Nehru Bal Pustakalaya

Fascinating Tales from the World of Medicine

The Magical Needles and Other Stories

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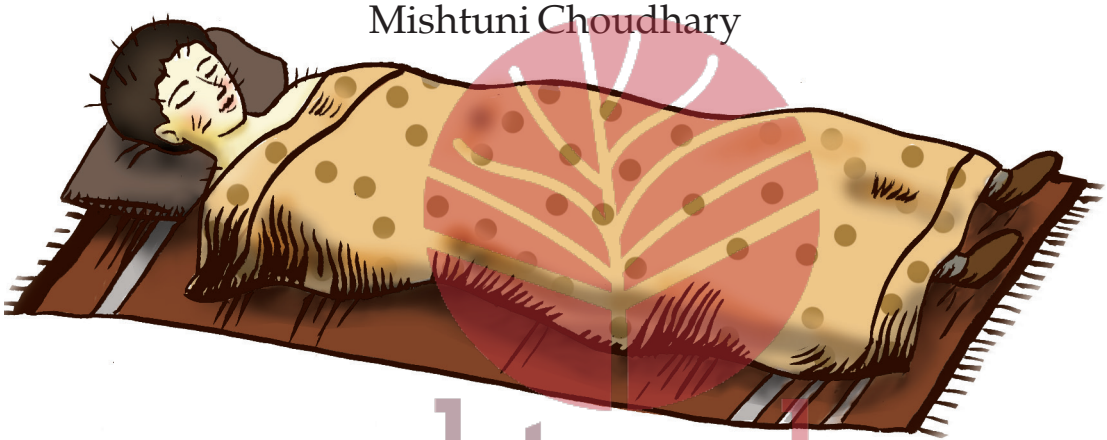

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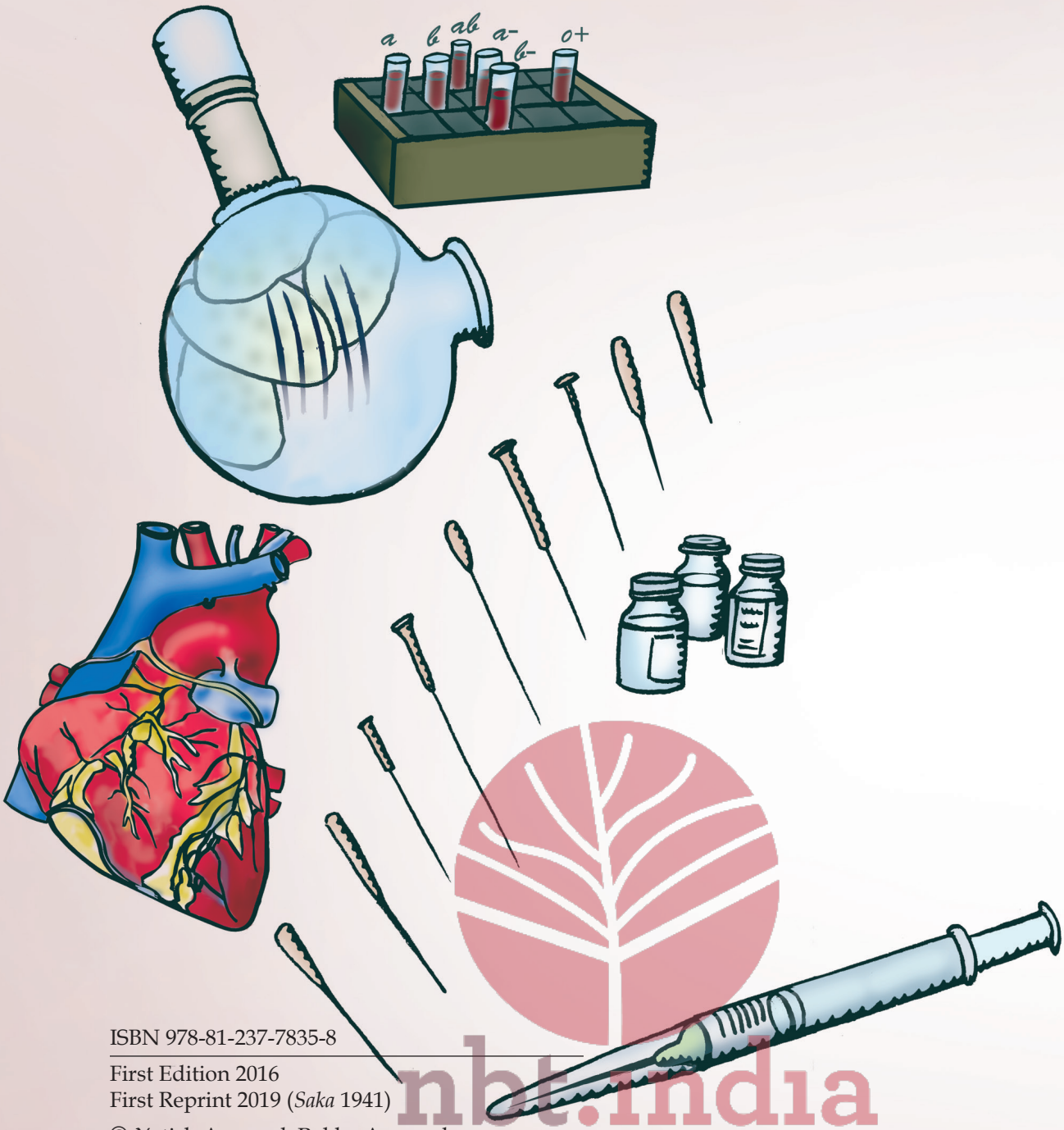

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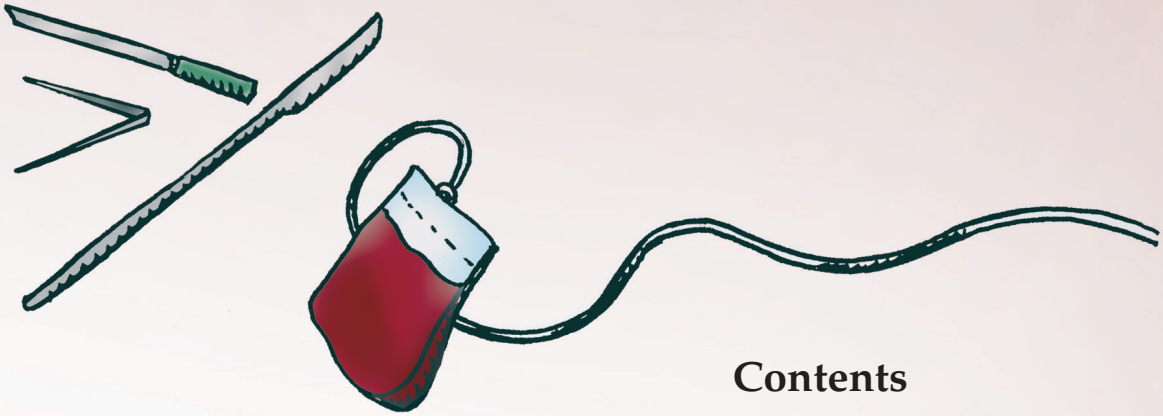

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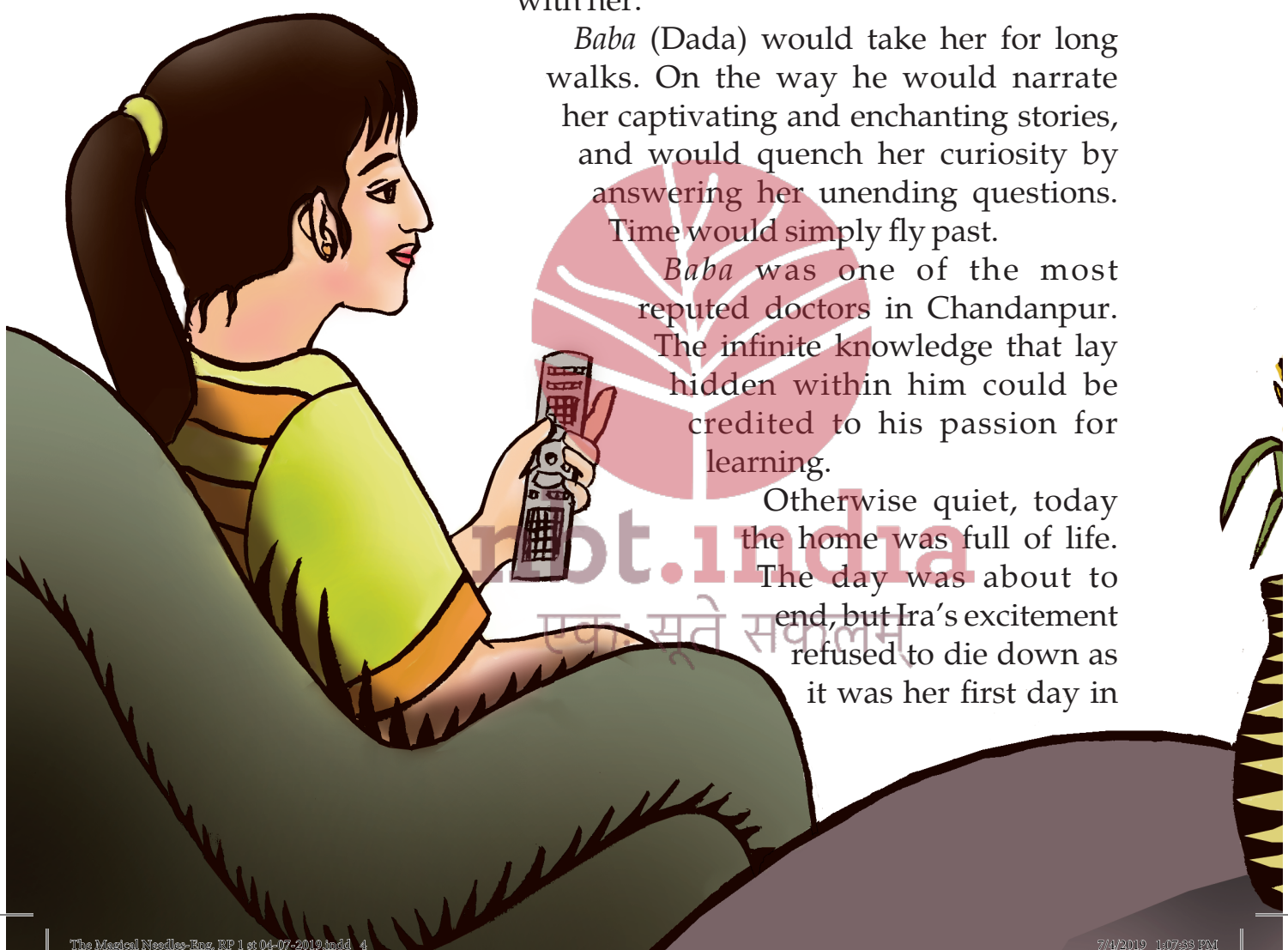
The Magical Needles

The air was intoxicated with the sense of festivity. It was Dussehra!! While everybody was busy celebrating the victory of good over evil, Ira had another reason to kick up her heels.

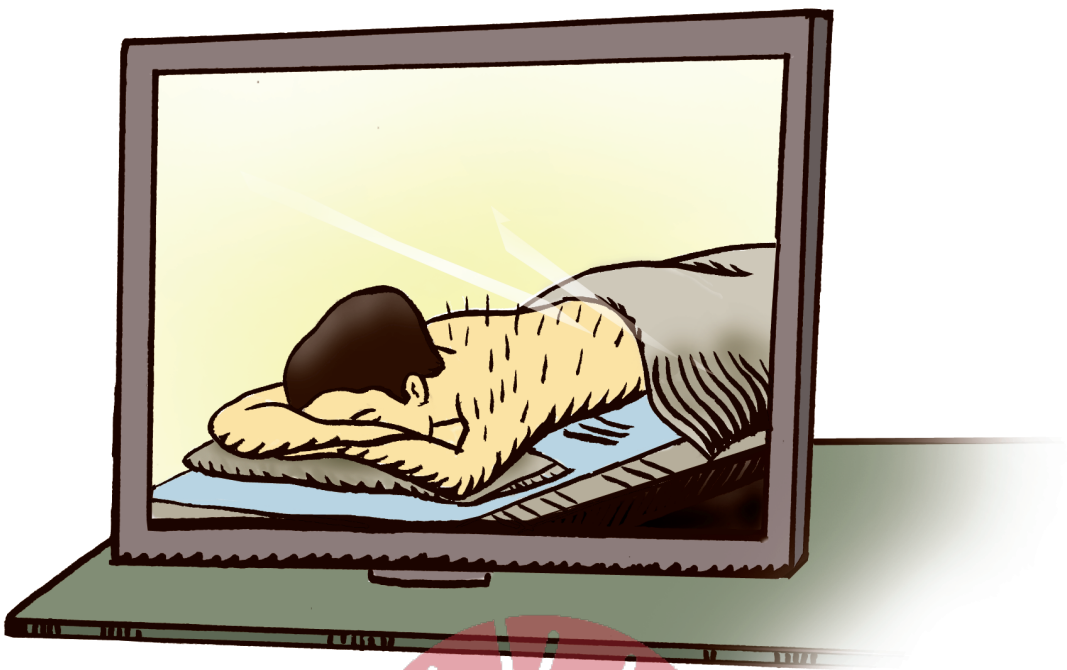
It was like a ritual. She would spend her Dussehra holidays with her *Dada* and *Dadi* in Chandanpur away from hustle and bustle of the city. She loved spending time with them as both doted on her. *Dadi* would make her *besan ka halva*, *laddoos*, knit sweaters and play chess with her.



Baba (Dada) would take her for long walks. On the way he would narrate her captivating and enchanting stories, and would quench her curiosity by answering her unending questions. Time would simply fly past.

Baba was one of the most reputed doctors in Chandanpur. The infinite knowledge that lay hidden within him could be credited to his passion for learning.

Otherwise quiet, today the home was full of life. The day was about to end, but Ira's excitement refused to die down as it was her first day in



Chandanpur. She and *Dadi Ma* buried themselves in the newspaper trying to solve the crossword in the living room.

As the clock struck nine, *Baba* switched on the television to watch news. After a while, some perplexing and intriguing shots flashed on the screen, which attracted Ira's attention. It was a news about the ongoing conference on acupuncture, a form of alternative medicine used for pain relief. While the patients were lying on the bed they had three inches long, ultra-fine, stainless-steel needles pierced into their ear, in another one's face, and in someone's back and knees. Surprisingly, there wasn't a slightest trace of pain on their faces.

Suddenly, the electricity went off. The news piqued Ira's curiosity about the amazing science.

"Needles for healing! *Baba*, I have never heard about this earlier. Is it a new way of treatment?" she enquired.

Baba smiled, "No Ira! Acupuncture therapy is an 8,000 years old science which originated in China. The therapy has its own interesting story which led to its birth. "

"8,000 years old system of healing!" Ira jumped with excitement. *Baba* knew what Ira would ask for. So, without any delay he began narrating the story.

"China was not an authoritarian country or was not governed by single administration, but was divided into varied tribes during that era. Petty fights would often become a matter of pride leading to a battle among these tribes.

Ira, people in the primitive age used weapons like spears and arrows."

"Really *Baba*? Were they similar to the ones that we saw on the history channel the last time I visited Chandanpur?"

After a pause, Ira continued, "And if I am not wrong, even the *Ramayana* and *Mahabharata* battles were fought with spears and arrows."

"Yes dear! It was an era of bows and arrows, spears and maces.

"Besides, in those days, priests used to treat people. A clan of priests held the responsibility of nursing and tending wounded warriors of the tribe. They would dress and bind them, raise their spirits and would listen to their experiences.

"During the process, warriors would reveal several amazing experiences, like after an arrow had pierced in one of the warriors foot in the battle, the chronic headache he had been suffering from years had miraculously disappeared. Another narrated how his sinusitis vanished over night after the tip of a spear had pierced the back of his knee."

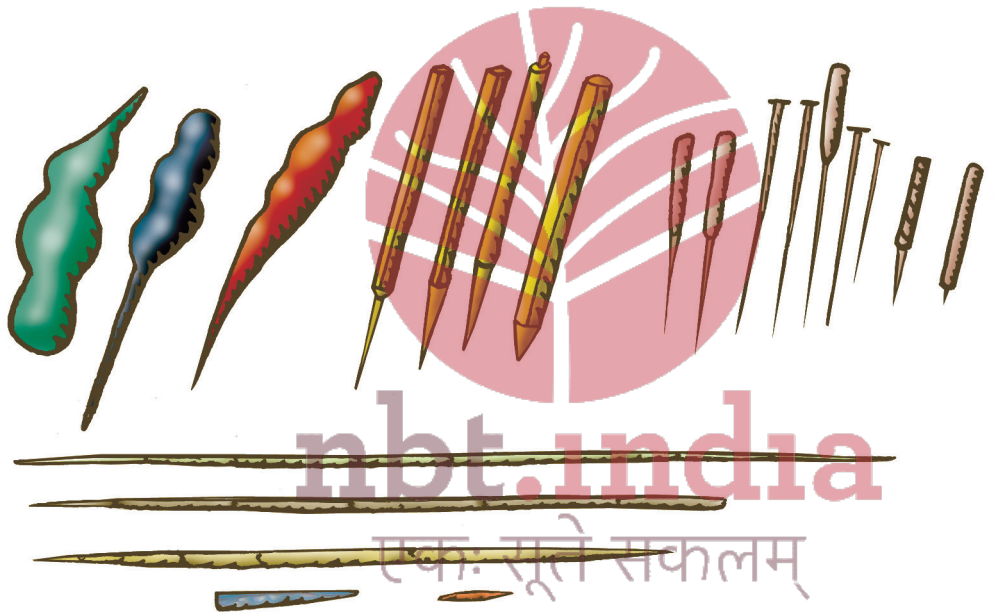
"Really?" Astonished, Ira asked.

"Yes, Ira! When the priests repeatedly heard such experiences of the warriors, they tried stringing them together into a cord.

"Gradually, on compiling numerous experiences, priests identified 160 acupuncture points on the body, which when pierced with the needles could be very effective in affecting the internal organs and ultimately help in treating illnesses."

"It was a miraculous discovery *Baba*. Well, did stainless-steel needles existed in those times as well?"

"No, Ira! Initially, pointed stones were used. Later, the bones of big animals were sculpted and these bone slivers were brought into use. Besides, some people carved out bamboo stalks and chiselled them into bamboo slivers. Soon, metals replaced bones and bamboo. Several ancient gold, silver and copper needles had been found in archaeological excavations in China. You would be surprised to know that some of them are more than 2,000 years old!"



While Ira was hanging on to each and every word *Baba* uttered, her sub-conscious mind thought about things mankind can learn from the past. She was all set to know and capture more.

"Binding their experiences with knowledge, Chinese physicians readied a chart of meridians and acupressure points on the body. They found numerous pressure points on the ears and feet, which directly connected to the body organs.

"With time the know-how about the science increased; priest gradually realised that it was not enough to pierce a patient with needles just once for uprooting ailments. Only after assessing the seriousness of the disorder the number of times a patient would have to come for treatment could be determined. While some could get relief within fifteen to twenty times, whereas, others had to visit the priest more than thirty times.

"Acupuncture kept flourishing and thriving in China. It became an indispensable part of ancient Chinese medicine. The beneficial effects of acupuncture reached every corner of the world just as openness marked China's attitude towards international relations. It reached the world after Richard Nixon, the President of America, visited China in 1972. The accompanying journalists reported about the incredible science. The reports created the much needed furore.

"Special needles made of long, ultra-fine, stainless steel began to be made to administer acupuncture for patients. Doctors began paying attention to the fact that needles should be pre-sterilised and made completely safe before use. Disposable needles, meant to be used just only once came into existence. It was absolutely necessary for these precautions to be taken so that the needles would not lead to any sort of infection in a patient's body."

Ira had all her ears to what *Baba* had to say. As soon as he mentioned long, ultra-fine stainless steel needles the scenes of acupuncture which had been telecast on television, a short while ago, crossed her mind.

Suddenly, she interrupted *Baba* and asked, "*Baba* how does acupuncture functions in our body? Do you know about its painkilling secret as well?"

"There is a lot of research being done in the field. Biologists have even investigated its various effects on the body. There exist two schools of thought to understand the unique qualities of this therapy.

"If we go by the old Chinese School of thought there is a divine life-force *Chi* flowing through our body, which circulates through our body all the time. Its *chakra* or energy centre passes through all the cells, tissues, organs and systems of our body. This life force flows only over the surface of our body.

"The Chinese believe that being healthy or unhealthy depends on the simple flow of *Chi*. If the natural flow of *Chi* stops at some point then some or the other organ of our body becomes affected."

"This is a complete philosophy by itself, *Baba*!"

"Yes, Ira! There is another principle that is linked to this ancient Chinese school of thought, which says that *Chi* is governed by two opposing forces, Yang and Yin. Yang is the positive force, whereas, Yin denotes the negative force. Our well-being depends on the balance maintained between these two forces. If one becomes weak the other gets powerful and this causes our body to fall ill.

According to this ancient Chinese school of thought there is a direct connection between acupuncture points, mapped out over the surface of our body and the internal organs of our body. By piercing these acupuncture points with needles there is an improvement in the flow of *Chi* and the imbalance between Yang and Yin gets corrected. This cures the ailment."

"How wonderful, *Baba*! And which is the second school of thought?"

"Ever since the therapy of acupuncture has reached America and Europe different kinds of scientific research and experiments are being carried out on it. Several amazing facts about this method of treatment have come to light."

some points of acupuncture

"What are they, *Baba*?" Ira immediately asked.

"My child! On carrying out various scientific researches it was found that the population of 'lymphocytes' coursing through our blood increases with this treatment. Lymphocytes, a type of white blood corpuscles, are the soldiers of our body which protect us. This means that acupuncture awakens fresh self-healing capabilities of our immune system, which then bolster our energy and resistance to diseases."

"Great!! This information is very useful, *Baba*!"

"Ira, scientists have unveiled the secret as to how acupuncture relieves pain. It has been found that on getting acupuncture done endorphins, a class of biochemicals, are released in a man's brain and spinal cord. These natural pain-killing hormones work like morphine. The moment they are released by the body one gets relief from excruciating pain."

Before Ira could shoot another question, *Dadi* intervened, rebuking

Dada, "How long do you plan to continue chatting? Let her go off to sleep? It had been a long journey for her today. Go Ira, take some rest."

"Come dear, let's doze off now or else… you know it all."

Baba couldn't stop laughing while Ira could be heard giggling too.

The Thief and an Anatomist

Rising from the east, the morning sun had filled the sky with its beautiful shades of pink, red and orange. Unlike the usual morning, when *Ma* would keep calling out for Ira to leave her bed and get ready for the school, today she woke up all by herself. It was the bulbul, flitting from one branch to another, who had been chirping at the window that woke Ira up, as if she now held the responsibility of waking her up. Still drowsy, she casted a fleeting glance at the clock. It was five o' clock.

Something struck her mind and she got up.

"Morning walk!!" shouted Ira.

She freshened herself up. Morning walk with *Baba* was the most awaited time of the day as she got to listen to numerous interesting stories from *Baba*.

Baba was all ready waiting for Ira in the living room.

"Good morning *Baba*!"

"Good morning. That was really quick Ira!"

Heading towards the apple orchard, both set off for a walk.

On the way, Ira casually asked, "*Baba*, how many bones are there in our body?"

"Two hundred and six, dear!"

"206? How are they linked *Baba*?" came the next question.

"Ira, there are joints between the bones. These very bones and joints make up the skeletal system of our body."

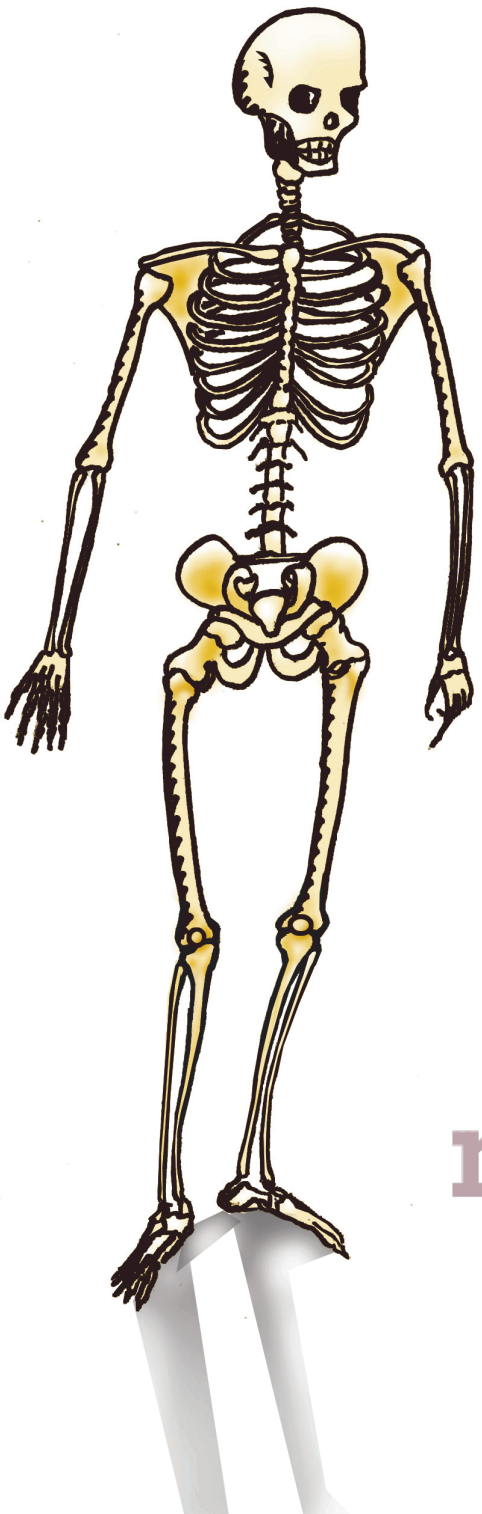
"*Baba*, how do joints remain in their normal position in spite of all the movements a human body makes?" Ira asked in amazement.

"The body tend not to lose its control so that bones and joints stay in place and do not get displaced. A network of muscles and tough ligaments cover the bones from head to toe, which strongly binds the bones to each other and provides a flexible bone to bone connection while effectively regulating the movement. This allows us to make a high or a long jump like a rabbit and cross a ditch. Besides, it gives us liberty to turn our neck to look right and left, up and down or anywhere we want."

"*Baba*, how many muscles and ligaments do we have in our body?"

"I do not remember their exact number, but the count would certainly be in hundreds."

"Two hundred and six bones, dozens of joints, hundreds of muscles and ligaments, and then all the body organs housed within them. Baba, an entire city dwells within us!"



"That was splendid Ira!" *Baba* laughed.

Unwilling to rest, Ira's curiosity made her ask more.

"*Baba*, how did we get to know about the number of bones, muscles, ligaments in our body, the joints and which all organs do we have and how are they structured?"

"Oh! So you want to know about Anatomy. I will explain to you the science of the structure of human body tonight, for certain. But promise that you won't be scared, Ira?"

"Well, why would I be frightened?"

"Alright Ira! We will see how brave you are, tonight."

Ira spent rest of the day with *Dadi*. She was enjoying every moment in Chandanpur.

Finally, the sun was about to set allowing the stars and the moon to take the stage. As the clock struck 8, *Dadi* called Ira and *Baba* for the dinner.

Ira was desperately waiting for everyone to finish the dinner as she wanted to know about Anatomy. The term had been doing rounds in her mind throughout the day and she could not wait more. After the dinner, *Baba* and Ira settled themselves in living room.

"*Baba*, now tell me what is Anatomy?

"Ok! Carefully listen to the story and don't be scared," *Baba* mischievously smiled and began narrating the story.

"As the silence loomed all around on a dark and a cloudy night, eerie sounds of jackals' howling...hu hu hu...hu hu hu...hu hu hu... could be heard intermittently.

"Shadows of two men could be seen advancing towards the city's burial ground as the clouds play hide and seek with the full moon. Left unmonitored, the doors of the graveyard were closed. Both stood there for a while and then leapt over the wall and secretly sneaked in.

"Hiding into the darkness of night, trying not to make any noise and carefully taking their every step they reached the grave of an unclaimed corpse buried on that very day. They were carrying a huge sack with them. They kept the sack on the ground, took out two spades and began removing the soil heaped over the grave. The soil was still soft. It did not take them long to remove the soil. Soon the coffin began peeping out from beneath the ground. They removed the fresh soil covering its top and lifted the coffin's lid. In hurry, they took the dead body out from the coffin and placed it in the sack they had got along and tied it with a rope. Hiding their tools in the empty coffin and burying it at the same spot, the two men jointly picked up the sack, silently opened the graveyard's door and vanished into the dark."

Baba paused!! There was silence. *Baba* tried reading the expressions on Ira's face.

"Who were they? Where did they get the courage of digging the body in a graveyard? How did they manage to sneak out with the body? The darkness didn't scare them? Why did they steal?" Ira asked in quick succession.

"Wait! I will explain you everything in detail."

"Ira, these two men, who had mustered the courage of putting their lives at risk by sneaking away with the corpse in the dark, were not some robbers or rogues, but were the distinguished men of the city. If anybody would have spotted them he would probably not

have believed his eyes. One of them was Andreas Vesalius, a famous anatomist of the city of Brussels. He was forever engrossed in treating and nursing the sick. The other man was his long time associate."

Baba, then what forced them to commit this theft?"

"Ira, Vesalius stole the corpse to know more about the internal structure of the human body. This was possible only when he dissected a corpse for every minute detail of the body organs.

"Andreas was born on the night of 31 December 1514 in Brussels, modern-day Belgium. He inherited his profession from his family of physicians and pharmacists. His father was personal pharmacist to Queen Margaret of Austria while his grandfather was a renowned physician of his times. The profession ran through their blood. After studying Latin, Greek, Hebrew and Arabic languages in the University of Louvain, he decided to study medicine and took admission in the University of Paris.

"Ira, it would be interesting for you to know that the study of medicine commenced with anatomy and physiology. During those days, books written by Galen, a prominent Greek physician of the second century, were considered the Bible of Anatomy. The whole of Europe regarded Galen as the master of medicine. His books were read and taught all over so much that even the Emperor of Rome acknowledged his work. Nobody ever thought beyond what Galen had put down in his work.

"Dear Ira, do you know how many books did Galen wrote? His contribution to the medical science could never be ignored. He gave 500 books to the medical science. He worked really hard in his lifetime of 70 years. Above all, he even dissected animals to gather information about the anatomy of the human body. In those days dissection of humans was forbidden by religious laws.

"With time the social norms changed and so the perceptions. By that time dissection of human bodies in medical colleges had been sanctioned by the Church. But the professors continued to teach from Galen. In fact, the professors considered performing actual dissections as a threat to their dignity. The skilful act of surgery was then carried out by the barbers who knew how to perform small surgical operations. They were employed by medical colleges for this task. Professors would read out loud from Galen's books during the anatomy class and the poor barber-surgeons, who knew little about the surgery, would actually dissect the human body.

"Some people felt that there were glaring discrepancies between what could be seen on dissecting a corpse and what was written by Galen in his texts. However, people had such implicit faith in Galen that it was unthinkable for them to dispute what the 'Great Master' had written. So much so that some of them would say that possibly human anatomy had somewhat changed in the intervening twelve to thirteen centuries, since Galen's time.

"It is not as if all of them were the same, bound by tradition and least receptive to modern ideas. Sparks did burst forth from time to time.

"In fact, Arabic medical thinkers and physicians like Al Razi, Ibn Sina and Ali Abbas even tried dissecting human corpses. Besides, they even wrote about the same, which contradicted Galen's theory but all in vain. Not only was their work left unacknowledged, every effort was suppressed irrespective of what doctors across the world had to say, Galen's classical texts continued to be the final word in the medicine world.

"As the medieval period was coming to an end and the field of medicine saw things changing, it was the time to raise the voice. But the voice came from a different corner— painters and sculptors. Leading them was Leonardo da Vinci, the greatest artist of his era, who had attained multifaceted glory during the Renaissance. He felt the need to know every minute details of the human body for faithfully rendering life-like paintings on canvas. He even went to the extent of dissecting human corpses so that he could thoroughly understand the structure of the human body, every organ, and every tendon, and could make remarkably accurate figures.

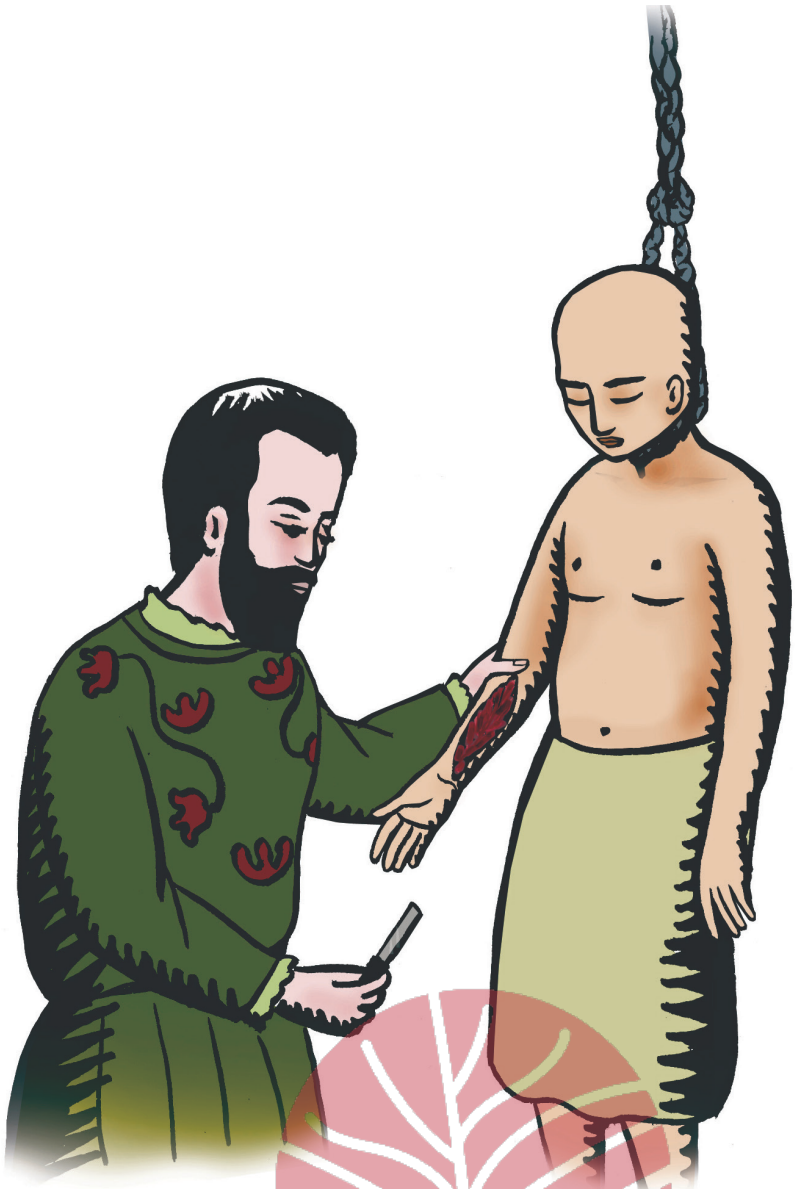
"Vinci readied more than seven hundred drawings of the human body. Medical science was highly unfortunate that Vinci was not a physician. His sketches lay unattended and gathered dust for the next two centuries. Besides, the texts written by Galen still remained the last word in medicine.

"In midst of all this, a 19-year-old boy, Andreas, who desperately wanted to study medicine took admission in the medical college of Paris. Andreas was born with a scientific bent of mind. The actual anatomy of the human body was different from what his professors taught in class and this fact could not remain hidden from him for a long time. However, professors would not pay the slightest heed in this direction. Most of Andreas fellow students would learn the lesson exactly as it had been taught by their professors, with their eyes closed.

"This made the young Andreas feel disappointed. He knew there was no point in arguing with the professors as they would stick to the books. Instead of discussing his queries and confusions with his professors he started making notes of the facts which were contrary to Galen or would not match at all, after he would be back from the college.

"Andreas desperately wanted a chance to perform dissections himself on the human body and see what the truth was. He would happily volunteer to perform the dissection whenever he would get an opportunity in the class. With the time, he and some of his friends found out another way to find what was right and what was wrong. They would sneak and secretly steal the corpses of criminals who had been sentenced to death, and whose dead bodies had been buried outside the city's boundary. This gave them the freedom of dissecting the bodies without any intervention.

"After completing his studies in Paris, Andreas returned to the University of Louvain. He kept on with his unfinished work there as well. At an age of 23, he was made the professor of Anatomy in one of the most famous medical colleges of Padua in Italy. This further added to his urge to know more about the human body. He kept working diligently and would be seen working in the dissection hall throughout the day. Besides, Andreas even developed new dissection instrument. His hard work did pay off. With time he was able to



unveil the mystery of anatomy of the human body. He was surprised by the mistakes in the classical texts, but nobody was bothered or even made an effort to rectify them.

"Besides the research that Andreas was working on, he would take keen interest in teaching his students. Above all, he would motivate them to do dissection of the corpses themselves and carefully examine the internal structure of the human body.

"He minutely studied each and every bone, muscle and ligament which give the body its basic structure. Andreas discovered that the

red cells are produced in the bone marrow. He got to know how and where the muscles and ligaments are connected to bones. Besides, he did research on veins and arteries, and found out how nerves are spread across the body. Andreas was successful in discovering several new facts about heart's structure, and organs like the lungs and stomach.

"Simultaneously, Andreas kept writing about his discoveries. He got his friend Jan van Kalkar to make hundreds of drawings of the human body. These drawings sketched from different angles of the body were truly unique and depicted the ideal human form. Stringing these illustrations in his written work, Andears composed a new book 'De humani corporis fabrica libri septem' on the fabric of the human body. This book was divided into seven sections and each section threw light on a particular system of the human body. This book is no less than any of the present day books on Anatomy. It was printed and published in 1543.

As soon as the book was published it created a furore. Some physicians who had a scientific bent of mind heartily welcomed the book. However, their number was considerably less. Unfortunately, the adherents of Galen could not accept the truth and they ridiculed Andreas so as to sustain. Things went bad to an extent that Sylvius, an old teacher of Andreas, declared him mad.

"Initially, Andreas tried confronting the opposition by visiting universities and presenting proofs. He put forward evidences and pleaded that people should accept scientific truths, but the centuries-old works of Galen had such deep impact on people that they were just not willing to look at new discoveries.

"The constant denial, ultimately, forced Andreas to resign from Padua Medical College. He came to Spain and became the personal physician to Emperor Charles V of Spain and then to his son King Philip II. He stayed in the royal court for the next 21 years, where he was deservedly honoured and held in high esteem.

"The following incident dates back to 1564. Andreas was returning from a pilgrimage to Jerusalem when he got news that the term of his banishment was over and professorship had been offered to him in Padua once again.

"But as fate would have it, this did not happen! The ship in which Andreas was returning wrecked. Sadly, the lamp that had laid the foundation of modern anatomy extinguished for all times to come. Some historians believe that there was a conspiracy behind the accident.

"Whatever may be the truth, Ira! The flame of the lamp that was ignited by Andreas showed light to several physicians of the coming generations. All branches of medicine now had a scientific base in form of 'De Fabrica,' the book written by Andreas Vesalius, which gave a detailed description of human anatomy.

"This revolutionised the evolution of surgery. In fact, now the surgeons were able to perform new surgeries as they had detailed information about each and every part of the human body. Now, they knew how to protect the anatomical mesh of blood vessels, nerves and other vessels running through the body, while making the cut and can as well decide the path they need to take while passing through various tissues and the method they should adopt to reach any particular part of the body."

"That was truly splendid, *Baba*! The story added so much to my knowledge bank. The story made me understand why Papa's friend Avneet uncle always look into his medical books and re-check the facts before performing a surgery, even today," said Ira.

As the clock struck 10, *Baba* and Ira turned towards the clock. Meanwhile, they could hear *Dadi* yawning and calling for Ira. *Baba* quietly switched off the lights and both slipped off to their respective rooms.

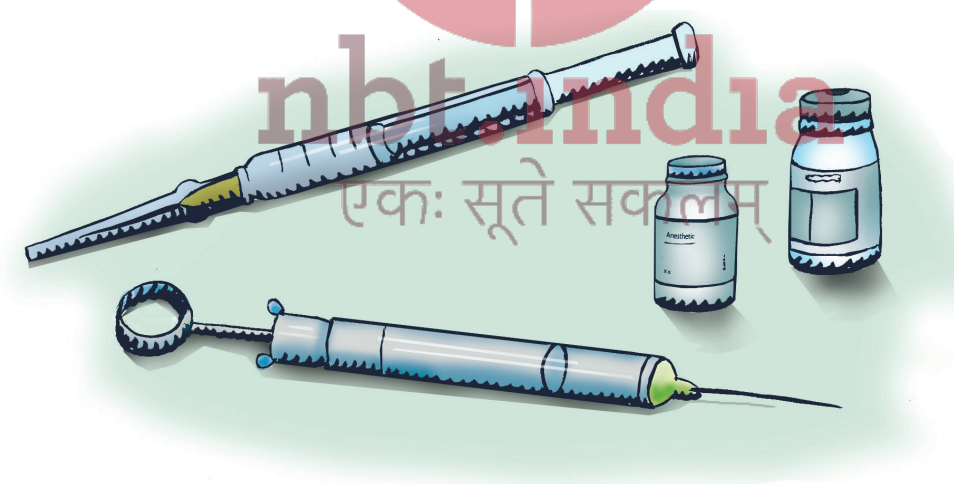
Paralysing the Pain

The next morning, as Ira picked up the newspaper to read, a report on 'Save the Tiger' campaign attracted her attention. A considerable amount of space was given to the report. Two tigresses had been sent from Ranthambore Wildlife Sanctuary to increase the fast diminishing tiger population in the jungles of Sariska. Both the tigresses had fought ferociously to establish their own territories on reaching Sariska. One tigress had been so badly wounded that she had to be operated the same today. In fact, some veterinary doctors had been called from Delhi for the surgery.

The report forced Ira to think.

"How would doctors of the wildlife sanctuary operate upon a powerful and strong animal?" she wondered and ended up asking *Baba*.

"Ira, it is not a difficult task. Expert and doctors in a wildlife sanctuary drives in a tranquilising injection in the tiger's back with the help of a dart gun, from a distance. Thereafter, when the tiger enters a state of sedation, veterinary doctors take him into the operation theatre. Administering anaesthesia in the theatre has a sedating effect on the beast while surgeons perform the surgery."



"Is it true *Baba*?" asked Ira in disbelief.

Could *Baba* be pulling her leg? Is it possible to keep such a large-sized animal calm by giving anaesthesia? However, a composed expression on *Baba*'s face convinced her that he was telling the truth. All sorts of questions kept cropping up in her enquiring brain. After all, which particular property of anaesthesia takes a huge animal like the tiger into a state of deep sedation, numbs his sensations and leaves the creature perfectly healthy when he regains consciousness. Neither does he have any good or bad memory of the operation nor does he know what has happened to him. Deep within her, Ira had decided that she surely wants to know the story behind anaesthesia.

While on the breakfast table, Ira seemed lost. She was still hanging on to the tigers in the wildlife sanctuary.

Reading the expressions flitting across her face, Baba could gauge that there was something that was troubling his little granddaughter.

"Dear, is everything alright? You seem to be lost. What is the matter? Are you missing your Mummy and Papa?" he asked with a smile.

"No, *Baba*. It's anaesthesia. How did the mankind discovered anaesthesia? Is it safe? When and how did surgeons begin using it for surgery? Which kinds of anaesthetic agents are brought into use by the surgeons of today? How do they work? *Baba*, I want to know."

"Ok, Ira! Calm down. I will definitely explain you everything about anaesthesia. Let's finish our breakfast and then we will sit in the garden and talk about it."

It was Sunday and since it's a holiday for *Baba*, Ira made sure that he spent his entire day with her answering her never-ending questions.

Ramu Kaka got chairs for them and kept them beneath the garden umbrella. Soon enough, both grandfather and granddaughter sat cross-legged engrossed in their discussion.

"Ira, the first page of the story on anaesthesia was written on 16 October 1846. I will give you an eye-witness account of what happened that day.

"Imagine yourself being in the city of Boston in America! The old huge Massachusetts General Hospital lies right in the centre of the city. Its huge surgical amphitheatre seems to be overcrowded today. The spectators' gallery is jam-packed with physicians and medical students. An operating table has been laid out bang in the middle of the theatre and a patient is sitting on it. She has a tumour growing right underneath his jaw, which is going to be surgically removed today.

"The preparations for the surgery which is about to begin, had been completed. The trolley carrying surgical instruments has been set. Surgeon John Warren has taken his position. Everyone is waiting impatiently for Dr Morton to arrive. He has claimed that he will demonstrate an absolutely new technique today. He has claimed that the patient will not feel the slightest of pain during the operation.

"Most of the physicians present in the surgical amphitheatre think it's impossible. They wonder the possibility of patient not letting out a slightest groan of pain upon the use of the technique. Although they have gathered as their minds are curious and eager to know if this is feasible at all.

"The wait for the people present is finally over!!

"Dr Morton steps into the amphitheatre from the main door, holding a glass globe in his hand.

"As soon as he enters, Surgeon Warren sarcastically says, "Sir, your patient is ready."

"However, this did not deter Dr Morton. He starts with few encouraging words to the patient to help him get rid of the fear. Then with a gesture he explains to the patient that he will have to place the tube fitted to an aperture of the glass globe, next to his mouth.

"There is no need to be scared. You just have to keep the tube next to your lips and keep inhaling," directs Dr Morton.

"Pieces of sponge soaked in ether have been housed in the globe.

"The patient begins inhaling from the tube fitted to an opening of the glass globe. Silence looms all around as soon as the procedure begins. Everyone is looking intently at Dr Morton and the patient. After a few moments the patient's body shakes a bit. Slight contraction of his body's muscles can be seen momentarily and then his eyelids begin to

droop. Soon after, he enters a state of deep sedation and appears to be sleeping. Dr Morton indicates that Dr Warren should go ahead with the surgery.

"When Dr Warren makes the first incision on the patient's neck with his scalpel, physicians and medical students present are left astonished. There is absolute silence. Surprisingly, the patient does not move or cry out of pain. It was nothing less than a miracle for the entire medical fraternity. The surgery moves ahead. The experienced hands of Dr Warren lift up both edges of the skin on the neck, on which the incision has been made, cut through the underlying tissues and find the tumour lodged within. Safely manoeuvring past the blood vessels, nerves and neighbouring tissues he goes on severing the tumour from its roots. Soon after, he excises the tumour and takes it out. The tissues are sequentially compressed in their positions and Dr Warren stitches up the incision made on the patient's neck. The surgery is over. Amazingly, the patient keeps breathing lying in the same posture.

"After a while, the patient regains consciousness and opens his eyes. He is surprised and at the same time happy to know that the surgery has already been done.

"At that moment, surgeon Warren could not refrain himself and proclaims, "Gentlemen, this is no humbug!"

"Ira, it was a special moment in the medical history. It was truly a test of the patients' courage and tolerance to be able to give consent for undertaking an operation in that era. Every incision made by the surgeon would cause them unbearable pain. Writhing in pain, patients would scream and shout in agony but a couple of people would hold them tightly when the surgery was going on. In fact, some patients would end up breathing their last in the operation theatre.

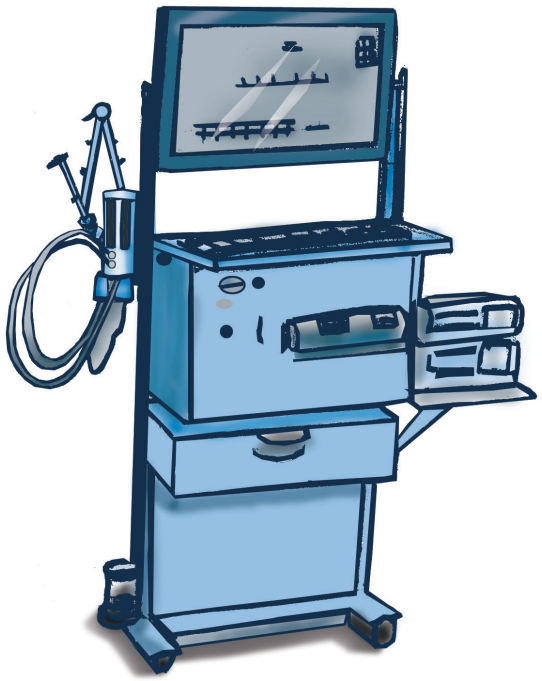
"The patient and his family members would agree to go in for surgery when there was no other option left. Only selected surgical operations would be performed in such circumstances. A

very few surgeries like repairing fractured bones, correcting joints which had been dislocated, removing stones formed in the urinary bladder, amputating half cut hands or feet to save the patient's life, were undertaken. Surgeons could not dream of going ahead with a big surgery. Above all, the surgeon would be under tremendous mental pressure while operating. He would try his level best to get over with the surgery as soon as possible so that the patient would have to bear minimum pain and agony.

"This new technique by Dr Morton changed the entire course of surgery. It became imaginable for patients to get a surgery done. The patient was made to inhale ether gas before the surgery, which would make them unconscious. Thereafter, the surgeons would comfortably perform the surgery.

"During the same time, some doctors tested the anaesthetic effects of nitrous oxide and chloroform as well. In 1844, American dentist Dr Horace Wells pioneered the use of anaesthesia in dentistry by administering nitrous oxide. Similarly, in 1847, Sir James Simpson, the famous Scottish obstetrician, discovered the anaesthetic properties of chloroform. Precisely six years later, Dr John Snow was responsible for giving chloroform to Queen Victoria of England at the birth of her son in 1853. It saved the Queen from the labour pains. Thereafter, everyone began raving about the anaesthetic properties of chloroform.

"Gradually, the science and concept of anaesthesia kept evolving. Constant technological developments kept taking place in this field. Special kinds of masks and machines were made for administering anaesthetic gas to a patient when he was to be operated upon.



When the patient would breathe through the mask, the anaesthetic gas would enter his body along with the air. New advanced anaesthesia gas machines were manufactured, which specialised in controlling the volume of anaesthetic gas entering the patient's body and regulated his breathing pattern.

"Progressing by leaps and bound, anaesthesiology was established as a new branch of medical science all together. In 1905, the American Society of Anaesthesiologists came into existence. Keeping the safety of patients in mind, new standards were set. New drugs and gases were discovered.

"Ether was highly inflammable and chloroform was dangerous, therefore they were replaced by new anaesthetic drugs. Cyclopropane, Trilene, Halothane and Methoxyflurane were few of the leading gases in this category. Later on gases namely Desflurane, Isoflurane and Sevoflurane, which were better and safer, came into existence. They are used even today. In fact, they are converted into vapour in the anaesthesia machine and are administered to the patient through a mask along with nitrous oxide.

"Ira, the first intravenous anaesthetic, Sodium Pentothal, was introduced by American physician John Lundy, in 1932. It can be said that there exists an extended family of intravenous anaesthetics in the present era that is flourishing beyond boundaries. Several drugs like Propofol, Etomidate, Methohexital and Ketamine fall under this category. These drugs have an effect within a few minutes after being injected into the vein. Anaesthesiologists use these drugs in two

different ways. Minor operation is performed with the numbing effect of this drug while for lengthy surgeries patient is sedated with this drug. Later, the surgery is carried out with the help of an anaesthetic gas (given by inhalation through a mask)."

"*Baba*, how do anaesthesiologists determine which drug or anaesthetic gas should be given to a particular patient?" asked Ira.

"It is a complete science in itself. Anaesthesiologist takes into consideration factors like which surgery has to be performed, how long will it take, patient's health and which organs of his body are working, to decide the appropriate anaesthetic drug that should be given to a particular patient.

"Ira, it is imperative for a patient's muscles to relax while being operated upon. Anaesthesiologists give special muscle relaxants to patients for the purpose. Curare was the first drug of its kind. It was administered for the first time to a patient undergoing surgery in 1942. On 23 January, the surgery was performed by Dr Harold Griffit and Dr Enid Johnson on a patient undergoing an appendectomy. Dr Griffit and Dr Johnson used intercostrin, a synthetic preparation of curare, for the surgery. It proved to be great success as it relaxed the patient's muscles of the stomach in spite being swollen, which helped in carrying out the operation easily."

"*Baba*, where and how was curare discovered?"

"Ira, you are aware of the fact that earlier man used to hunt with bows and arrows. In that era, tribals in the dense forests of South America while hunting used to coat the tips of the arrows with a special kind of alkaloid or toxic fluid. This fluid would be extracted from the leaves of wild plants growing in the forest. When the arrow would hit its mark, even the biggest of animals would stagger and collapse with a thud leaving the animal unconscious.

"It was nothing less than a miracle. To know more, physicians did a chemical analysis on a sample and found that it contained curare. Several muscle relaxants like curare are produced synthetically.

Tubocurarine and Rocuronium are the leading ones of the lot. On administering them the patient's muscles relax and it becomes easy for a surgeon to operate."

"You are right *Baba*! I have read about how surgeons numb a specific part of the body during minor operations."

Baba had already sensed what would be Ira's next question. He smiled and said, "I know what is coming to me Ira. You want to know about the local anaesthesia. Am I right?"

"Yes, *Baba*! Is it a kind of anaesthesia too?"

"Ira, doctors had been successful in searching out special drugs which can numb a certain part of the body. The patient does not feel the slightest pain when an incision is made on that body part and it is stitched up. Local anaesthesia numbs the muscles and makes sure that the patient does not feel the pain while being operated."

"Do you also use these drugs, *Baba*?"

"Sometimes, when I have to put stitches (sutures) on a patient then I bring these drugs into use. Lignocaine, Lidocaine, Procaine, and Bupivacaine are some of them. And of course, there are several ways of administering them. During a minor surgery, needle is used to inject the medicine while local anaesthetic sprays are also used that is effective for a shorter duration. However, if a surgery is to take a longer time then nerve blocks are used.

Surgeons at times use special techniques of administering local anaesthetics. The sensations of pain, pressure and heat first travel from all organs of the body up the spinal cord and backbone to the brain through sensory nerves. In case, the surgeon has to numb a portion of the body which lies below the torso (trunk of the body) or legs then things can be managed by just blocking the backbone. It is called spinal anaesthesia. When your *Nani* got her knees replacement done she was given spinal anaesthesia."

"But *Baba*, what is the advantage of spinal anaesthesia? Isn't it better to give general anaesthesia to the patient and put him to sleep?"

"Good question, Ira!"

"I would like you to know that elaborate paraphernalia is needed for administering ordinary general anaesthesia to patients for sedating them. Firstly, anaesthesia is injected, muscle relaxants are given and then the patient's breathing pattern is regulated with the help of a machine. The patient's heart beat, blood pressure, pulse rate and oxygen levels are constantly monitored by the anaesthesiologist during the surgery. As long as the effect of general anaesthesia lasts after the surgery is over, the patient is kept in an intensive care unit to keep a close watch. A restriction is imposed on his food intake and glucose solutions are given by intravenous infusion to maintain the body's energy until the patient's body becomes normal.

"And, in case, patient's heart, lungs or kidneys are ailing, the complications escalate.

"However, it is much easier to administer spinal anaesthesia than general anaesthesia. That is why doctors prefer to give spinal anaesthesia though certain precautions should be taken, but still it is less complex."

Baba had explained everything with such simplicity that Ira did not face any difficulty in understanding and grasping each and every detail. She got answers to all her questions like why did the anaesthesiologist had given spinal anaesthesia instead of general anaesthesia to *Nani* during her knee replacement surgery, why did *Chacha* was kept in the recovery room, adjacent to the operation theatre, for six hours and was not allowed to return to his room immediately after surgery.

Ira could finally understand that besides the doctors and surgeons who are burdened with the responsibility of saving the patient's life, anaesthesiologists share the responsibility too.

Fighting away the Bacteria

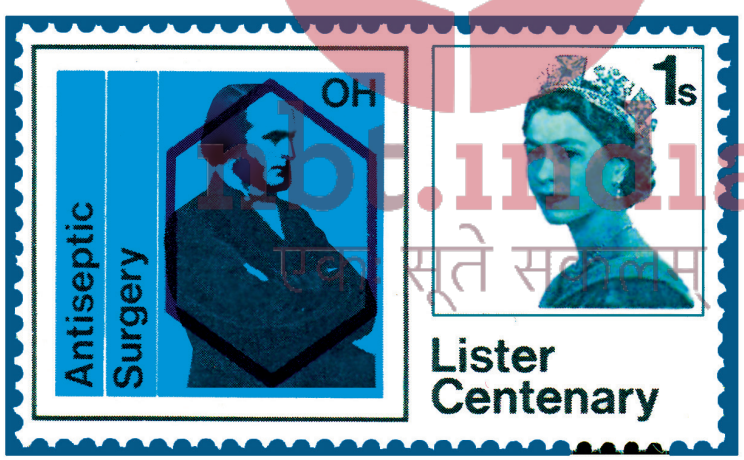
Sitting in the study, Ira had been relishing the stamp collection throughout the evening. Questions were hatching in her mind every second. She would get up every time she saw something new; select a suitable volume of the Encyclopaedia Britannica from *Baba*'s library to know more about a particular stamp. Hours passed by. Her concentration was broken when *Dadi* called out for her after *Baba* had come back from the clinic.

Ira placed the stamp album back into the cabinet before heading towards the living room for evening tea.

"Good evening! *Baba*, you have an elaborate stamp collection!" she exclaimed.

"Hmm...so what all did you see in the collection?" *Baba* asked with a smile.

"Postage stamps featuring plants and animals, stamps related to space, a collection of stamps on old historical monuments, another



collection featuring cricket and stamps on medical science. *Baba*, an entire world of thrill and mystery lay hidden in your stamp collection."

A pleasant smile passed through *Baba*'s face. He seemed to be impressed with Ira's curiosity and her questions.

"Ira, you have turned out to be a true connoisseur. Frankly speaking, only a few people can understand the meaning of a stamp collection. But you have given an account of the entire philosophy of philately in such few words. Well done!"

"*Baba*, who was Joseph Lister? I was glancing through a stamp issued in his honour by England when you came back from the clinic."

Baba just could not hide how proud he was of Ira. The fact that Ira was more interested in knowing the world rather than wasting time browsing internet, watching television and playing video games made him really happy. At least, she had time to ask such questions.

While *Baba* was engrossed in series of thoughts, Ira interrupted him.

"*Baba*, who was Joseph Lister?"

"Ok! Wait. You will get to know all about Joseph Lister after the dinner. During my stay in England, I had a chance to visit his office. I saw the glimpses of his biography. Some slides of that time frame have been carefully stashed by me. If you want I can show them to you by projecting them on a screen."

"Why not, *Baba*! All three of us, *Dadi Ma*, Ramu *Kaka* and I, would love to listen to the story of Joseph Lister's life."

After the dinner, Ramu *Kaka* set up *Baba*'s old projector and screen in the living room. The light in the room was dimmed. *Baba* projected the first slide on the screen when everyone had taken their respective seats.

The first slide was of a beautiful building.

"This is Glasgow University from where this story begins.

"It was a night of the month of August in 1865. While the moon and clouds were busy playing hide and seek, silence loomed over the University of Glasgow. But bulbs were still twinkling in one of its rooms and the echo of footsteps could be heard at intervals. Ongoing closer, it was found that this room belonged to the Professor of surgery. Dr Joseph Lister was pacing up and down in the room. He was stressed and the wrinkles on his forehead narrated the entire story.

"Thirteen springs had passed by since he had become a surgeon. The field of surgery had drastically evolved during these 13 years. Anaesthesia was discovered, which entirely changed the way surgery was done. It was one of the biggest discoveries in the field. Patients were no longer forced to bear the intolerable pain while being operated. An anaesthesiologist would make the patient drift into peaceful sleep while the surgeon would complete the surgery. Shouting and screaming could no longer be heard in the premises of the hospitals. Surgeons had the liberty to take their time while performing the surgeries.

"Anaesthesia had brought the much needed revolution. In spite, surgery was still considered unsafe as there were times when the patients' health would deteriorate despite successful surgeries. Postoperative infections like swelling with redness and pus, high fever, chills were prevalent. Though the patient would recover in a few weeks time, but there were always chances of blood poisoning. Writhing in agony, they would breathe their last sooner or later in the hospital.

"In those days, postoperative infections like pus were a common occurrence for incisions made during the surgeries. It was so common that most of the surgeons believed that it was necessary for the wounds to become pus-filled to heal properly. The pus in a wound was called 'laudable pus,' by surgeons of that age. They thought it was a sign of healing.

"Death of a patient, in spite of a successful surgery because of an infection was something that was constantly bothering Joseph Lister. He was a hard working surgeon. His name and fame had reached far and wide because of being the Regius Professor of Surgery at the University of Glasgow. He was committed to his profession and wished that every patient he had operated upon should recover fully and go home hale and hearty.

"Postoperative infections or blood poisoning in a patient's body would be unbearable for him. He would feel dejected about the patient's condition deteriorating suddenly even after the surgery had been satisfactorily performed. He would be disturbed for several days at a stretch if a patient would die.

"Lister firmly resolved that come what may he would find out the reason for a sudden deterioration of health of a patient who was recovering well after surgery.

"Ultimately, Lister obtained a clue on deeply delving into his experiences. He found that blood poisoning would occur in those patients whose wounds would become pus-filled. Which meant that there was a deep connection between the two?

"It was getting imperative to know the cause of the infection. Joseph Lister was always on the lookout to unveil the links of the mysterious chain. He would painstakingly work in the operation theatre, day in and day out. After performing surgeries he would spend the free time in the laboratory and deliberate over the matter with his other surgeon friends.

"That night while he was dwelling over the problem someone knocked on his door. It was Professor Thomas Anderson on the door, Dr Lister's dear friend. Anderson was a noted 19th century chemist. After customary greetings, Lister got him inside.

"Anderson was a close friend. He very well understood the pain weighing on Dr Lister's mind. In addition, he knew that Lister wanted to find out what caused wounds to rot and was working day and night on it.

"A research article of the famous French chemist Louis Pasteur had come to Anderson just a few days back. Pasteur had written on why while making wine from grape juice sometimes led to putrefaction (decay) of the juice. On reading this article Anderson felt that it would prove to be of great use to Lister. Soon after, he went to Lister to give him this valuable information.

"As soon as he sat on the chair Anderson told Lister, "Joseph, there is a good news! Recently a research paper has come to me. Though, it is on chemistry, but I am convinced that it will be useful in your research. Whenever you get time take the article from my room."

"Why delay when some good deed has to be done! The very next day Lister went and got the research paper from Professor Anderson. He found the entire article written by Pasteur to be unique. Pasteur had presented an absolutely new theory in front of mankind. He

had proved with experiments that putrefaction of grape juice occurs only when some microbes sneak into it and quietly wreak havoc. These airborne microbes keep hovering in the air and settle down on canisters filled with grape juice on getting a chance. When they start thriving in the grape juice it leads to souring and a foul smell being emitted by the juice. These living beings are so tiny that they cannot be seen with the naked eye and could be seen only under a microscope. They are known as bacteria.

"Dr Joseph Lister read the research paper. It took him no time to grasp the information in the article.

"If these bacteria floating in the air can settle down on a canister of wine and lead to rotting then they can certainly penetrate a wound and cause irreparable damage, he thought.

"As soon as this idea dawned on him Lister jumped with enthusiasm. He had finally got a solution to his many questions. Why did he never have any difficulty while treating an ordinary closed fracture in which the bone had not broken through the skin? Why did it never become pus-filled? It was crystal clear that the bacteria could not gain entry into the body because there was no puncture or open wound in the skin. However, the patients with open wounds with fractures had strong chances of their wounds getting pus. The compound fracture would generally be troublesome as the bacteria in the air would enter the wound and infect it.

"It was important to obviate the problem after the reason for this decay had been found. A patient's wound had to be protected from the harmful effects of bacteria at any cost.

"While Lister was struggling to find a way to protect the patients from the bacteria, one of his associates informed him how a municipality in their neighbouring city sprayed phenol to get rid of the stench emitted from the sewage in drains and gutters. The exercise helped in removing the offensive odour in the air.

"The piece of information by his assistant proved to be the solution for Lister. He decided to spray the air in operating rooms with a carbolic acid mixture (phenol) to see what happened. 'This might thwart the air borne bacteria to gain entry into the wound,' he felt.

"A few days later a patient was brought to Dr Lister for treatment. He had sustained a compound fracture after a cart wheel had passed over his leg. Lister decided to try his new method of treatment on him. He meticulously cleaned the wound with a piece of lint dipped in carbolic acid solution (phenol).

"Soon after, he instructed the nurse to get the cleanest towel in the ward to wrap it as a bandage.

"Surgeons would generally use old tattered clothes for bandaging wounds in those days. People would go and donate their worn out clothes to hospitals for this purpose. So much so that surgeons felt it was not necessary to wash them before use and they would make do with these discarded clothes.

"Dr Lister bandaged the patient's wound with that clean sterilised towel. Every day he would ask for a fresh sterilised towel and change

the patient's bandage. It was astonishing! The wound on the patient's leg healed in a few days time.

"And then the sky was the limit! Lister worked towards achieving his goal with doubled enthusiasm. One of his associates would keep spraying phenol in the air when he would operate. Dr Lister brought about quite a few improvements in the conditions of operation theatres, which were truly appalling.

"In those days surgeons would not pay the slightest heed to the clothes they were wearing. Bloodstained coats would keep hanging outside the operation theatre. Wearing the same frock coats, they would operate. These blood spattered coats would last for several years without being washed.

"The surgeons didn't consider it important to wash their hands before the surgery. In fact many times, they would march straight into the operation theatre immediately after a post-mortem. Their surgical instruments would be casually strewn on some table or a trolley. The sewing threads used to suture wounds would be frequently pulled out of the lapel of their seldom-cleaned frock coats so that they would be easily accessible for the next patient. Indeed, how could microbes not launch an attack on the patient in such circumstances?

"Dr Lister brought about a drastic change in these deplorable conditions. New instructions were issued. Now every doctor, nurse and OT Technician had to wash his/her hands thoroughly before entering the operation theatre. Everyone had to wear immaculately clean, laundered clothes during the surgery. Now, it became imperative to immerse surgical instruments in carbolic acid solution, to boil bandages and sterilise them.

"Dr Lister introduced a new type of sterilised thread for putting internal stitches in a wound. It made from catgut, a strong cord made by twisting the dried intestines of sheep. There was no need to cut and pull out this thin cord after a surgery because it would subsequently dissolve on its own. The catgut thread is used for surgery even today.

"Initially, the changes were strongly opposed by many. However, after some time their fruitful outcomes were visible to everyone. People saw that Dr Lister had wrought a miracle in the surgical wards. There was not the slightest trace of suppuration in his patients. In addition, there was a noticeable decline in post-operative infections.

"Thereafter, Dr Lister decided to share his experience with his associate surgeons. He presented a paper on his findings at the annual meeting of the British Medical Association on 9 August 1867.

"Several surgeons who attended the meeting refused to accept 'Antiseptic Principle in the Practice of Surgery' presented by Lister. They felt that he was simply fibbing and exaggerating. 'How could the natural process of a wound becoming pus-filled be possibly stopped?' they reasoned.

"However, some were ready to accept the theory, but on a condition. They wanted to test the theory presented by Dr Lister. On implementing his antiseptic principle, they were stunned with the effectiveness. Gradually, Lister's methods gained acceptance.

"It strengthened the roots of antiseptic surgery. The campaign against bacterial infection, during an operation, gathered momentum. New antiseptics were discovered, which replaced carbolic acid or phenol. Mercury and zinc compounds were the leading antiseptics at that time.

"The field of surgery saw a drastic makeover. Surgery became painless and safe. Besides, there were other aspects as well that changed too. Gradually, with time, surgeons felt that it was not always necessary to spray carbolic acid or phenol onto the air while operating. Rather it was absolutely necessary for the surgeon to wash his hands thoroughly, wear spotlessly clean clothes, and sterilise the surgical instruments and bandages by boiling them before beginning the surgery. Another vital thing that came to the light was the fact that

patient's skin should be cleaned with an antiseptic solution before starting the operation.

"Several new and easy methods were discovered to make the operation theatre sterile and germ free. Besides, the clothes worn by surgeons, nurses and OT staff saw drastic improvement.

These days surgeons wear clean and sterilised gowns, tie surgeon caps around their heads and wear masks over their mouths and noses while operating. In addition, they wear sterilised rubber gloves on their hands throughout the operation.

"A lot of attention is given on keeping the surgical instruments clean and sterile. A special procedure is adopted for this exercise. Instruments are sterilised by high pressure steam sterilization or dry heat sterilizers, which as well help them retain their sharpness for a longer period of time. Autoclave plants are installed in big hospital for this process. The surgical instruments and bandages are sterilised in these strong, pressurised, steam-heated vessels. They are then packed in a sterile tray and sent to the operation theatre.

"A special air flow pattern is installed inside to keep the operation theatre bacteriologically free. Not everybody can enter the operating theatre. There is always a red bulb flickering, and a display board 'Operation is in Progress, Do Not Enter,' is put up at the entrance for the purpose. If these precautions are not taken there is a possibility of infection as the bacteria might enter the operation theatre with people going in and out. Moreover, relatives are restricted from meeting the patient for the first few days of surgery.

"In spite of every precaution, there are times when the patients get infected and their wounds become pus-filled even today. But this nuisance can be averted by giving antibiotics to the patient. These drugs are so powerful that bacteria which lead to the formation of pus, collapse with their onslaught...," smiled *Baba*.

Everyone was so engrossed in the story that they had no inkling of the time. All of them were deeply absorbed in watching the slides

and listening to *Baba*. Before he could say further, the wooden cuckoo clock announced that it was 10 o' clock. Immediately, *Dadi Ma* ordered everyone to march to their rooms.

Ira noticed her *Baba* yawning. She immediately stopped herself from asking another question hatching in her mind. She ran towards him, kissed him and raved, "Thank-you *Baba*! You are just wonderful!"

Baba smiled.

Ira affectionately wished him and her *Dadi* a 'good night'.

It was a pleasant night for Ira as she dreamt of becoming a surgeon. She saw herself in a surgical gown, with a surgical mask over her face and a surgical cap on her head. Above all, she performed surgeries to serve the needy and alleviate their suffering.

Blood: The Lifeline

It was a beautiful evening. *Baba*, *Dadi* and Ira were sitting in the lawn after having tea. While *Dadi* was busy knitting a purple jersey for Ira, *Baba* was engrossed in the newspaper and Ira was watering the plants. Purple was Ira's favourite colour.

Suddenly, something struck *Dadi*'s mind. She raised her head while adjusting the spectacles on her nose. She interrupted Ira and asked, "Ira, would you like to solve a riddle?"

"Yes, of course! Why not, *Dadi Ma*!" Ira exclaimed enthusiastically.

"In that case, make a guess. Let me see what all your *Baba* has taught you!"

Baba's attention got distracted too.

Smiling he responded, "Oh, I see! So I am being tested under the pretext of questioning Ira. You must, you certainly must! Ira will solve the riddle in no time."

Dadi Ma geared herself up and said, "Okay, let's see. Ira, try and guess the answer to the riddle:

'Colour is red, qualities are many.
It flows virtuously like the Ganges.
Donating it is a great gift,
Whoever is its donor is known as Karna.
It is the basis of life
Try and guess what it is? '

"*Dadi Ma*, the answer to this riddle is so very easy. Blood...indeed this is blood! Isn't it!" confident Ira said.

"Well done, Ira," said *Dadi* with a smile.

"Blood is indeed a life giving force. It gives life to cells present in our body. Oxygen and glucose are able to reach each and every part and cell of the body, and get the strength to do their work by diffusing into the blood stream. In addition, it is responsible for taking biochemicals secreted by various glands from one part to another. This enables metabolic processes in the body which sustain life. It further enables the gaseous exchange of oxygen and carbon dioxide in the lungs, detoxification of the body by kidneys and the liver, travelling of hormones and other biochemicals throughout the body. It helps us to breathe and stay alive."

"Wao! *Dadi Ma*. You explained it wonderfully."

Baba agreed too.

"Let it be the topic of discussion today," *Baba* said.

"Brilliant! *Baba*, you have said exactly what I had been secretly wishing for!" said excited Ira, instantly agreeing to the proposal.

Dadi Ma agreed too with a smile.

"Can you all tell me how much hard work is put in by the blood in our body?" questioned *Baba*.

"Un-uh," Ira instantly shook her head, indicating that she didn't.

"Why don't you tell us!' Ira insisted.

"Alright! Then listen to this and I am sure you will be utterly amazed to hear what I have to say. The blood travels at a speed of 65 kms per hour. Blood flows through our blood vessels, 24 hours a day, day in and day out. Neither does it gets time to sleep nor any respite for taking rest. Coursing speedily through the network of blood vessels running through our body, it circulates through every organ and cell. Just try and guess how long one cycle would be.

Baba paused for a moment, but a blank expression on Ira's and *Dadi*'s face made him continue. "The cycle is as long as 1,19,000 kms."

"Really, *Baba*? How can it be so long? Ira was unable to believe her ears. I would probably not be able to run for even one kilometre at this speed!" she said grasping her breath.

"Ira, the primitive man had estimated the power of blood long ago. Ever since man had begun living in tribes he had found that blood conferred strength and potency. When these people would hunt down big wild animals in the jungle they would collect the blood of the beasts. They would sing and dance to celebrate, a lavish feast would be given and special functions would be held on their return. People would sprinkle the blood of these animals on their individual bodies as a part of celebration. They firmly believed that their bodies would become much stronger. This tradition prevailed for years together in some of the tribes.

"There were tribes who believed in the custom of drinking the blood of animals which had been killed. If a tribesman was weak or ailing he was given animal blood to drink."

"Baba, were the feeble benefited from this practice?"

"Of course, Ira! The blood of dead animals did offer the ailing person much needed protein and iron. His weakness would gradually disappear with this practice. A new strength would suffuse his body and if he recovered from the illness dwelling deep within, he would become hale and hearty once again."

"*Baba*, how did they get to know the path on which the blood follows through the body?"

"Ira, Galen, a famous physician of the Roman Empire during the second century, elaborated on the flow of blood. Galen dissected animals to know about the internal structure of the human body. It helped him to know that an intricate network of blood vessels runs through the entire body and blood races through them.

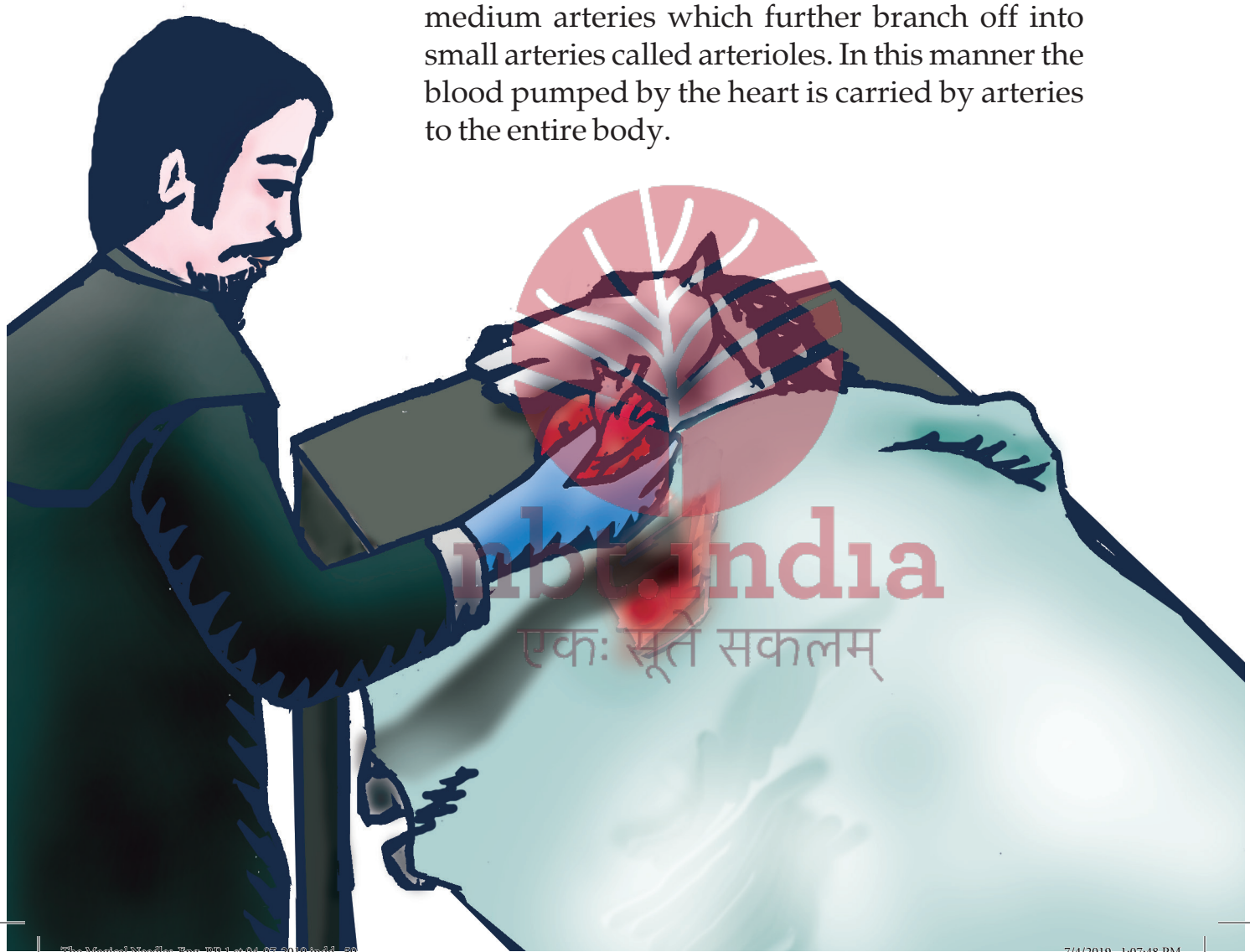
"Much later in the sixteenth century, Andreas Vesalius, a professor of anatomy in Padua, situated in northern Italy, laid the foundation of modern human anatomy by dissecting the corpses. It was from him that we got to know about the blood vessels in our body. However, Andreas Vesalius experimented only on corpses; therefore, he could not unveil all the secrets. Besides, he could not explain how blood circulates through our body."

"*Baba*, who discovered it?"

"Dr William Harvey, the famous physician of Britain, was the one who gave us this piece of information in 1628.

"He was the personal physician of Charles I, the monarch of Britain, and was very dear to him. When Charles would go for hunting expeditions Harvey's horse would be trotting alongside his. William Harvey ended up making the hunting ground his laboratory.

"Harvey would conduct all sorts of experiments on captive animals who were dying. Cutting open the chests of such animals he would conduct a detailed study of blood circulating through their hearts which were still alive and working. He proved by these experiments of his that the heart works like a pump. Blood is pumped by the heart which propels the blood in a circular course through the body via arteries. An intricate network of blood vessels runs through our body. The aorta, the largest artery in our body, originates from the left ventricle of the heart. This branches off into many large and medium arteries which further branch off into small arteries called arterioles. In this manner the blood pumped by the heart is carried by arteries to the entire body.



"Ira, it was one of the greatest breakthroughs in 17th century medicine. Dr William Harvey had no microscope to help him with his work at that time. With sheer hard work, imagination power and common sense, he unveiled all the secrets which lay hidden behind the cycle of blood circulation. In 1628, he published his theories in a book entitled 'Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus', in which he threw light on the motion of the heart and blood in living beings.

"Harvey revealed that blood pumped from the left ventricle of the heart passes through arteries and takes oxygen to the entire body. Thereafter, when the blood is de-oxygenated it picks up carbon dioxide from these very organs and returns back. A network of veins runs through our body to make this possible. The smallest veins or venules also become progressively larger. Converging into larger veins, they assume the form of two major veins, the superior and inferior venae cavae."

"And these two major veins open into the right atrium of our heart. Right *Baba*?" Ira added with confidence.

Just a few days back, she had read a book, 'The Story of Blood' and she could remember that a beautiful picture of the body structure representing the blood flow had been given in the book.

"Excellent Ira!! I am sure with an open and a receptive mind like this you too will make many new discoveries."

Seeing the sparkle of self-confidence in Ira's eyes he smiled.

"There is an interweaving network of the smallest of blood vessels as well, that connect the arterioles and venules. It works as a bridge between both of them. These small thin blood vessels are called..."

"Capillaries. Marcello Malpighi, an Italian anatomist, was the first to discover capillaries," *Dadi* added with a smile.

"That was splendid *Dadi*! How come you know all this? Have you also read *Dada*'s books on medical science?" Ira asked in amazement.

Dadi Ma burst out laughing.

"I have read about these interesting bits of information while going through the syllabus of biology. I had read about capillaries when I was doing BSc," *Dadi* explained.

Ira seemed amazed with the *Dadi*'s sharp memory. Meanwhile, a thought struck her and she asked *Baba* about the history of blood transfusion?

"Ira, this new idea was motivated by the work of Dr William Harvey. Experiments undertaken by him proved that there was a continuous circulation of blood within our body. The heart, blood vessels, capillaries, veins and arteries are all parts of this system. A new way of thinking arose from his findings that if blood was transfused into the artery of an animal it would mingle with the beast's own blood and start coursing through his body.

"Learning from the idea, Richard Lower, a Cornish physician, tried to keep dogs alive by transfusion of blood from other dogs. He was successful in this endeavour of his. After trying this fruitful experimentation on other dogs he mustered courage to transfuse the blood of a lamb into a man.

"Similar endeavours were made in France across the English Channel. Dr Jean-Baptiste Denys transfused lamb blood into some people who were weak. But how could the blood of a lamb match with the blood of man! One of Denys' patients who had undergone blood transfusion died and he was arrested. Transfusing blood from animals into patients was banned in France in 1668. Furthermore, a law banning blood transfusion was imposed in England in the year 1678."

"That was a terrible thing to have happened. The entire

thought process of blood transfusion would have fizzled out by this act," Ira remarked with dismay.

"Yes, dear! After this law had been enforced no one dared to think of blood transfusion for almost 10 decades. Then, in 19th century, an English obstetrician James Blundell proposed that a human to human transfusion would be best for treating haemorrhage. He had seen many of his patients dying during childbirth, and was determined to develop a remedy. With blood transfusion, Dr Blundell succeeded in giving them a new lease of life.

"In 1875, Leonard Landois, a German physiologist, presented his treatise on blood transfusion and kept many new pieces of information before us. In the paper, he presented his experiences of transfusing the blood of healthy people into 347 people who were ailing. Besides, he demonstrated that if red blood cells are taken from an animal belonging to one species and transfused into an animal of another species, the red cells typically clump and sometimes burst, which ultimately leads to their destruction. This was the first major breakthrough in making the practice of blood transfusion safe."

"*Baba*! What were the other developments? How did everything happen?"

Baba smiled and asked Ira to be a little patient as he was yet to complete the story.

"Distinguishing main blood groups was the greatest achievement in this field. In 1901, while doing research on blood in Vienna, Dr Karl Landsteiner proved that blood flowing in every human is not the same. It can be divided into four groups: 'A,' 'B,' 'AB,' and 'O' (the ABO blood group system.) The blood of one group does not match the blood of another group. Landsteiner found that blood transfusion between people with the same blood group did not lead to the destruction of blood cells and the donor's blood did the task of saving the recipient's life.

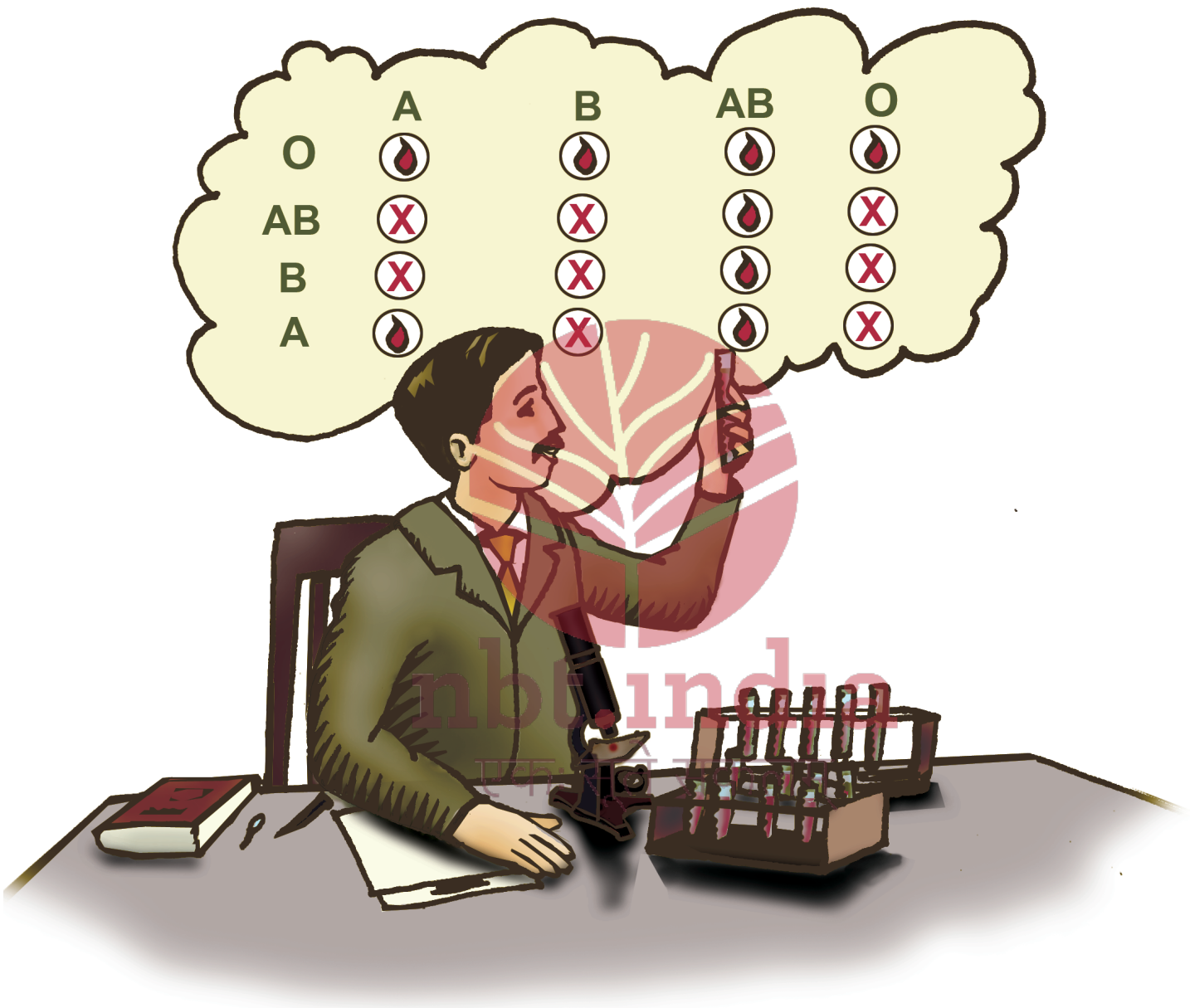
"This was a great achievement in medical science. Transfusing blood from one person to another became less risky on matching blood groups of the needy recipient and the donor. The recipient and donor were made to lie down on adjacent beds, next to each other. Then one of the donor's arteries was sewed to the vein of the recipient. Since the pressure of blood in the artery would be much more in comparison to the vein, the blood would start rushing from the donor's artery to the recipient's vein. Initially, blood was transfused into many people with this very technique," explained *Baba*.

"Splendid! This means that similar scenes in old Bollywood movies were not mere figments of our imagination," piped in *Dadi Ma*.

"Yes, Rekha! However, Dr Luis Agote, in 1914, proved that sodium citrate act as an anticoagulant if added to the blood and can prevent coagulation (clotting) of blood outside the body. With this discovery the process of blood transfusion became easier. Doctors would add a bit of sodium citrate in a bottle beforehand and extract blood from a donor in that very bottle. This blood would stay safe for several days at a stretch in these bottles. Not merely this, the blood extracted from

a donor could be kept in a vehicle and transported to some distant hospital for helping a person in dire need of blood. Very soon the benefit of adopting this technique of non-direct blood transfusion became visible. Thousands of soldiers got a new lease of life by blood transfusions during the First World War.

"In 1940, Dr Karl Landsteiner developed the Rhesus factor, the second most important blood group system after ABO, which divided the blood of humans into various blood groups. "Dr Landsteiner's



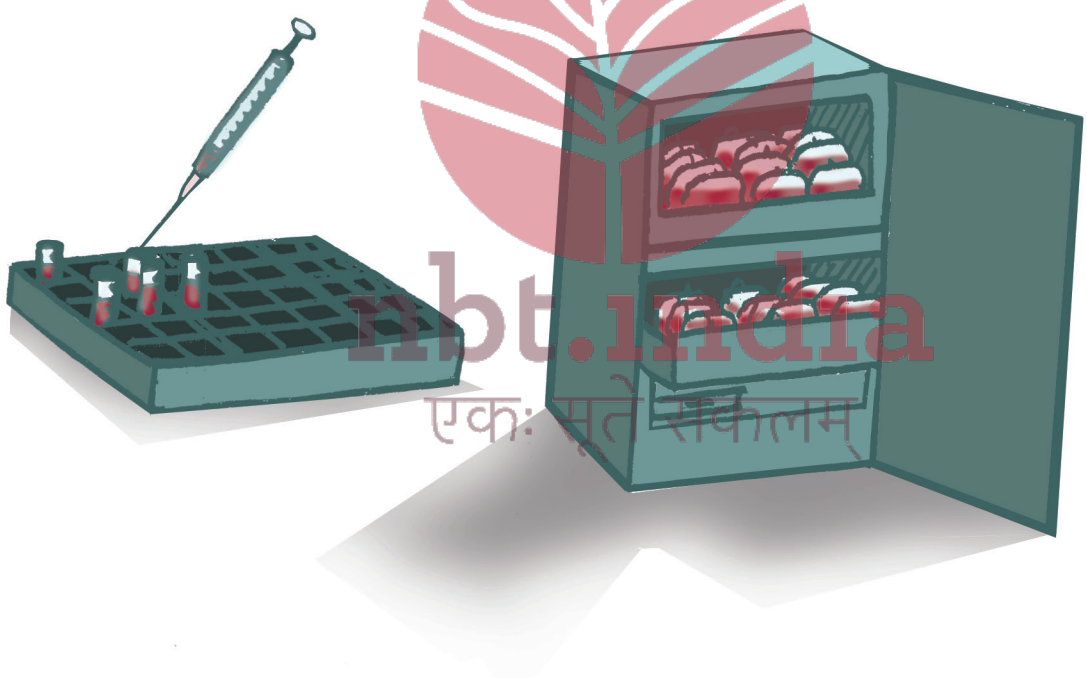
identification of the Rhesus factor divided the blood of all people into Rh positive and Rh negative blood groups.

"There are about two dozen of such human blood group systems on the basis of which blood can be divided into various groups. Out of them there are some blood group systems like Kell, Diego, Lutheran, Duffy and Lewis which were discovered much earlier, but practically speaking the ABO blood group and Rhesus blood groups are the most special as they assure safe blood transfusion.

"In 1943, John Freeman Loutit and Patrick Lowden Mollison discovered a new improved technique which permitted longer term storage of blood during the Second World War. They introduced acid citrate dextrose (ACD) solution, which helped in storing the blood safely for next 21 days at a cold temperature of 4 degrees celsius.

"This revolutionized the concept of Blood banks. Nowadays, we can find many such blood banks in every small and big city of the world, where the blood of all blood groups is collected and stored. As soon as a person is in need of blood his sample is sent to a blood bank."

"*Baba*, can anyone donate his blood and can become a donor?" Ira questioned.



"Yes, Ira! But there are certain guidelines which need to be observed. We can donate blood when we are absolutely healthy and are not suffering from any sort of acute infection. HIV positive people or those infected with the hepatitis virus cannot be blood donors, in particular. In addition, a donor's age should be either more than eighteen years or less than sixty years."

"*Baba*, how much blood can doctors collect from a donor at a time?"

"Ira, around 400 to 450 ml of blood is taken from a donor at a time. If someone is healthy and wants to donate blood he can do so once in every three months, which is a safe interval between donations. The body constantly makes new blood and soon replaces the donated blood in this time span."

"Is it true?"

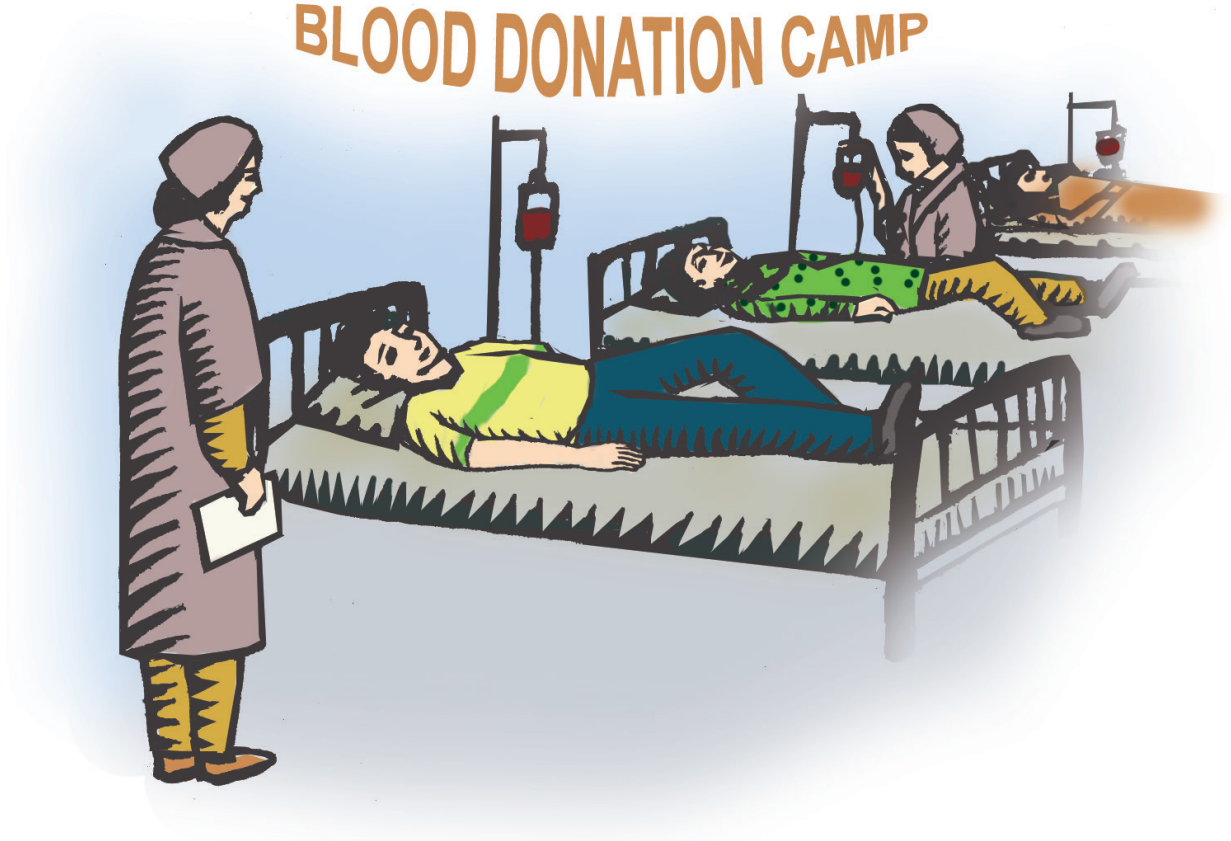
"Yes, dear! Donating blood at regular intervals does not have an adverse effect on the body," *Dadi* jumped in. She had been organising and holding blood donation camps on behalf of Rotary Club for the past so many years in Chandanpur.

"*Baba*, one of my classmates suffering from dengue needed to be given platelet transfusion when dengue fever cases had been reported in the past. I had read in biology that platelet particles are also a component of blood. How do doctors manage to separate out the platelets from blood?"

"Centrifuge machines installed in big blood banks not only separate out platelets, but also separate other components of blood. Spinning at great speed, a small 'centrifuge' spins the blood to separate its basic components on the basis of its particle size and density.

"Red blood corpuscles and plasma, a yellow coloured fluid, can be stored in a blood bank for an entire year. Red blood cell transfusions are given to increase the haemoglobin levels while treating anaemia."

"And what about plasma, *Baba*?"



"Dear, plasma transfusion is given to treat burn patients, people whose blood pressure drops suddenly, and those whose kidneys or liver fail."

"Platelets?"

"Platelet transfusion is for those people who have a low platelet count and if there is an impending danger of internal bleeding or haemorrhage."

"Yes dear! Hundreds of thousands of people get a new lease of life in this world nowadays because tremendous progress has been made in the science of blood transfusion," added *Dadi*.

"*Dadi Ma*, I have decided to donate blood as a regular practice on growing up," affirmed Ira.

"That is splendid, dear!" said *Dada* and *Dadi* pleased with Ira. What made them happy was the fact that Ira as well wanted to follow the footprints of her elders who had dedicated their lives in others' service.

'X' Beams

As *Baba* was all set to go to the clinic so Ira too. She sat in the car with *Baba*, who dropped her to the club. The club had a library, which was the main reason of Ira's attraction. She was really fond of reading and club had a big library with all sorts of old and new books on every subject. Ira was an avid reader. Besides, the librarian was her good friend.

That day she picked up 'Lord of the Rings' from the book rack as soon as she had come. She was thoroughly enjoying the read. The story was so gripping that she did not realise how the time flew by. Her concentration was broken when the librarian reminded her that it was lunch time and *Baba* must be waiting for her.

It was quarter to two. Ira immediately got up and briskly walked towards the clinic. She merely took a few minutes to reach and saw *Baba* talking to a patient in his cabin. An X-ray had been put up on a view box. Meanwhile, she decided to sit in the waiting room.

Baba rang the bell on his desk as soon as the patient walked out of his cabin.

Ira opened the door and stepped inside, "*Baba*, I am next!"

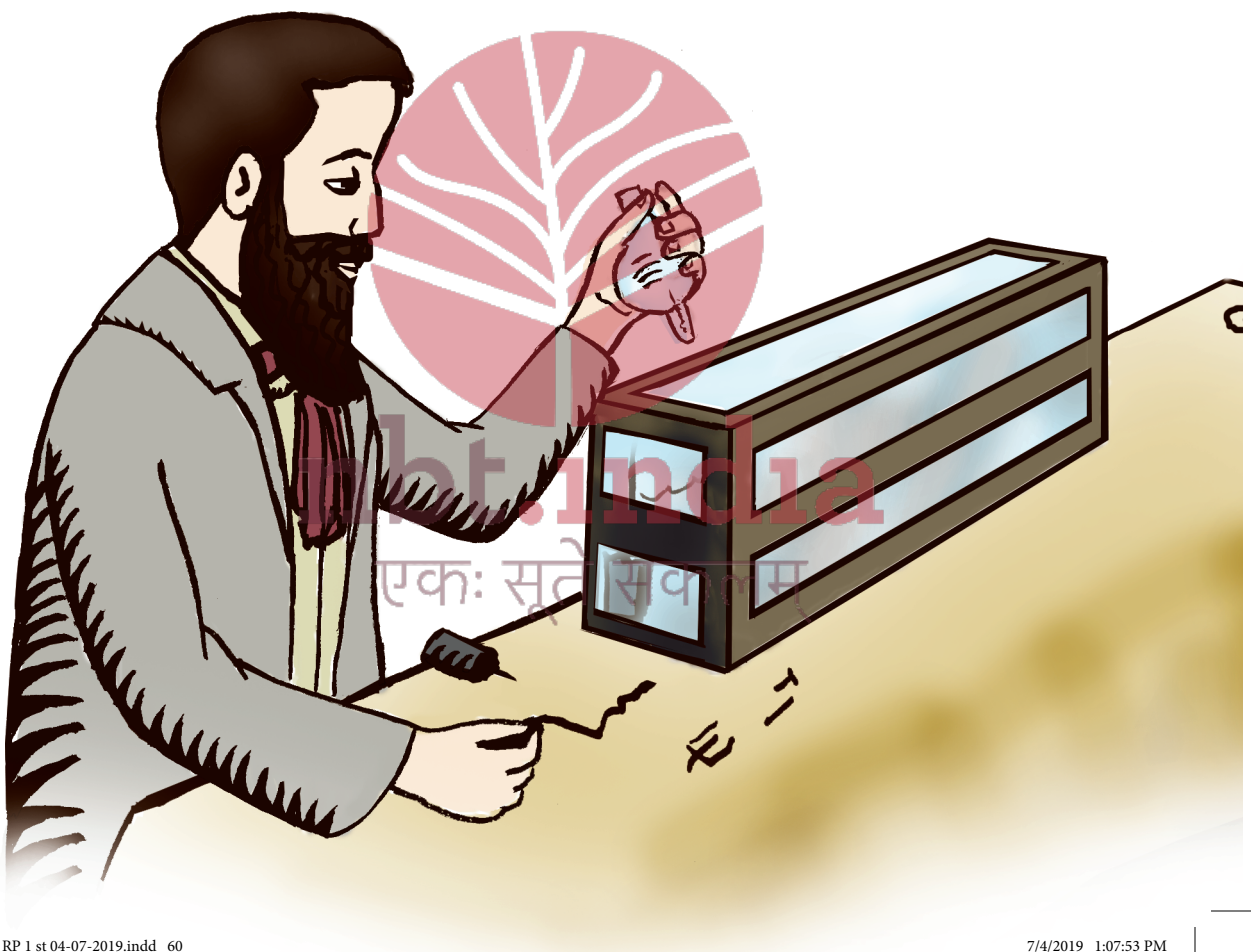
Baba burst out laughing, "Come dear, do come in. Well, shall we go home?"

"Yes, *Baba*!"

While on the way, Ira engrossed in her thoughts could not get the X-ray put up on the view box out of her mind.

"*Baba*, some time back you had put up an X-ray on the view box. I want to know the story of X-rays," urged Ira.

"Let's reach home, have lunch and then we will talk about how the investigative realm of x-rays was discovered."



After lunch, *Baba* and Ira placed themselves in the comfort zone of the living room. *Baba* started talking.

"The matter dates back to the 8 November 1895. Snow had engulfed the entire city while Christmas preparations were underway. Wilhelm Conrad Roentgen, a German physicist and director of Physical Institute in Wurzberg University of West Germany, had set up an apparatus for experiment in his laboratory.

"The experiment was being carried out on a long tube, which was sealed from all sides. This was a special discharge tube. Air in the tube had been evacuated to create a vacuum and low pressure. There was an electrode encapsulated at each end of the tube. The tube had a positive electrode anode, at one end and a negative electrode cathode at the other.

"Ira, this kind of tube had been created by Sir William Crookes, the famous chemist and physicist of London. Roentgen was working on cathode rays produced by this very Crookes tube. Cathode rays had been discovered just a few years back. Roentgen was absorbed in the task of finding the properties of these rays.

"Roentgen applied high voltage current on the electrodes to produce cathode rays within the Crookes tube. Electrons would be emitted at a speed from the cathodes now and cathode rays would produce a fluorescent glow in the Crookes tube.

"Cathode rays were not strong enough to pass out of the Crookes tube into the air, therefore, a small and a thin aluminium

window is added so that one can look at the cathode rays by peeping inside. However, instead of making a small aluminium window in the Crookes tube, Roentgen enclosed it in a black cardboard box. He further covered the box with a sheet of tin. He assumed that the cathode rays in the Crookes tube would be clearly visible to him in the absolute darkness of the box.

"However, as soon as Roentgen bathed the cathode with an electric charge something amazing happened. It resulted in the emission of rays which illuminated a barium platinocyanide screen, kept at a distance of about three metres from the discharge tube. It was dark in the room and the visibility was zero; nothing could be seen. But as and when Roentgen would repeat the experiment the screen would get illuminated.

"Roentgen was astonished beyond words. He began to minutely examine the event. It did not take him long to reach the conclusion that some invisible rays were being produced in the tube, for certain that illuminate the screen. The screen was so far away from the tube that they could not be cathode rays. It was crystal clear that unknowingly Roentgen had discovered new rays.

"Roentgen decided to research about the rays. He began experimenting. Soon after, he kept a thick book lying nearby between the tube and screen. He was again amazed. What was this! The image of the book could be clearly seen, projected on the screen. The thick book was incapable of stopping these unknown rays. After this astonishing experience, Roentgen repeated the experiment with other objects as well. He found that these rays could pass through almost all kinds of objects of random thickness while Lead was the only metal which could block these beams completely.

"One of these day when Roentgen was busy working on these rays his wife visited him in his laboratory. By mistake, her hand came in between the screen and the tube. Roentgen was dumbstruck to see

what ensued thereafter. Ira, just imagine what he would have seen on the screen at that moment?"

Ira could figure out it was X-ray beams.

"*Baba*, the image of the bones in his wife's hand must have been prominently projected on screen.

"Yes, Ira! You are absolutely right. It is not difficult for you to imagine such a thing today since you are accustomed to modern imaging, but how thrilling it would have been to clearly see the image of the opaque bones and translucent flesh of her hand unexpectedly projected on screen at that time."

"*Baba*, his wife must have been terrified watching her bones."

Baba laughed and responded, "I am not sure of that, but I can surely say that it was a golden moment in the history of science. X-rays' entry into radiography and other fields of medical science began from this very moment."

"When did Roentgen give the name of X-rays to these beams?"

"To know more about these rays, Roentgen did a lot of subsequent research and undertook a lot of experiments. He even discovered a technique to keep a record of the image projected on the fluorescent screen (by using a photographic plate to capture the image of various objects of random thickness placed in the path of these beams.) However, he could not find out how these invisible beams are produced in a cathode tube."

Baba paused for a while and continued.

"Ira, you must be aware of the fact that letter 'X' is used to refer to an unknown object in science. To highlight the unknown nature of his discovery Roentgen kept the name of these mysterious beams as 'X-rays.'

"On 28 December, three days after Christmas, Roentgen wrote an article on the basis of his experiences and sent it to a friend of his in Vienna, along with some images. When his work was shown to a newspaper editor he published this news of Roentgen's discovery in his paper, the very next day. It created a sensation all around. Within a week, the news of this unique discovery was printed in bold letters in the newspapers across the world.

"Roentgen was awarded the first Nobel Prize in physics in 1901, the year when the Nobel Prize had begun being awarded to people and organisations.

Here came Ramu *kaka* with tea and snacks.

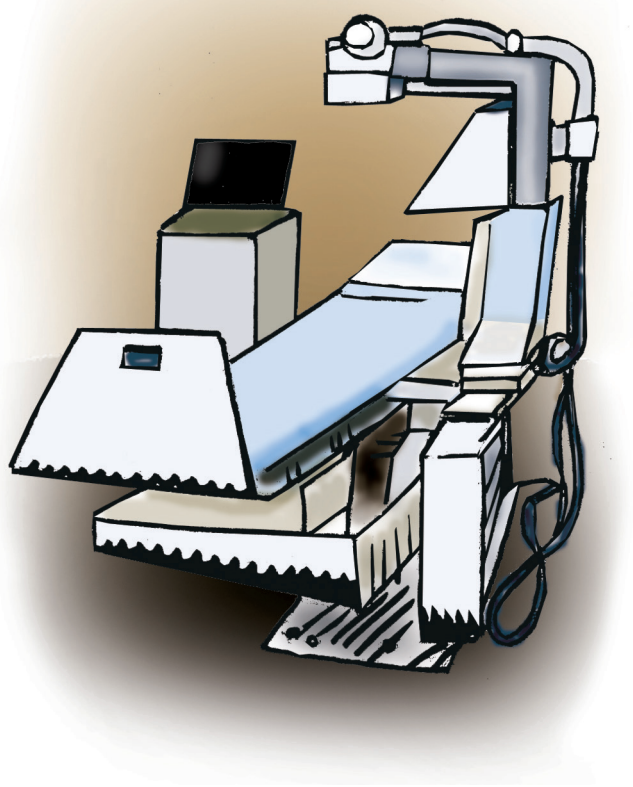
Baba picked his cup and sipped his amazing ginger tea and continued.

"Doctors found that with the help of images produced by X-rays they could get the internal picture of any organ in the body, to see what was happening inside.

"Dear, doctors even found that various parts of the body could be seen separately and clearly by showing up on an X-ray film while the X-ray beams could not penetrate the bones because of their denseness. The bones could be seen as solid or clear white areas on the X-ray film. X-ray beams could easily pass through those parts of the body which contain air like the lungs and intestines. Consequently, these organs could be seen as darker areas on the X-ray film. Whereas, the body parts that contain blood like the heart and arteries appeared opaque on an X-ray film.

"After undertaking all sorts of experiments, doctors began to identify what changes could be seen on taking an X-ray of any part of the human body when patients were suffering from different diseases. Doctors began using x-rays to diagnose fractured bones, bladder stones, TB, pneumonia, tumour, cancer and other disorders.

"Gradually, with time more discoveries were made, which led to birth of the new field of radiology in medical science.



Specialised doctors who could identify diseases in patients by using X-rays began to be called 'radiologists'."

"What you have told me is something really interesting, *Baba*. I have heard that sometimes doctors take coloured X-rays as well. What is the mystery underlying this practice?"

"Dear, certain parts of our body cannot be clearly seen with a simple X-ray. Doctors have found out an easy method to get rid of this problem. When they have to gather information about some specific organ of the body, patient is given a chemical compound to drink, which collects or concentrates in that particular part of the body, which they want to examine. Soon after, a radiologist can take live moving images of that organ from different angles with the X-ray machine. People call these very images coloured X-rays.

Barium sulphate is generally used to help doctors examine the oesophagus, stomach and intestines. The patient is given this compound to drink and live images of inner organs of the body are recorded by an X-ray machine when it reaches its destination."

"Oh! That is why this process is called 'barium test' by doctors," Ira piped in.

"Correct. Various types of iodine-based compounds are also prepared just like barium. By injecting these compounds into the veins special organs like kidneys, urinary tract and urinary bladder

can be examined, the condition of arteries can be assessed, and an integrated assessment of the uterus and fallopian tubes in women can be made.

"Truly speaking radiology is abundantly endowed with so many qualities today that no part of the body can escape its prying eyes."

"Is that true, *Baba*?" asked Ira.

She paused for a moment and then with a mischievous smile questioned, "*Baba*, can doctors read the mischievous thoughts arising in our mind as well?"

"This is indeed a very complicated question! It is not possible with X-rays, of course, but with the help of MRI, another modern diagnostic imaging technique, this is possible!"

Before Ira could ask another question, Baba added, "Several new sciences were discovered thereafter and were linked to radiology after X-rays were discovered. Ultrasound, CT scan, MRI and abdominal CT scan are all names of modern radiology. But we will talk about them at some other time."

God knows what all sweet dreams Ira saw that night. She felt that hidden X-ray machines had been installed in her school ground. Amazingly, the truth of every single friend of hers was clearly showing up on the X-ray films. Indeed, what a splendid sight it was! If anyone had peeped into her mind he would have surely bitten his forefingers in astonishment.

Human Horns

"Ira, look, someone has come to meet you," *Dadi* said. The sound of footsteps could be heard at the front door.

When Ira stepped out she saw *Baba* and his childhood friend Brigadier Gupta walking towards the door.

Seeing Brigadier Gupta, memories of what had happened three years ago freshened up and coursed through Ira's mind. She had come to Chandanpur for her vacations that year as well. That is when she had met Brigadier Gupta for the first time. Seeing his handlebar moustache and his habit of laughing out loud she had been so overawed.

Brigadier Gupta was very jovial. Ira got along with him very well. Besides, Brigadier Gupta had been a renowned hunter in his heydays. If some problem cropped up anywhere he was the first one to be

called by the State Government, very much like the famous hunter Jim Corbett. In addition, he had shot dead several man-eating tigers and leopards that were preying on people in nearby villages.

Brigadier Gupta had narrated several interesting tales and stories to Ira during those vacations. Some of them were about hunting while others were about the battlefield. During the 1965 War, he had been a witness to the skirmishes along the western border of the country.

While engulfed in her thoughts, she started walking towards the two. As soon as she reached

near them, Ira stood in attention and stomping her heels, saluted Brigadier uncle.

"Good morning, Ira reporting sir!" she greeted him with a smile.

Brigadier Gupta gave a responding salute in return.

"Hello, my child! I am so very glad to see you. You have grown up!" he remarked with a smile.

Thereafter, the sequence of animated conversation between Brigadier Gupta, *Baba* and Ira went on for long. While talking, Ira got to know that Brigadier uncle had also started living in Chandanpur. He had bought himself a bungalow in Civil Lines. Whenever they get a chance, uncle and *Baba*, even today, would set off for trekking together and both are still fond of bridge and badminton.

As soon as they entered the home, *Dadi* came out to greet Brigadier uncle.

After exchanging pleasantries Brigadier Gupta said, "*Bhabhi*, let's have a piping hot Darjeeling tea prepared by your hands."

"Yes, of course, why not! I will just go and get it," responded *Dadi Ma*.

Soon after, everyone got busy talking for the next half an hour. Hearing Brigadier Gupta's witty remarks and jokes everybody couldn't stop laughing.

After a while, Brigadier Gupta said, "Okay then, I will get going! It is time for the doctor to go to his clinic. Patients must be waiting for him."

However, Brigadier Gupta made the three of them promise before leaving that they would come to his house for evening tea and dinner.

They set off towards Brigadier Gupta's bungalow in Civil Lines before the sun had set in the evening. The Brigadier and his wife offered them an enthusiastic warm welcome. *Dadi* and Mrs Gupta got along very well so both of them went and sat outside in the garden, while *Baba*, Brigadier Gupta and Ira went towards the living room.

Memories of Brigadier Gupta's hunting sprees came rushing back to Ira's mind as soon as she entered the living room. Photographs of Brigadier Gupta's military life, and stuffed heads and bodies of animals had been strategically placed and mounted on the walls of that spacious room. A stuffed lion, displayed in a corner of the room, looked so alive that it seemed he would start roaring the next moment.

Ira felt as if she is in a science museum as she looked around. Her gaze fell on the horns of a stuffed antelope head mounted on the wall.

When Brigadier Gupta saw her looking intently at the antelope head he disclosed, "Dear, this hunting incident dates back to 1966 when our platoon was stationed in Kumaon. I had hunted down this antelope in the remote jungles of Kumaon."

Baba interrupted the two and said, "The antelope is a very beautiful animal. But, you will be surprised and amused to know that horns can grow on the forehead of human beings too."

Astonished Brigadier Gupta said," Human horns! Doctor, you have disclosed an astounding fact! (Brigadier Gupta addressed Baba as Doctor.)

"*Baba*, how can a horn possibly sprout on a human's forehead?" Ira felt as if *Baba* were fooling them again.

"No child, I am not joking. I have seen such cases myself. The seriousness in his voice made the two believe *Baba*."

When she was leaving the house Ira had decided that she would listen to the hunting escapades of Brigadier Gupta.

But *Baba* had spoken of something so astonishingly unbelievable that she could not refrain herself and urged, "*Baba*, why don't you tell us about human horns today!"

"Yes doctor, let's get going! Once in a while, one gets to read about such incredible matters in newspapers and magazines. It is hard to believe that they are true. We have to be convinced now since you are saying so. Let us also know about the underlying secret of human horns."

Baba could not evade their request. He revealed that, "Horns can sprout even on a human's forehead. The first time I had come to know of this fact was during my days in Medical College. The illustration of a woman with a long horn on her forehead was given at the beginning of our book on surgery. When I saw that picture my curiosity piqued and I wanted to know about her. On searching, I found that this picture belonged to a widow named Dimanche. She

used to sell water-cress in the streets of Paris to earn a living around 1930.

"When Hamilton Bailey and McNeil Love, two famous British surgeons wrote 'Short Practice of Surgery' they so liked the illustration of widow Dimanche with her extraordinary horn that they gave it as the frontispiece, an illustration facing the title page of their book. In case you want to see that picture I can show it to you when we reach home. That book is a part of my collection even today.

"However, this is no marvel to be astonished about. Nor is it something incredibly improbable," Baba clarified.

"Actually it is a special kind of disease affecting the inner layer of our skin. We have a multitude of microscopic sebaceous glands in the epidermis or inner layer of our skin. These glands are found in the greatest number on the face and scalp. You would have seen that the faces of some people are quite oily. This oiliness of the skin is due to sebum, an oily secretion produced by these glands, which ooze out. Sebum is constantly produced by the oil glands and passing through the ducts in these glands it oozes out of hair follicles and onto the skin from time to time. If at some time the oil duct of a hair follicle is blocked due to some reason the sebum collects in the sebaceous gland because of which a small lump or cyst is formed on the skin.

"Sometimes, the follicle of the duct opens and then gets blocked intermittently. When this occurs the layers of sebum oozing from the follicle gather, one on top of the other, and accumulate. These very layers assume the form of a horn with the passage of time. That is why there is no need to be astonished about this fact nor should it be interpreted as linked to some god or goddess. This formation has been given the name of a sebaceous horn. And of course, its treatment is not very difficult. With surgical excision it can be removed from the root and the patient's forehead can start looking normal once again."

Everyone was so absorbed in listening that they forgot about the tea on the table.

As soon as *Baba* finished, Brigadier Gupta exclaimed, "Indeed, this is a very interesting fact you have revealed, doctor! Come let's have tea now."

Soon after he called out loudly, "Kishan, let's have piping hot cups of tea for everyone. And that reminds me, send the cake which James had got in the morning for Ira."

The chocolate cake was truly very delicious. Ira tasted the piece of cake, thoroughly enjoying its chocolate flavour. Ira loves chocolate. In the meantime, Kishan arrived with hot tea. Soon after, Brigadier Gupta and *Baba* could be seen enjoying sips of steaming hot tea.

Meanings

Special air flow pattern: This is such that filtered and purified air circulates and contaminated air is removed continuously. There is restriction of personnel traffic, closing of OT doors and a good ventilation system.

First day covers: are specially designed envelopes with attractive postage stamps which have been postmarked on the day the stamps were issued by the Post Office.

Nerve blocks: is the injection of numbing medication (local anaesthetic) near specific nerves to decrease pain in a certain part of your body during and after surgery.

Putrefaction: the act or process of putrefying; the anaerobic decomposition of organic matter by bacteria and fungi that results in obnoxiously odorous products; rotting.

Regius: (of a professor in a British university) holding a chair founded by or dependent on the sovereign.

Rhesus: The RH factor is the Rhesus (rhesus as in monkey) blood factor. If your blood tests positive for this, you have the factor in your blood. If you test negative, you do not have this factor. The RH factor is a protein found in human blood that is directly linked to the Rhesus Monkey.

A small but noticeable percentage of patients still displayed hemolytic reactions to transfusions of their own ABO blood type.

Chests of such animals: The study of the hearts of dying animals, in which the events of the heartbeats are have considerably slowed down, and therefore more easily discernible

Suppuration: The discharging of pus from a surgical wound.

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