Dear Readers!

This publication, based on unique photos, is a combined version of popular lectures on the philosophy of G.A. Ilizarov that were delivered by us in a large number of Russian cities and countries around the world. The book is intended for a wide range of readers. For medical professionals and social workers, we disclose the key ideas that are relevant when dealing with people. To all those who are striving for success, we prove that one can become a genius in one’s profession working far away from big capitals. But most importantly, we hope that this book will be useful to patients and their families. It will inspire and encourage them with optimism and faith in the cure!

We will be pleased to receive your comments by e-mail: alexander@gubin.spb.ru

Alexander Gubin
Director of the Russian Ilizarov Center for Restorative Traumatology and Orthopaedics

It all started half a century ago when Gavriil Abramovich Ilizarov organized a scientific and medical photolaboratory to document the institute’s medical and scientific activities as well as to popularize the Ilizarov method with patients’ photos and videos. Currently, the photolaboratory has a huge collection of material in its archive files. Academician G.A. Ilizarov and the Institute’s teams showed their scientific and clinical achievements at all-Union and international exhibitions having Sovexportfilm, Medexport, Technoexport, the News Press Agency of the USSR and the Chamber of Commerce and Industry of the USSR as partners that assisted with displays for many years. We are pleased to present to the attention of our readers some of the interesting photos stored in our archives.

Ruslan Alekseev
head of photolaboratory of the RISC for RTO information and analysis department
Miracles are a matter of illusionists. We are scientists.
G.A. Ilizarov
Introduction

*Humans have been trying to change the size and shape of their body parts since ancient times to our days. One should acknowledge that those attempts have been successful.*

Practices of different cultures and tribes on such changes are the evidence. Why they practice these changes is not always clear. Scientists believe that the main reason is the desire of individuals, groups or tribes to stand out among their own kind. Most of these practices seem to us frightening, repulsive and, of course, harmful to health. It is quite possible that the contemporary fashion for intricate tattoos, piercings in the most amazing places and pumped muscles will also seem "savagery" to our descendants.

The girls of the Ethiopian tribe Mursi must cut their lower lip to insert a small peg into it and then plates of clay that are sequentially changed by larger ones until the required size of 15-18 cm in diameter is attained. A similar method to enlarge the ears is used by women of the Surma tribe. And the Masai girls use gravity to stretch their ears, gradually increasing the weights inserted into the lobes. It is believed that the larger is the size of woman’s lips and ears, the higher is her status and a more attractive she is for men. Of course, different cultures have different ideals of beauty. That is why a girl from the Masai tribe with very long ears will not be stolen by neighboring tribe males!

---

*Image from www.friendshelpingothers.org*

---

Body part shape changes by compression are no less exotic. A long neck (up to 30 cm) in young Padaung women living on the territory of contemporary Myanmar and Thailand is created by gradual adding of metal rings secured on the neck and is achieved not by stretching the spine but by deforming the ribs and collarbones. Radiographic examination of their neck showed no changes in its vertebrae.

---

*Image from the site www.free-eyes.com*
Changes in the shape of the head were popular for many millennia and most often were performed by its lengthening due to narrowing the brain part of the skull using compressing devices in infancy. Extended "egg-like" skulls are found during excavations of ancient burial sites all over the world, including Siberia and the Southern Urals.

You won’t be deceived as now you know that these skulls do not belong to alien visitors from the space (regional museum of Ica, Peru)

Up to date, people of the Mangbetu tribe from Congo keep the practice to tie up baby’s skull with a special bandage. The reasons for this "fashion" are unknown. Presumably, this art is a cult or even of a fantastic nature.

A "simple" way to increase person’s stature due to the size of the head

Wooden systems of compression for flattening the head and creating a beveled forehead were described in the works of South America explorers. They are reflected in the art, like in the painting of Paul Kane "Flathead Woman and Child" (1849-1852).

Well, how patient were Indian children!
Paul Kane. Flathead Woman and Child

Chinese women stopped practicing shaping the "lotus feet" only at the beginning of the 20th century. Their feet were deformed intentionally with tight bandaging. It caused frequent skin inflammation, mal-development and even bone infection which further reduced the size of the foot (up to ten centimeters in length). Such serious anatomical changes resulted in gait disorders, which was considered attractive but led to restriction of independent walking.
sincere confession of a woman from the novel "Snow Flower and the Secret Fan" by the American writer Lisa See illustrates this excruciating Chinese practice in detail. Nevertheless, for more than a thousand years, this procedure was very popular, and the "lotus foot" was sung by many poets as an ideal of beauty. There is an opinion that the idea of the smallest foot in the Cinderella's fairy tale was borrowed from the Chinese literature.

In all historical periods, changes in the shape of the body with such methods were produced in healthy people to alter their appearance. In all the cases, there occurred a gradual reshaping of bone and changes in cartilage structures as a result of their compression or stretching. Thus, the natural potential of growth and plasticity of tissues in children and adolescents was used to obtain the maximum results.

In the middle of the 20th century, in the town of Kurgan, which was far from major Russian scientific and political centers, there came a man who decided that the physician was able to guide the laws of nature on controlling the change in the shape of body parts by using compression and stretching. He made it the goal of his life! The laws that he had discovered were successfully embodied in unique techniques that cure millions of crippled and injured people from suffering and severe deformities. The main instrument for the implementation of these laws was the apparatus for external fixation of bones, which later received the author's name, the world-famous \textit{Ilizarov apparatus}. The works and life of Gavriil Abramovich Ilizarov inspired thousands of researchers and doctors to new discoveries based on the ability to use controlled mechanisms of compression and distraction for the benefit of people's health.

Ilizarov's discovery resulted in a new in the world of orthopedics sub-specialty \textit{Limb Lengthening and Reconstruction Surgery} (LLRS) as well as in emergence of professional scientific societies that unite doctors specializing in external fixation. The first such organization was founded on January 13, 1982 after Gavriil Abramovich Ilizarov had delivered a number of
lectures at the orthopaedic meeting in the Italian city of Lecco. It was given the name "Association for the Study and Application of the Ilizarov Methods" (ASAMI). At present, such associations exist almost in all countries of the world. The associations hold a large number of scientific and educational events. The biggest of the forums is a joint congress which meets every two years.

The life of Gavriil Abramovich Ilizarov surprisingly intertwined with many well-known personalities who applied to him for help.

The start of a wide popularity of G.A. Ilizarov is associated with the name of Valery Brumel. Six-time world champion in high jump, the best athlete of the planet in 1961-1963 came to the Kurgan hospital with a diagnosis of "pseudarthrosis complicated by osteomyelitis" as a result of the injury and failed treatment at Moscow clinics. He was successfully cured by G.A. Ilizarov. Valery returned to big sport and was able to jump the height of 2 meters and 8 centimeters. The story of Valery Brumel and his miraculous healing in Kurgan is a perfect example of the patient’s will, which helps overcome the disease and return to active life. Installed in 2016, the "Brumel Gate" in the garden of the Ilizarov Center is dedicated to person’s will to overcome diseases and striving for recovery.

#11
Valery Nikolayevich Brumel called Gavriil Abramovich his second father, and Kurgan - his second homeland

#12
Brumel's world record in high jump was 228 cm and remained unbeaten for 8 years. After treatment with the Ilizarov method, the athlete resumed training and jumped 208 cm. Later, he turned to acting and writing. He wrote the script for the film "The Right to Jump" (1971) and acted in the film “Sport, Sport, Sport” (1970)

#13
The "Brumel Gate" was installed on the way from the outpatient consultative department to the main building of the Ilizarov Center in Kurgan. Passing under the bar, each patient can make a wish to "recover" and achieve new goals.
Carlo Mauri, the world famous Italian traveler, alpinist and photographer, member of the transatlantic expeditions of Tour Heyerdahl on papyrus and reed boats, was also brought back to active life by Ilizarov after twenty-year suffering from an old fracture that had developed into non-union in the tibia and due to which his leg was shorter.

Smoking in medical institutions was prohibited by the Russian law only in 2013. Ilizarov, like many doctors of his time, was an addicted smoker. Of course, Carlo Mauri and Ilizarov smoking in the photo in the operating room seems hooliganism, but it is an excellent advertisement of safety and painlessness of surgical interventions and treatment in the renowned clinic.

The cure of this particular patient brought Ilizarov a truly world fame.

First publication in an Eastern German newspaper about the Siberian doctor of miracles (1974)
Ilizarov’s marketing and organizational approach to concentrate on one technique was also unusual for that time. Its result proved to be very effective and was recognized at the world level. This Ilizarov’s approach, often criticized by doctors and scientists, has not been acknowledged yet in terms of achieving business success as the most important key to the advance of any innovation.

However, the Ilizarov's role has been underestimated in Russia and comes down exclusively to his "apparatus for bone union." This opinion is common even in the Trans-Urals, the region where he lived and made all his discoveries. Therefore, it is especially important to publish this book, in which we explain the meaning of the work of the Genius of Orthopedics.

HOW TO RESHAPE THE BODY?

The time and magnitude of the impact on tissues needed for growth and regeneration are the main secrets that were unveiled by G.A. Ilizarov.

Tensile stretching or compressive loads applied to a body part gradually and continuously are able to change its shape. Very heavy earrings were kept suspended to have the longest ears in a woman in some tribes, and clay plates were immerged into the lips to have the largest lips.

Gradual stretching of tissues using various devices is called distraction.

The longest neck can be achieved by gradually squeezing the upper part of the thorax with metal rings, making it narrower. Small feet can be obtained by their tight bandaging for many years.

The method of tissue compaction is called compression.

Two points are very important in order these two actions run successfully.
First, the time It takes just as much time as required, so that human tissues adapt to the strain and perceive it as normal, physiological, and necessary for the body.  

Second, the magnitude of pressure or stretching Again, it is on the verge of the one that the body perceives as permissible, but not as pathological or unhealthy.  

The formula of the Ilizarov’s main law is as follows: "Under dosed stretching of living tissues, the tension that arises in them induces and maintains active regeneration and growth of tissue structures in a natural way throughout the period this factor acts."

Ilizarov’s law or the law of "tension stress", which formulates the general biological principle of the tissues response to distraction, has been engraved on the pedestal of the monument to the Genius of Orthopaedics. Practical application of this law with the help of the Ilizarov apparatus or other numerous devices opened the possibilities which were unreachable for doctors earlier - elongation and correction of the shape of the limbs and improvement of regeneration (restoration) of body tissues.

In practice, the Ilizarov method is as follows.

Flexible thin stainless steel wire pieces (1.5-2 mm in diameter) sharpened at one end, or, simply “wires” pierce the skin and are drilled through the bone to exit on the other limb side (the word "spitsa" is used for a wire in Russian). Wires are fixed to flat steel external rings with special locks attached in the ring holes. These wires are tensioned very tightly so that they do not bend and firmly hold the bone. Metal rods with a thread are also inserted in the holes and clamped with nuts to the ring. They connect several external rings positioned above and below the fracture site. If you turn these nuts, the rings will approach or move away from each other once the bone is broken. These are the processes of compression or distraction.

Next, a one-centimeter incision is made on the anterior limb surface between the rings. A special chisel of the same width is inserted into it to cut the bone. Surgeons do this very carefully and cut only the front and the sides of the outer layer of the bone, and its backside is broken by turning the rings in opposite directions. This method, proposed by Ilizarov, is called corticotomy (cortex - an outer layer of bone; tomy - intersection), that is, the intersection of the hardest layer of bone. At the same time, vessels of the medullary canal, soft tissues surrounding the bone, and the periosteum (connective tissue membrane of the bone) are minimally injured.

Once the bone is cut through, the rings are joined with rods and a pressure bandage is applied to the wound to reduce the hematoma (accumulated blood in the wound). The first bonding between bone fragments should appear within a week, and it is a gentle tissue, well-supplied with blood. Therefore, distraction begins not earlier than in five to seven days. Distraction is implemented with nuts that are turned a quarter turn four times a day. A full turn of the nuts results in one millimeter of distraction. Thus, the limb can be lengthened at a rate of one millimeter per day. This is the magic magnitude that is most often used. Sometimes it is necessary to reduce the distraction rate, or, on the contrary, to accelerate it slightly. It depends
on the patient's condition and the quality of the young bone tissue or “regenerate” (new regenerated tissue) formed.

#20
Stages of surgery for tibial lengthening and deformity correction. The operating field is ready and marks have been done.

#21
Insertion of wires with an electric drill and their fastening on the rings.

#22
Wires are tensioned with a special instrument to become rigid and ensure stiffness of fixation.

#23
One centimeter is incised to cut (osteotomize) the bone.
The bone is cut with a special chisel and broken by turning the rings in opposite directions (rods are disconnected).

Visual control, gradual performance, and the possibility to change the rate of correction or stop it on time are important merits of the method, especially in complex cases.

The orthopedic surgeon will do adjustments with the Ilizarov apparatus after the operation within the period required for lengthening or correction. It does not hurt, as the amount of correction is very small and the body tolerates it well. The device is safe and provides accuracy of deformity correction. The patient can watch the procedure and even participate in it.

Doctors judge about the quality of bone regeneration using X-ray images. After two or three weeks post-surgery, a barely noticeable shadow between the diverging bone fragments becomes visible in the radiographs. If necessary, **one can not only lengthen the limb but at the same time eliminate its deformities** using special posts to assemble hinges. **The regenerate can be grown in any direction and acquire different shapes.** This is very important when bone deformity is complex and multi-planar, which happens very often. Both tubular bones of the limbs and flat bones of the skull and pelvis are able to regenerate. Distraction systems, based on the Ilizarov law, altered not only the orthopaedics but also the maxillofacial surgery of the 20th century.

The Ilizarov law can be applied at any age to create conditions for good recovery and growth as in childhood. In children, regeneration proceeds well and fast. Blood supply to the limb undergoing elongation increases by several times when the Ilizarov law is in action. So, it has a beneficial effect on healing. Limb blood supply can be significantly improved by moving a split bone fragment using the Ilizarov method in diseases associated with obstruction of the leg vessels, which often affects adults. Under the influence of distraction, wounds and bedsores heal better. This phenomenon has been also widely used in surgery.

It would seem that everything in the Ilizarov method is simple. Why was this approach not used before?

Many surgeons searched for better ways to treat patients with bone nonunion after fractures, to correct complex deformities, and tried to lengthen limbs. Most of the techniques they proposed were used to solve a certain narrow problem and were designed to be applied on a
particular part of the body. Anyway, all the ideas consisted in a mechanical impact on the bone being exposed from soft tissues, broken and united in a new way. To unite it, crossed stitching of bones with wires was used, or a plate was screwed to the bone fragments, or plaster was applied. *Grafts* made from cadaver bone or bone pieces taken from another part of the patient's body were placed to the site between bone fragments to stimulate bone formation.

External fixators have been used since the end of the XIX century. Their idea originated from the experience of using orthopedic appliances and orthoses. The system of external impact on the bone would be convenient for the doctor, but it is practically impossible to exert a strong and directed pressure on the bone through soft tissues. Moreover, this procedure is excruciating for the patient. If the limb is pierced through with metal pins or screws, then fastening of the outer parts of these clips on the external frame would ensure holding the fragments tight and even moving them. This approach has always seemed insecure because of the fear of infection. The risk of inflammation in the area of any implanted product, especially when it comes out through the tissues to the surface, restrained the use of such external fixators. Ilizarov began to widely apply external fixation not as a separate method of bonding bones, but as a complex universal system. This helped surgeons overcome the fear of infection and understand that the process of bone formation and soft tissue regeneration can be regulated by an accessible and comprehensive mechanical method.

*Many orthopaedic surgeons were inspired by Ilizarov's success and started inventing devices for distraction, compression and other additional manipulations.*

**ILIZAROV AS ORGANIZER**

**BREAKTHROUGH TO THE WORLD MEDICINE FROM KURGAN**

Gavriil Abramovich Ilizarov did not study marketing and did not graduate from any business school. Nevertheless, the name "Ilizarov" (his method as a technology, laws as fundamental principles, and the apparatus as a unique set of tools) is the only Russian medical brand, known worldwide. A lot of researchers and doctors in different countries have made their careers while applying and modifying the Ilizarov method. Dozens of world manufacturers fabricate the Ilizarov apparatus or its analogs. We will never know whether many of the organizational approaches of Gavriil Abramovich were a unified well-thought-out plan, or, most likely, resulted due to his unique character and abilities.

No less interesting is the issue whether this strategy can be used today. Our answer is certainly yes! But with great restrictions on duration and significant nuances of performance, associated with completely different economic, and most importantly, cultural concerns (habits) of the present time.

One needs maximum concentration on one product to *make a breakthrough*. The authors of the projects that have changed the world were moved by this principle on their way to success. This strategy is well described by the story about the success of Steve Jobs who reduced the number of Apple products from four hundred to four but united them by a common concept. This approach was present in the Ilizarov's product from the moment he had invented the device until the end of his life. It was of a hard and aggressive nature and was the subject of
criticism and even jokes. Nevertheless, his bewildering breakthrough in the conditions of relative isolation, opposition and limited resources was remarkable. This approach is very rare among medical practitioners. Moreover, in contemporary dynamically developing medicine, it cannot be used for a long time. In business, this is called a breakthrough product that determines the success of any young company. Many specialists, both before and after Ilizarov, used their external fixation devices, but could not create a breakthrough product of such a level.

Steve Jobs (the founder of Apple) used a united concept in his company products, design and functionality.

(Photo from the site www.3dnews.ru)

Gaevrii Ilizarov created his breakthrough product, the Ilizarov apparatus, with a unified concept of application versatility, unrivaled until now.

Both geniuses concentrated themselves on one product (system) to make a global breakthrough.

Comprehensive solution Doctors are a creative community and eagerly invent new medical devices and appliances. Regularly, their products are made in small quantities and "live" in the hands of the author and his closest associates. However, there are exceptions. Then, manufacturing companies build a business on a new product and attract the inventor to refine it for advancement to the market. This option was not possible in the USSR, and is rarely found in modern Russia. Ilizarov approached to the promotion of his method comprehensively. He concentrated all the efforts on the development of the apparatus, its modernization, its accessories and tools, training system and promotion on the market, fundamental scientific trials and research in the hands of one "company." It resulted in a comprehensive solution for osteosynthesis of any complexity and location. Thanks to the method of Ilizarov, an orthopaedic surgeon could make a successful career in a unique specialty of bone reconstruction and limb lengthening.

Complete methodical files on the use of the apparatus for different conditions and diseases were prepared and distributed. Economic calculations were made to prove high efficiency at low costs. Indeed, the USSR was not in the whirlpool of the world of consumption at that time: a car was bought for life, packaging was reusable, and the clothes were handed over. The Ilizarov method from the standpoint of the Soviet health care, built not on quantitative and price indicators, was a fantastic decision. The device is reusable, treatment is fully controlled to
the finish, and costs of additional material are minimal. From the point of view of ecology and conservation of natural resources, the solution is ideal.

Advertising policy In the Soviet Union, advertising of medical services was limited to the promotion of hygiene and a healthy lifestyle. But Ilizarov launched an active campaign to promote his method. First of all, the advertising policy was aimed at the patient as a real consumer. Unlike implants, the device could not be hidden, and it could inevitably frighten people. In the photographs and video materials shot for its promotion, patients with apparatuses on limbs turned into models, living a normal happy life, representing people of different professions and age. Such advertising, as well as numerous stories on TV programs, in newspapers and magazines, feature films and books, created a calm perception of a person wearing a strange device. This approach is now used in advertising new prostheses. They are not shown to simulate the limb becomes healthy, but emphasize the functional advantages that create conditions for active life.

#28
The advertising campaign for promotion of the Ilizarov method in the 1980s was primarily aimed at accepting patients with external fixators on by the society.

#29
Characters on advertising photos were people of different age, various social and professional groups.

#30
The Ilizarov apparatuses do not impede doing their usual work, have a rest and even play sport games.

Team Ilizarov understood perfectly well that the power of the project was in people who were keen on the idea. He assembled a team of young specialists. His employees were not "spoiled" by their own experience and other “schools”. Long-term brainstorming and joint analysis of
clinical cases were habitual. A new type of orthopedic insiders, the apparatchiks, was shaped from the "soft clay" that was deeply committed to the ideas of Gavriil Abramovich.

Gavriil Abramovich was able to unite like-minded people into a team who believed in the prospects of the method and gave their best years for the development of a new direction in medicine and creation of a world-famous clinic in Kurgan.

Many of them went further into the world but remained adherents and active propagandists of the method. We would like to name them "Ilizarov-minded doctors" (doctors who think Ilizarov-like). One of the features of their personality is the ability to maintain long-term and productive relations with patients.

Alexander Kirienko (Milan, Italy), Honorary Professor of the Center, is the world's leading specialist in the application of the Ilizarov method for foot pathology.

Many specialists who worked at the Center or were trained there have left the Center or the country. They continue to successfully develop and promote the method, making it truly international.

Treatment with the apparatus implies control over the position of bone fragments and the possibility to interfere with the process of bone union not only during the surgical intervention, as with the use of internal fixators, but also during the entire treatment, which is psycho-emotionally difficult. Ilizarov-minded doctors always improvise when applying the device and are able to manipulate it in the postoperative period, depending on the situation that has developed. One can say that they play chess with diseases, and do not collect puzzles. The element of flexibility, freedom and creativity in transosseous osteosynthesis is very high. Doctors are not chained to the tools of a specific manufacturer and do not depend on the firms supplying implants. The device is a fascinating construction set. And to invent new parts or units for this set is a favorite activity for the "apparatchiks" themselves. Ilizarov-minded orthopedic surgeons who picked up the method's "relay baton" and do not want to work on a pattern are found all over the world.

... The strength of the project lies in people who are keen on the idea.

Charisma Ability to come into contact and create a lasting sustained and successful communication is a key ability in the work of a doctor, a politician and a businessman. Ilizarov had an unusually strong charisma. Judging by the reminiscences of the people with whom he used to work together, there was something mysterious about him, which made people believe him and implicitly carry out his assignments. The influence spread also on patients, creating a
powerful psychotherapeutic effect. So, the Ilizarov’s associate Anatoly G. Kaplunov in his amazing book "Unknown Ilizarov: some strokes to the portrait" repeatedly emphasizes that Ilizarov’s talent almost instantly, at the level of intuition, recognized the psycho-emotional component of the patient's illness. When the diagnosis was made, Ilizarov skillfully improvised, giving the patient the power of unconditional belief that his problem was understandable, and the treatment would be effective.

His charisma attracted not only patients, but also colleagues. Many foreign doctors, having listened to his lectures with a great number of examples of successfully cured difficult cases, began to practice his method themselves, came for training to Kurgan, organized societies to study and implement the Ilizarov method in their countries.

Successful doctors make their career with the support of influential and grateful patients. **Ilizarov had an amazing gift of positive influence on people who were far from medicine.** And most of them were people of creative professions or politicians. The psychological impact of Ilizarov explains the improvement of the condition of the great musician Dmitri Shostakovich, who underwent a conservative (without surgery) treatment in Kurgan.

The great composer Dmitri Shostakovich (second right) was treated by Ilizarov in 1970 and 1971. Gavriil Abramovich used all his talent as a psychologist and was able to rehabilitate the musician so that he returned to active work. In Kurgan, while staying at the hospital, he was composing music for the film "King Lear" and wrote his 15th symphony.


An alternative in everything Ilizarov planned or intuitively, but skillfully, chose his own alternative way.
He was not in a hurry to obtain scientific titles. He postponed presentation of his thesis, already prepared, and combined his great practical experience and experimental substantiation in such a way that later the dissertation board, having accepted his thesis for a candidate of medical sciences degree, de facto recognized its highest level and voted for conferring him a doctoral degree. It was a very rare case. He was once again singled out as Ilizarov from those many who were walking in the standard way.

Faced with a deaf resistance of the academic community in the Russian capital, Ilizarov focused on active dissemination of the method abroad. Gavriil Abramovich made about a hundred trips to other countries and many hours of lecturing there in the last decade of his life. He got acquainted with well-known leading foreign orthopedic specialists and built strong business contacts with them. For them, he was a phenomenon from Siberia, a carrier of completely new ideas and approaches. Ilizarov’s only book in the English language was published by the prestigious international publishing house Springer.

Principles of the method and Ilizarov’s laws were disclosed in a series of articles published in the leading world orthopaedic journal Clinical Orthopedics and Related Research in 1988-1989. None of domestic orthopedic research papers has been so much cited as these articles. Thirty...
years ago a doctor from Kurgan did what, decades after, is dictated as the main task of domestic scientists – to publish the research results in high-ranking international scientific periodicals.

A well-known Russian scientific journal the "Genius of Orthopedics", founded in memory of academician G.A. Ilizarov, publishes studies of orthopaedic surgeons and traumatologists from around the world.

ILIZAROV AND KURGAN

In the USSR, new clinical centers were built mainly in large cities and were affiliated to recognized scientific schools with well-known specialists working in them. These medical institutions were supported by the Russian Academy of Medical Sciences and the Ministry of Health. Since the flow of patients is the most important thing for the viability of any medical project, create it from a scratch in metropolitan cities is always easier because the patients and specialists mostly come there. It is also true that the competition is tougher there. It generates its own hidden rules of "game" that are incomprehensible to an outsider. The "game" requires a lot of effort and time, so it is almost impossible to concentrate on one task under such conditions.

Creation of the largest in the country and the world scientific center for traumatology and orthopaedics in a small remote from the Russian capitals city of Kurgan can be called an exception. But in the case of Ilizarov, this exception is natural! It is obvious to us that if Ilizarov had decided to work in one of the capitals, then the integrity of his life project would have been under a great threat. In Kurgan, a new team in a new place was united by his new concept. Having a team, it is easier for a leader to coordinate and synchronize efforts with other organizations and structures surrounding them. Of course, there is a downside to the coin. To knock at the door of decision-makers is much easier in Moscow, but it is also easier to get lost in the crowd of those who knock. The genius of Ilizarov, as an organizer, is his particular intuition. He always remained a doctor, even while dealing with the authorities. This is what he was able to conquer and achieve success with.

As a result of moving several machine factories from the cities in the European part of Russia to Kurgan during the World War II, the town of Kurgan was ready to fulfill the technical assignment for the manufacture of the Ilizarov apparatus. From the point of view of the logistics of patients' transportation, Kurgan was well located on the Trans-Siberian railway, and the former Ryabkovo settlement (now the city district) where the Center was built lies on the "Baikal" highway that connects the east and west, north and south (now Kazakhstan) of the country.
Perhaps, the amazing nature of the Kurgan region played a certain role in the Ilizarov choice to stay. Five minutes ride, and you are out of town in clean pine and birch forests, on endless golden fields, or near blue lakes and rivers that are so numerous in this area.

#39
Kurgan region, land of lakes and rivers

#40

#41
Endless fields and small birch forests

#42
Five minutes ride to be out of the city
Kurgan is a major railway junction that opens the way to Siberia and Kazakhstan. The railway till nowadays remains an important means of transport for patients from all over the country and the former Soviet republics to arrive at the hospital.

Gavriil Abramovich was very fond of being out of town. He was an excellent mushroom picker. His whole life was connected with small towns or villages. It seems that nature has given him the incentive to find a biological way to solve a medical problem. No wonder that in one of the interviews Gavriil Abramovich talked about the similarity of the principles of horse cart management and his apparatus control. Of course, this is a legend that the idea of his device came to him while he was watching the work of the horse cart shaft and wheel. In fact, Gavriil Abramovich used to carefully study all the variants of the metal structures that had been already created for fixing bones and never made a secret of it.

Perhaps, because of his love for nature, Ilizarov’s law is called biological. And Ilizarov’s philosophy is a skilful guidance of the nature power for recovery of damaged tissues.
The first place of work of Ilizarov was a hospital in the village of Dolgovka.

Ilizarov used to live in small towns or rural areas. Undoubtedly, the nature had a beneficial influence on him.

The story that the idea of the apparatus came to Gavriil Abramovich when he was observing a horse harness is just a legend.

BBC team, shooting the film about Ilizarov in one of the Kurgan region villages.

The secret, grafted to Ilizarov by the agrarian Kurgan region, is to transfer the ideas of regeneration to human tissues in a complex way, as a biological task, and not just to make one more technical solution or invent a new apparatus, as the samples of Western designs.

We came up with a new slogan for the Center which sounds: “Directing the force of Nature”.

The fundamental difference of the Ilizarov system from apt devices of his colleagues from other cities of the USSR lies in this guidance of natural forces. They did not offer a new treatment system based on tissue regeneration. For the West, the revelation and impetus for development was the Ilizarov system but not just a technical solution.

Ilizarov combined a deep understanding of the systemic approach to the treatment of diseases, based on stimulation of the hidden power of the human body, and a well-thought out elegant tool for implementing a new ideology.

An oriental background of Ilizarov had an effect on his systemic approach to bone regeneration, considering the bone as a living and a very active tissue, while at the same time offering a mechanical solution understandable to the rational West. All these factors together have created a direction and a whole philosophy of the biological approach to the treatment of musculoskeletal diseases. There is also a difference in the perception of the Ilizarov's discovery. Eastern specialists refer to the Ilizarov method with great devotion and care, precisely as to a philosophy. The specialists of the western part of Russia, who have been always guided by Western technical solutions in the surgery and tried to copy them, have a cold pragmatic attitude to the method.

THE ILIZAROV METHOD IN THE WORLD

Approximately at the same time, when Gavriil Abramovich was developing his device in Western Siberia, orthopedic traumatologists asked themselves the same questions in a
prosperous Switzerland: how to change the principles of fracture management for more reliable and effective ones? In 1958, Maurice Muller, Martin Allgower, Walter Bandi, Robert Schneider and Hans Willenegger founded the association for the study of internal osteosynthesis or AO (Arbeitsgemeinschaft für Osteosynthesefragen), which later set the whole tone in the development of modern traumatology. Paradoxically, (they were not familiar), Ilizarov and the founders of AO put forward unified postulates:

- stable fixation,
- careful treatment of soft tissues,
- early mobilization of patients to recover the range of motion in the affected limb.

Ilizarov and the AO founders approached to bone union in a systematic way, and not simply from the mechanical positions of particular solutions. This is the main secret of the success and breadth of the dissemination of the Ilizarov's and AO's approaches, unlike other schools.

Both Ilizarov and AO promoted the principles of compression. The AO propagandized the compression plate, imposed on the bone, Ilizarov promoted the external fixation system. AO organizers, like Ilizarov, paid a great attention to a careful recording of the medical process, training of specialists, scientific approach to treatment (including the use of experimental models) and the development of new technical devices for fixation. Somewhat later than Ilizarov, the AO specialists postulated the minimally invasive surgery as one of the key tasks (operations to be performed from small incisions with minimal soft tissue damage), based on the need for delicate interaction of fixators with bone and soft tissues. And in the late 1980's and early 1990's, they started discussing the importance of preserving blood supply to the bone, changing the design of plates and nails. Finally, compression plates with lateral stability appeared in the 2000s that mimic the work of external fixation devices in many aspects, the only difference being that they are immersed into the body. Surprisingly, it is only natural that the international trend was in synchrony with the Ilizarov's work.

The basic question was one: to fix bone fragments inside the body or outside? This difference has deeper aspects than just medical ones. Ilizarov began his development facing a severe shortage of modern equipment and high-quality materials. Everything was built on enthusiasm and without any financial support. Swiss colleagues ideologically, and in fact, headed the profitable high-technology manufacture of internal fixators. From the very beginning, their project had a well-thought-out commercial component and attracted considerable funding. The difference also laid in the organizational principles of health systems - a free Soviet and a commercialized Western one. Financial expenditures, including intellectual, were high, but not in the USSR (and not in the contemporary Russia). Patients in Europe were ready to pay money for high-quality and very expensive implants, and accordingly expensive operations. The saving could be in a reduced inpatient stay at a hospital, which was also expensive. The founders of the AO built a system for well-to-do citizens convenient for the doctor: fast operation, the patient soon on his feet, then discharged and forgotten. Their engines have been and still are manufacturers of implants and high-tech equipment, which contribute to high-quality operations. Companies invested much into promotion, advertising, training and research.
The uniqueness of the Ilizarov method is that the apparatus is very simple and cheap. It is reusable. The most expensive parts, the rings, are almost eternal. Special materials for the manufacture of the apparatus parts are not required, hence only the wires are immersed into the body. Accordingly, the manufacture process can be adjusted at any plant. It is easy for a doctor to readjust the device and replace its elements, since everything outside the body is perfectly controlled and, if necessary, can be changed during the course of treatment.

The peculiarity of the Ilizarov apparatus is that its system of fastening and control of bone fragments is outside the body. Only wires pass through the limb tissues. Accordingly, it was possible to invent and manufacture parts from various materials and low requirements were needed for manufacturing accuracy in comparison with internal fixators. All of them after trials became elements of a set for transosseous osteosynthesis.

The downside is a low economic profit from sales, because business in all industries seeks to make a disposable product. The work with the apparatus requires a minimum of equipment in the operating room and a minimum of complex instruments. On the contrary, patient’s management requires a lot of work. During the whole process of bone healing, the participation of the attending physician, rehabilitation specialists and nurses is necessary. Out-patient treatment is possible, but with careful monitoring and change of wire dressings. Also, the psychological aspect should not be excluded: the bandage on the limbs is not as frightening as the metal frame.

Therefore, the Ilizarov method is more in demand and more widespread in developing countries. Patients in these countries often cannot afford high-quality implants. And the complexity of injuries and the number of their complications in India, Bangladesh or Egypt is higher for socio-economic reasons. In developed countries, limb amputation is acceptable if the recovery process is too long, difficult and work-consuming (and at the same time the patient does not have to feel like an outcast). Loss of limbs is a catastrophe and is unacceptable for most patients who do not belong to the "golden billion". The Ilizarov method has become a great opportunity to solve complex health problems in a cheaper and reliable way for patients in developing countries. Modified Ilizarov apparatuses are fabricated in the East in large quantities and often of a very low quality. But if the Ilizarov method may "forgive" it in most cases as it is external, the technology of internal osteosynthesis never will.
With all the variety of materials and elements used, all external fixation devices have basic platforms or supports (rings) on which the fixator elements that pass through or attached to the bone are fastened, and the connecting rods that allow the supports move relative to each other.

Until now, the disputes about who is right and what is better depend not only on the technology itself but also on the place of its application and the specific life situation. The Ilizarov method in developed countries has inspired many inventors to create new internal and external systems working according to the laws of the Kurgan orthopedist. Gavriil Abramovich destroyed an inert approach to dealing with bone that was reigning in the orthopedic community. In practice and in experiment, he proved that bone is an active tissue that is amenable to good regeneration and transformation. A new biological direction in the regeneration of bone and cartilaginous tissue has appeared. Specialists who master the Ilizarov method in the US and Europe apply it in the case when they cannot cope with the disease using internal systems. New materials and electronic systems enabled to produce bone implants capable of growing a distraction regenerate by slowly moving apart their components. They are not so reliable, limited in the possibility of application and, most importantly, cosmetrically expensive. In general, orthopedic surgeons in Russia and throughout the world may choose the best from various technologies or combine them. So, it happened with the Ilizarov method. In the places, where there are masters of this craft, the classical Ilizarov technology is mostly used, in the other parts it is combined with other approaches. However, it serves as a salvage method in the conditions of despair, when all other options turn ineffective. We call the Ilizarov method a “lifeboat” or “parachute” in orthopaedics.

For any highly skilled contemporary orthopaedic surgeon, the Ilizarov principles and the mastery of external fixation techniques give a feeling of freedom and security, the certainty that one can cope with any complex and unusual situation having an inexpensive, reliable product in hands and ... a creative start. No wonder, in any well-equipped clinic of the world, you will find a ready-to-use toolkit that has already acquired the common noun "Ilizarov". And experts say: "We are followers of the Ilizarov philosophy."

The famous American orthopedic surgeon Dror Paley (on the right) had his training in Kurgan in the 1980s and was inspired by Ilizarov to apply the method. Nowadays, he combines the Ilizarov method with other techniques and his own developments.

Photo taken in Dr. Paley’s operating room
Bangladesh, with a population of more than 160 million people, ranks eighth in the world in terms of population and only 90th in territory. It is one of the poorest countries in the world. There, the Ilizarov method is not just effective, but in many cases it is the only available opportunity to rescue people's life and health.

Honorary Professor of the Ilizarov Center Mofakhkharul Bari devoted his life to promoting the Ilizarov method not only in Bangladesh, but throughout the world. His activities advanced the method in his homeland and salvaged limbs of thousands of people from amputations.

In India, the Ilizarov method becomes more popular with each year. This country hosts a large number of scientific conferences, educational schools and training courses on the application of transosseous osteosynthesis. A lot of orthopaedic surgeons use the Ilizarov method in their practice. Most of them were trained at the Kurgan Ilizarov Center or participated in the courses conducted in India by teachers from Kurgan.

Conference on the Ilizarov method in the world-famous charity hospital Sri Sathya Sai Super Specialty Hospital, Puttaparthi, A.P., India. Participants of the conference in the central hall of the clinic

Ilizarov video-audio demonstration surgery in Sri Sathya Specialty Hospital. The surgeons of the Ilizarov center are operating: Borzunov D.Yu., Gubin A.V. and their Indian counterparts

Professor Sihe Qin from Beijing, China, (also Honorary Professor of the Ilizarov Center) has been using the Ilizarov method for more than thirty years. In his clinic, tens of thousands of patients with consequences of poliomyelitis and other diseases of the upper and lower extremities were treated. Chinese doctors have made many of their own modifications to the device. At the same time, Professor Qin always perceived the Ilizarov method precisely as a philosophy based on biological laws, well coordinated with Chinese historical and cultural traditions. There are
two portraits in his office, of his Chinese teacher of surgery and of Gavriil Abramovich. In the recent years, the cooperation between China and Russia in the field of transosseous osteosynthesis has been actively developing.

At the famous USA children’s hospital in Dallas (Texas), the Scottish Rite Hospital for Children (TSRHC), the Ilizarov method has been used extensively since the early 1990s. TSRHS is the world's best example of a hospital with a friendly atmosphere which is “saturated” with love for children. The hospital is the record holder for the number of Honorary Professors of the Ilizarov Center. There are three of them, Mikhail Samchukov, Alexander Cherkashin and John Birch. These are our active associates in the dissemination of the method on the American continents. In addition, they held countless training meetings on the Ilizarov method throughout the world. Professors M. Samchukov and A. Cherkashin modified the Ilizarov apparatus, making it more comfortable for a "spoiled" Western surgeon. Since 2014, the Ilizarov Center has been actively cooperating with the TSRHS. The two hospitals are exchanging specialists and conducting joint scientific conferences in Russia, the United States and other countries.
Mikhail Samchukov and Alexander Cherkashin are demonstrating the TSRHC biomechanical laboratory, where they develop modifications of the Ilizarov apparatus.

THE ILIZAROV CENTER IN THE XXI CENTURY

The Ilizarov Center is one of the few Russian clinics that are well-known in the world, a reliable medical brand that arose thanks to the brilliant idea realized by its founder, his associates and followers, and for decades supported by the work of hundreds of its employees.

The Ilizarov Center is the best place to obtain unique knowledge and skills for specialists who encounter with the use of external fixation in their work. It is the place from where doctors depart full of enthusiasm, new ideas and prospects, after having passed the training course and acquainted with original treatment solutions for diseases that seem hopeless to cure.

Specialists from all over the world come to the Ilizarov Center to exchange experience and learn new skills. It is difficult to find a training clinic in the world with such a variety of rare cases and breadth of approaches.

Finding faith in one’s abilities is another "Ilizarov effect." I experienced this feeling myself when I was doing an internship in Kurgan in 2002. In the last week of studying, the idea of what exactly I would change in my approaches when having returned, what new things I would do using the Ilizarov’s philosophy, did not let me fall asleep. At that time, I did not know yet that 8 years later I would be lucky to work at the famous institute.

The Center’s soul is the Ilizarov philosophy. The Ilizarov philosophy is not just the techniques and the apparatus. It is the willingness to take responsibility for treating any patient with a very difficult, often a rare problem, to work with him as much as necessary, take non-traditional flexible decisions, "play chess" with an ailment being in partnership with the patient.

Such a "game" is impossible without science and synergy (cooperation) in the work of various specialties providing professional continuity, which is part of the technological continuity. This is the principle of scientific justification of the combination and consistency of the application of a particular technique or technical solution. To implement the principle of technological
continuity, specialists of the Ilizarov Center have a team approach to treatment. This team of surgeons conducts regular analysis and discussion of clinical cases.

Today, medicine helps those whose treatment previously seemed doomed to fail.

The Ilizarov method has no age limit in its application. In Russia, orthopedic assistance to children and adults is provided by different institutions and different specialists. There exists a concept of "pediatric orthopedists" and "children's hospitals". And therefore, approaches to the treatment of children and adults frequently develop in parallel ways. When a kid grows to a teenager, the passport age and biological development may cease to coincide: someone ceases to grow at the age of thirteen while the other continues to grow after eighteen. In this transient age range, doctors face the greatest risk of making an error in the treatment approach. A pediatric orthopedic surgeon is faced with the problem of choosing techniques and implants for treating a child that has the adult size, and an adult orthopedic surgeon is forced to treat an adult patient with active growth zones and childhood diseases. These systemic failures are clearly visible at scientific conferences on complications after the application of various methods. We follow the concept of age continuity at the Ilizarov center. This is a system that provides a broad view of the problem of treating a patient in a time line of life.

Pediatric patients do not need to look for a new, "adult" institution for further treatment after they reach the age of 18. They remain under the supervision of the specialists that are well-informed about their diseases and previous treatments. Age succession is also an excellent organizational solution that allows optimal distributing of both human and material resources. Within the walls of one institution, there are specialists, equipment and tools that can provide all the necessary treatment options, regardless of the nosology, size and age of the patient.

The Ilizarov philosophy, technological and age continuity are three "whales", on which the concept of the Center’s development is based.

We are committed to personalized medicine with an individual approach to a specific patient and clinical situation. In practice, a safe and personalized approach is possible only with a very competent combination of modern diagnostic measures, qualitatively tested drugs and implants, and well-developed, scientifically valid manipulations. For this, high-tech clinics, such as the Ilizarov Center, are needed. The method of Ilizarov had become the basis of personalized medicine long before this concept appeared. The Ilizarov apparatus is a standard, reliable and affordable tool, the application of which can be infinitely personalized depending on the individual characteristics of the patient and the situation.
But the availability of reliable equipment and good material support is not enough for success in rendering aid to patients.

All patients experience fear and expect pain when colliding with surgery. Unfortunately, the pain is not only physical but also emotional.

Creating a patient-friendly environment is a new approach to the partnership of the patient and the staff of the medical institution.

A deep mutual respect for the personalities of a patient and an employee lies in its essence. The goal of creating a friendly environment is to minimize fear and pain, which can only be achieved by constantly analyzing each of our actions in regard to the patient.

We constantly conduct a whole complex of medical, psychological and organizational activities so that patients understand that the Ilizarov Center is the place where they are loved, where they are wanted and, most importantly, can be helped.
#63
The complex process of postoperative rehabilitation often takes place in an entertaining manner.

#64
In summer, the green lawns of the "Ilizarov’s" park turn into a zone of entertainment and games for patients.

#65
The hospital that is friendly to the patient should little remind the hospital. The hall of the main building of the Ilizarov Center is an area for having walks and meetings. Permanent and temporary exhibitions are displayed in cooperation with the Kurgan regional art museum and the organizers of the mobile exhibition "Primordial Russia".

#66
Patients often arrange improvised concerts in the winter garden of the Center.

#67
In order to help the patients and their relatives, the clinic of the Ilizarov Center seeks to organize treatment through a new positive experience, without fear, with minimal physical pain. We call such a hospital friendly to the patient.
The territory of the Ilizarov Center has been changing into as an open-air museum, which includes the Alley of Peace and Friendship and the Veterans’ Alley.

The Ilizarov Center immortalized the help of our younger brothers in the development and testing of new treatment methods.

Much has been already done but still there is a lot to be done, involving specialists of different fields in this process, and, of course, patients and their families. An invaluable help in this work is provided by patients’ organizations, social services, Internet communities and the mass media.

This work should result in the strengthening of public trust in medicine. It will allow doctors to preserve the most important thing in their difficult work - professional happiness while patients will gain health. Exactly so, we are sure, Gavriil Abramovich Ilizarov would have liked to see the future of the Center created by him: successful and satisfied with their work doctors, and happy patients, cured of diseases....