canada)

with him, which we publish below. The editorial board expresses gratitude to both Mr. B. Bradshaw and Mr. A. Khakimov for providing the text of the interview in English and Russian.

Amonulla Khakimov: Mr. B. Bradshaw, welcome to Uzbekistan! Please share information about the University of the city of Guelph with our readers, in particular, about educational programs and main areas of scientific activity?

Benjamin Bradshaw: The University of Guelph was formed in 1964 through the merger of three long-established institutions: the Ontario Veterinary College (founded in 1862), the Ontario Agricultural College (founded in 1874), and the Macdonald Institute (founded in 1903), which specialized in the social and applied humanities. Today University of Guelph is a multidisciplinary university that also includes new colleges in business, engineering, biology, arts, and physical sciences.

The University's high international reputation is based primarily on its unique research in veterinary medicine (ranked top 10 globally). It has also earned a respected reputation in the biological sciences (ranked top 150 globally), particularly in specialized fields such as biotechnology (top 70) and environmental studies (top 100 globally). We are also ranked among the top 100 schools in the world for our tourism and entertainment programs. Furthermore, the University houses specialized training and research institutes in cybersecurity, biomedicine, DNA barcod-

ing, artificial intelligence (AI), improvisation, legal studies, creative writing, and other fields.

Students have a huge choice of over 100 undergraduate specializations and over 100 graduate programs, which is why more than 36,000 students at the University are proud to be its students.

A. Kh.: How does the University of Guelph differ from other universities in Canada and around the world? In particular, from universities that also specialize in teaching and research in similar fields, such as agriculture and veterinary science?

B. B.: In the higher education system, the University of Guelph occupies a unique position, providing top-level education in agriculture and veterinary science, while being located just an hour from Toronto, a city of 4 million. Equally strong areas of study include biological sciences, engineering, physics, business management, social sciences, and humanities. And given our commitment to creating the best possible student experience—an area in which the University of Guelph regularly ranks first in Canada—this is what makes our University unique. Our priority is to provide top-level education and the best possible living conditions for students. It's no wonder our students recommend us to their younger siblings.

Overall, with educational programs consistently ranked among the top global universities (ranked in the top 10 to top 30 globally), we live in a very safe and welcoming country. Canada may be cold for four to five months of the year, but Canadians are very

kind and warm-hearted people; we enjoy making friends with people from all over the world, even in these challenging times.

A. Kh .: Could you give a few examples of the University's research projects that you consider most interesting?

B. B .: It's difficult to choose from a large number of projects, but here are a few interesting examples that caught my attention. For example, with the help of a \$25 million grant from the federal government, researchers at the University of Guelph are developing a national cybersecurity training program that will train over 100 students to develop smart agricultural technologies to protect against hackers and improve the reliability of digital technologies used in agriculture.

On the roof of our university, we've built a state-of-the-art environmental research center—we call it the Phytotron. It hosts year-round experiments in plant genetics, the biology and ecology of natural pollination, food research, and testing of engineering, agricultural, and food systems. Currently, university scientists are competing for a \$33 million research grant to establish year-round strawberry production by optimizing hybrid greenhouses with vertical heat-

ing systems, using artificial intelligence and smart sensors.

For nine years, the Arrell Food Institute at the University of Guelph has been working on global food systems, conducting intensive research with numerous partners and educating future food industry leaders to create a more sustainable, resilient, and equitable future for agriculture. The Institute recently received a \$16.3 million grant to launch SF4C, an entrepreneurship and education platform that will train students to commercialize innovations, from laboratory development to fully commercialized products.

In May 2025, a new honey bee research center opened at the University (Honey Bee Research Centre), established to study beekeeping and bee health. As your readers are well aware, bees play a key role in agricultural productivity and ecosystem resilience through their pollination of agricultural products and wild plants. This research centre helps bees fulfill this critical role.

Readers of the journal will be interested to know, especially given the special importance of water resources for Uzbekistan, that Dr. Beth Parker, a leading researcher at the Morwick G360 (Groundwater research institute) received a very important research grant in this area named after Donna Strickland for So-



Akbar Hakimov, Editor-in-Chief of the popular science magazine "Fan va Turmush" of the Academy of Sciences of Uzbekistan and Academician, introduces Benjamin Bradshaw, Vice President of the University of Guelph (Canada), to the editorial office's activities



Benjamin Bradshaw, Vice President of the University of Guelph, with the team from the Center for Science promotion at the Academy of Sciences of Uzbekistan

cial Contributions to Natural Sciences and Engineering Research. This Institute is a hub for international collaboration among more than 20 institutes from 11 countries on the maintenance and conservation of groundwater resources based on scientific data. With annual funding of over \$5 million from government and commercial entities, the Institute employs 17 researchers, who in turn collaborate with more than 150 graduate students and technical specialists.

A. Kh.: Recently, universities around the world have been actively participating in the commercialization of science and the development of entrepreneurship, creating their own companies and startups. In this regard, how is the University of Guelph contributing to the commercialization of science and innovation in agriculture?

B. B.: As I mentioned above, there's a good example of the Arrell Institute of Food Science, which is actively engaged in transferring scientific research from the laboratory to global markets. Science commercialization is a key focus of the Office of Science Innovation at our University. Science commercialization is also a priority under the Agri-Food Innovation Alliance Agreement, a comprehensive agreement between the Government of Ontario, the University, and the Agricultural Innovation and Research Initiative (ARIO), Ontario's provincial agency. This Agree-

ment funds all research and innovation projects in agriculture, provides funding for research centres and infrastructure for testing and scaling up new technologies, and supports various training programs and personnel certification. It provides direct funding for the commercialization of agricultural technologies, such as AI-based robotics, pest control technologies, beekeeping innovations, and various database-driven tools for farmers.

The University has a very strong track record in science commercialization, bringing to market innovations such as the Yukon Gold potato developed in 1980, gene barcoding invented in 2003 by Paul Hebert, the world-class composting coffee bin invented and commercialized in 2016, and gas-phase hydroxyl radical technology invented by Professor Keith Warriner in 2025 to eliminate foodborne pathogens such as *E. coli* within seconds without using water or pesticides.

A. Kh.: In your opinion, what are the most promising areas of scientific research in the field of agriculture and related disciplines?

B. B.: And the list here would be very long! Of course, with climate change, research into ways to enhance crop and livestock resilience to heat, drought, excess moisture, and new pests and diseases is critically important and relevant. In addition to traditional livestock breeding methods, University of Guelph

scientists are conducting research in genetics and genomics to improve crop and livestock resilience. Similar technologies are used to improve the nutritional value of feed and reduce water and fertilizer requirements.

Of equal value are the development of digital and high-precision agricultural technologies through the integration of satellite imagery, sensor internet technologies, automation, and AI, revolutionizing farm management. These technologies not only reduce production costs but also help achieve important environmental goals through more efficient use of water and chemicals. One of the most exciting areas in this regard is the development of robotics in agriculture, which minimizes the need for labor on farms and increases productivity. Climate-controlled agriculture is another exciting area of research, which allows not only for, say, growing strawberries in winter but also for addressing food security issues, especially in an era when some countries are erecting artificial barriers to international trade.

Very interesting work is being done on post-harvest preservation technologies to reduce agricultural product losses, as well as supply chain tracking and transparency using blockchain technology to reduce food loss, contamination, and crime prevention. We could go on, but let's stop here for now.

A. Kh.: Students in Uzbekistan are especially interested in learning more about student life on the University campus. Besides studying, how do students participate in social life, and what other activities are there to do outside of studying?

B. B.: As I mentioned earlier, many students are happy to call the University of Guelph their second home. The university's campus is teeming with trees and greenery amidst buildings of both modern and traditional architecture. We have barns for dairy cows, stables for horses, and other animals. Adjacent to the campus is a 165-hectare woodland area, which we call the Arboretum, perfect for walks and fieldwork. There are residence halls on campus for over 6,000 students, and we guarantee accommodation for all international students during their studies.

The University of Guelph consistently ranks first in Canada for student housing and dining quality, and we have 16 different student communities on campus. One of the reasons our student food is so high-quality is because we prepare everything from scratch and offer a wide selection, catering to students' dietary and religious preferences. We also have top-notch sports facilities. In addition to a 2,000-square-meter fitness center with indoor and outdoor running tracks, we have facilities for all sports, including an American football stadium and three standard football fields with artificial turf. We have over 20 varsity teams in various sports competing nationally, and a large number of intramural, non-competitive sports clubs for students who enjoy various sports. Campus social

life also includes numerous student clubs, including the International Student Organization, which any student can join and make friends from all over the world.

For those interested in the entertainment of the big city of Toronto, located just one hour away, with evening trains back to Guelph, for students returning from Toronto, for example, after attending a Drake concert or a Toronto Blue Jays baseball game.

A. Kh.: And to conclude the interview, what are your first impressions of Uzbekistan?

B. B.: We've only been here a couple of days, but sometimes first impressions are the most memorable. I must admit that I arrived in Uzbekistan with very limited information about your country, which sometimes even helps you get to know a new place better. I'm particularly impressed by the energy and search for opportunity among Uzbeks. This is evident in the smart clothes young people wear when visiting cafes and restaurants, the enjoyment you take in food and the company of others. It's also evident in the huge number of electric cars, mostly new and made in China, zipping quickly and quietly along the country's roads.

I see this energy in the faces of people who, like me, have traveled to Samarkand to enjoy the city's rich cultural heritage. I'm particularly impressed by how quickly the well-being of the general population has improved over the past 10 years. I was also struck by the fascinating blend of antiquity and modernity. In Samarkand, I visited well-preserved architectural monuments dating back to the 15th and even the 11th centuries! To get to Samarkand, we took a high-speed electric train, which traveled twice as fast as trains in Canada. The Tashkent markets are filled with vendors selling a wide variety of dried fruits, meats, and vegetables, and many shoppers who can afford to buy these same products in supermarkets still come to the bazaars. At one of these bazaars, I bought my wife traditional Uzbek dresses, and she was delighted with the richness of their colors and patterns.

Finally, I was amazed by the hospitality of my friends and everyone I met. For example, during a trip to Samarkand, we bumped into a friend who immediately invited us to visit his company's office in Samarkand and treated us to an unforgettable lunch, which, of course, included plov. That day, and indeed every day in Uzbekistan, I fell asleep with a full stomach and a heart full of pleasant impressions.



Mineral additives for the cement industry: results of scientific research.

T.J. Pirimov at the Institute of General and Inorganic Chemistry of the Uzbekistan Academy of Sciences in collaboration with Sh.S.Namazov, N.Kh. Usanbaev, A.R.Seitnazarov, U.K.Alimov published a monograph “Processing of serpentinite and industrial waste into magnesium compounds and mineral additives to cement”.

This monograph presents the results of scientific research on the development of a technology for the acid processing of serpentinite from the Arvatsinskoye deposit, as well as the production of mineral additives for Portland cement, magnesium oxide, and liquid fertilizers based on industrial waste. A technology for producing magnesium oxide and liquid fertilizers from serpentinite by processing sulfuric and nitric-sulfuric acids has been developed, as well as a modified composition of mineral additives for cement using serpentinite silica residues, kaolin sand waste, steelmaking slag, and lead-zinc ore waste.

The monograph is intended for scientific and engineering personnel working in the field of production of mineral fertilizers, binders and other branches of the chemical industry, as well as for bachelors and masters of higher educational institutions of technical profile.



Fauna of vertebrate animals of the Syrdarya and Jizzakh regions

The Vertebrate Laboratory of the Institute of Zoology of the Uzbekistan Academy of Sciences published a collective monograph dedicated to the fauna of terrestrial vertebrates inhabiting the Syrdarya and Jizzakh regions and their monitoring system. This publication, titled “Fauna and Monitoring System of Vertebrate Animals of the Syrdarya and Jizzakh Regions,” includes descriptions of 260 species, monitoring methods, and an assessment of the need for regional conservation based on indicator species.

This monograph is a new guide for biologists, ecologists, conservation organizations, and universities. This publication marks another important step toward the in-depth study and sustainable management of Uzbekistan’s wildlife.

Click the link below to read the book: https://izoology.uz/wp-content/uploads/2025/07/ФАУНА-И-СИСТЕМА_для-сайт.pdf



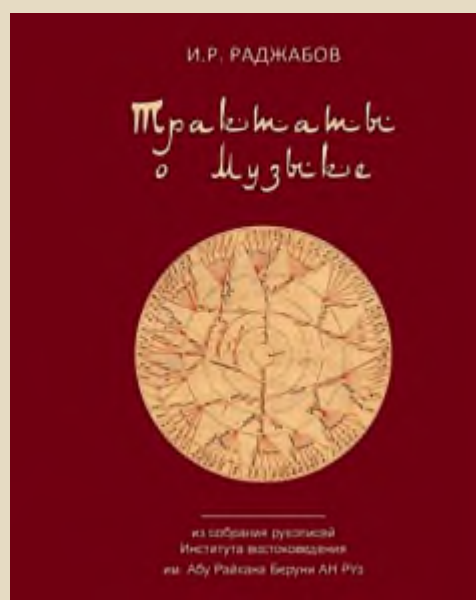
A monograph by an Uzbek scholar was published in Jordan.

A 470-page textbook-monograph on the history of Sufism entitled “The Roots of Sufism (History) of Maverannahr: Formation and Systematization of the Teaching (8th-11th Centuries)” by Komiljon Rakhimov, a leading researcher at the Institute of Oriental Studies of the Uzbekistan Academy of Sciences, was published in Amman, the capital of Jordan, by the prestigious Khutut va Zilol publishing house.

Ancient Maverannahr is considered one of the regions where Sufism originated and took deep root. The period of Central Asian Sufism’s history before the 12th century, that is, before the emergence of Sufi tariqah, played an important role in the development of Sufism and laid a solid foundation for its further development. Our Sufi ancestors, in their fundamental works on Sufism, managed to systematize this teaching, which had previously been presented in a fragmented manner. The systematization of Sufi teachings, initiated by Hakim Termizi in the 9th century, was completed by Kalobadi Bukhari and Mustamli Bukhari in the late 10th and early 11th centuries. This served as the theoretical basis for the formation of Sufi tariqas that began to emerge in various parts of the Islamic world, including ancient Maverannahr, beginning in the 12th century.

The book examines the important features, main ideas and key figures of Central Asian Sufism before the emergence of Sufi tariqahs, as well as the place of works of “At-Taarruf” by Kalobadi Bukhari and “Sharh at-Taarruf” by Mustamli Bukhari among Sufi sources, the meaning of “Sharkh at-Ta’arruf” as an important work on Sufism and its influence on subsequent Sufi sources.

It is important to note that this manual, produced in collaboration with Ahl al-Bayt University in Jordan, will also be used as a textbook.



Is’haq Rajabov. “Treatises on Music”

This book was prepared for publication by the Musical Art Department of the Institute of Art Studies of the Uzbekistan Academy of Sciences.

This book is the first publication of fundamental research conducted by the outstanding Uzbek orientalist and musicologist Is’haq Rizkievich Rajabov (1927–1982). It includes more than 22 musical treatises dating from the 13th to 19th centuries. By describing the contents of these musical treatises, conducting a comparative study, and commenting on them, the scholar attempted to understand the gradual development of the musical theoretical views of medieval music theorists and their connection to the musical practices of the Uzbek and Tajik peoples. In preparing I.R. Rajabov’s manuscript for publication, the editors made the necessary additions and clarifications.

This publication is intended for specialists in the field of theory and history of music of the Muslim East, teachers of music and history at universities, lyceums and colleges specializing in art and culture, as well as for anyone interested in issues of musical orientalism.

Cities of the Future Today: A Complete Encyclopedia of the World's Most Unusual Architecture



Have you ever looked at an ordinary high-rise building and thought, “Why does everything look so identical?” Luckily, there are visionary architects out there. For them, a home isn’t just four walls and a roof, but a giant sculpture in which one can live, work, and play.

Let’s take a grand tour of buildings that look like they belong in a movie about distant planets, and discover the science behind them.

1. Basket House: Office for a Giant (USA, Ohio)

Imagine you’re walking through a park and suddenly come across a picnic basket that’s as tall as a seven-story building. This is the headquarters of Longaberger company.

•**How it works:** The building is 160 times larger than a typical basket. The most difficult part of its construction is the handles. Each one weighs 75 tons (the weight of a giant airplane!).

•**Engineering trick:** Ohio experiences harsh winters. If ice had accumulated on the handles, they could have collapsed under their own weight. So, engineers installed a system of copper tubes filled with hot liquid inside the handles. They are always warm, and snow on them just melts away.

2. “Forest Spiral”: House without Corners (Germany, Darmstadt)

Artist Friedensreich Hundertwasser believed that straight lines were “the devil’s tool” because they didn’t exist in nature. He built a snail-shaped house.

•**Uniqueness:** This house has 1,000 windows, and you won’t find two alike! They vary in size, shape, and height.

•**Ecology:** The house’s roof isn’t just concrete, but a veritable garden with meadows, trees, and shrubs. This helps the house “breathe”: the plants absorb carbon dioxide and release pure oxygen directly into the residents’ windows.

3. Library Bookshelf: Giant Shelf (USA, Kansas City)

How to get people to read more? Build a parking lot that looks like a shelf full of world bestsellers!

•**History of creation:** City officials surveyed residents: “What books do you like most?” Based on the results, 22 titles were selected. Now, 8-meter-tall “spines” of “The Lord of the Rings,” “Romeo and Juliet,” and “Winnie the Pooh” stand on the street.

•**Material:** The “Books” are made of special, ultra-strong concrete and covered with panels that imitate the bindings of real antique books.

4. Crooked House: A Hallucinatory Building (Poland, Sopot)

When you look at it, it seems like you are seeing double or that the building is about to flow into a drain.

•**The secret of the form:** The architects were inspired by the fairytale illustrations of Jan Marcin Szancer. To achieve this effect, the walls were constructed not from straight blocks, but from curved steel structures, over which a special mesh was stretched and then filled with concrete.

•**Optical illusion:** The roof is made of enameled plates that resemble dragon scales and change color depending on the lighting.

5. Horseshoe Hotel: Ring of Light (China, Huzhou)

Sheraton Hotel Huzhou looks like a giant ring growing out of the lake.





•**How it stands:** It's actually two towers connected at the top by a curved bridge. Underwater, they're also connected by a strong foundation to ensure the building's stability.

•**Light show:** The entire façade is covered in 19,000 LED lights. At night, the building transforms into a giant screen, where digital fish can swim or flowers can bloom.

6. Habitat 67: Mountain made of cubes (Canada, Montreal)

This is a residential complex that looks like a child dropped LEGO pieces and they froze in mid-air.

•**Idea:** Architect Moshe Safdie wanted everyone in the city to have their own garden. He arranged the

cube-shaped apartments so that the roof of the lower apartment serves as a terrace for the one above.

•**Why does science need this?** This was one of the first experiments in "modular construction." Apartments were assembled in a factory and then stacked on top of each other by crane, like a construction set.

Secret Lab: How Does It Work?

To build such "crazy" buildings, scientists use the latest scientific advances:

1. **Biomimetics:** This is the science of mimicking nature. Architects study the structure of bird bones (they're lightweight and strong) or bamboo stems to build hurricane-resistant skyscrapers.

2. **3D printing with concrete:** Today, huge robotic printers can "print" a house of any shape in a couple of days. They don't need bricks—they extrude a special mixture layer by layer.

3. **Smart materials:** There is glass that darkens in the sun, and concrete that can "heal" its cracks with the help of special bacteria inside!

Is architecture magic?

No, it's a fusion of **bold imagination** and **precise calculation**. People used to build only from stone and wood, so houses were simple. Today, thanks to titanium, ultra-strong glass, and powerful computers, we can build anything we can imagine.

Who knows, maybe in 15 years you will be the one who comes up with a house that will float in the air on magnetic cushions or stand on the ocean floor?



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