Atomic Bomb Rescue and Relief Report

Takashi Nagai, M.D.

An atomic bomb exploded over the Urakami district of Nagasaki at 11:02 a.m., August 9, 1945.

Translated by Aloysius F. Kuo, M.D. Edited by Fidelius R. Kuo

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Report to the president of Nagasaki Medical University regarding activities of the 11th Medical Corps, August to October, 1945

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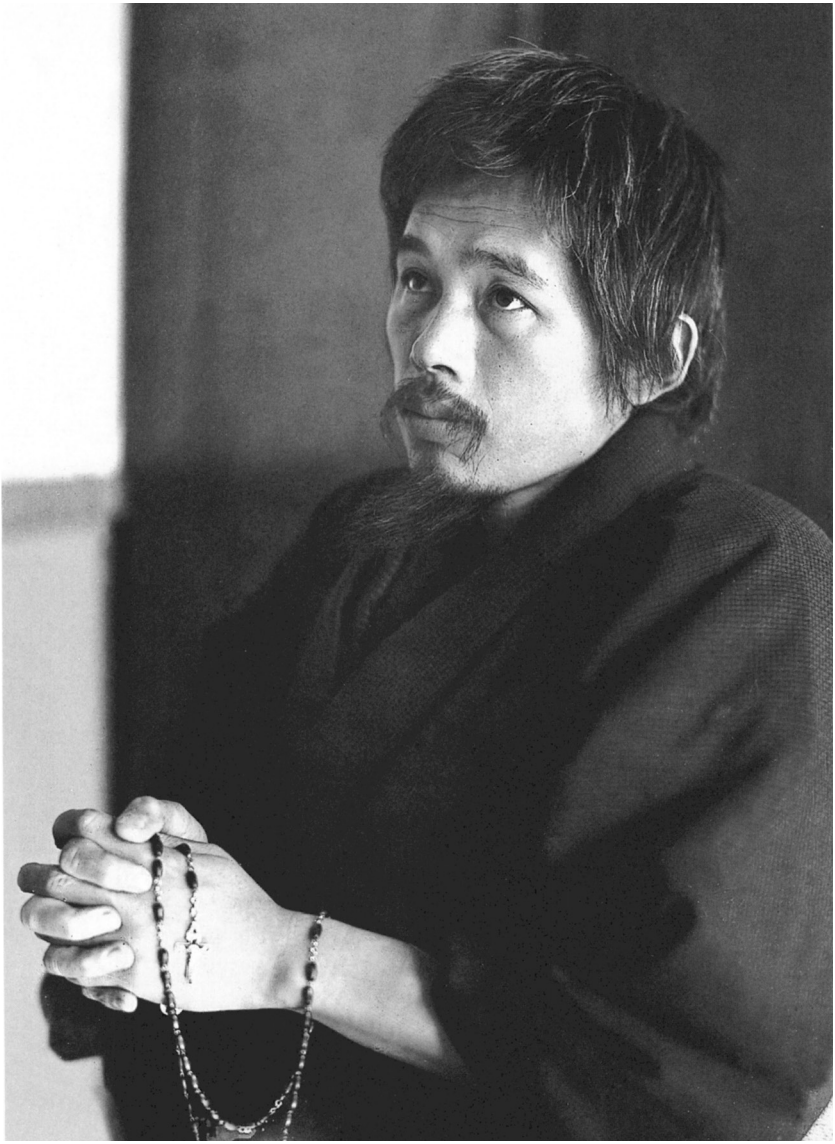

Takashi Nagai, M.D.
February 3, 1908–May 1, 1951

Dr. Nagai stayed in mourning for six months after his exposure to the atomic bombing, seeking "peace" and "restoration" in prayer.

Message

This publication is an English translation of the report by the late Dr. Takashi Nagai on medical relief activities after the Nagasaki atomic bombing. I celebrate the publication of an English version of this precious scientific medical document, and I am confident that it will also serve as a solemn requiem to the atomic bomb victims.

I hope the following article, which I contributed to *The Nagasaki Shimbun*, a local newspaper, in August 1999, will help readers understand how Dr. Aloysius F. Kuo and faculty and staff members of Nagasaki University School of Medicine feel about the atomic bombing.

In spring of last year, Dr. Aloysius Fang-Tsun Kuo, a native of Taiwan living in Maryland, U.S.A., visited Nagasaki University School of Medicine to find the burial place of his elder brother Fan-Huei Kuo, who had perished in the atomic bombing while a second year student in the Special Medical Department of Nagasaki Medical University.

Dr. Kuo had been seeking information on his brother Fang-Huei Kuo since the end of World War II. He had learned the circumstances of his brother's death through a letter from Mr. Hisataka Amano, a former friend of his brother. Communication with Mr. Fujio Nakamura and Mr. Shiro Fukui revealed that his brother had been buried at the entrance of a rifle range by Associate Professor Fukui, who had been digging an air-raid shelter with him at the time (*Testimonies: Voice of Hiroshima and Nagasaki*, Vols. 10 and 11, published in 1996 and 1997, respectively). But no one at the Nagasaki University School of Medicine could identify the location of either the rifle range or the shelter. Professor Tadaomi Aikawa who met then Dr. Kuo said "I have never felt more ashamed in my life."

Staff members of Nagasaki University School of Medicine led by Professor Aikawa commenced a search for the former rifle range and shelter in response to the request by Dr. Kuo. They found a copy of the Nagasaki Medical University campus plan dated 1942 on a bookshelf in the Building Maintenance Office and identified the rifle range on it, then compared a current map with the old map to locate the site. Cutting away thick foliage on a sloping area forgotten for decades, they found the rifle range embarkment and shelter, and the site was confirmed the testimony of people living in the area since before World War II. Old documents revealed that the Pharmaceutical Department, Nagasaki Medical University commenced the digging of a large air-raid shelter in February 1945, and that the Pharmaceutical and Medical Departments, working in shifts, dug the shelter deeper.

On August 9, 1945, at the 9 : 00 a.m. roll call about two hours prior to

the atomic bomb detonation, 29 third-year students in the Pharmaceutical Department begun work in three groups engaged in digging the shelter, tidying up the basement drug store room and working in the herb garden, respectively.

The fatal time of 11:02 a.m. arrived. Only the five students with Professor Seiki who were in the innermost part of the shelter and six students in the basement drug store room survived the blast; all the others died. Fang-Huei Kuo apparently died while digging the shelter, but it is unknown if he was the only person from the Special Medical Department digging the shelter at that time. Out of 112 second-year students in the Special Medical Department who were exposed to the atomic bombing, only four who were in the reinforced concrte hospital building survived. At the time of the atomic bombing, the students of Nagasaki Medical University and its Special Medical Department were attending classes in five lecture halls, and approximately 500 teaching staff and students were killed at the Sakamoto campus where all the buildings were made of wood.

Many teaching staff and students of the Pharmaceutical Department, as well as Fang-Huei Kuo, were killed at the rifle range and shelter. Nagasaki University School of Medicine and Pharmaceutical Faculty of Nagasaki University alumni associations joined in erecting a monument there for the consolation of the souls of the atomic bomb victims and as a prayer for lasting peace. Today, on August 9, 1999, an unveiling ceremony will be held at 10:20 a.m. prior to the Memorial Service for the Medical University Atomic Bomb Victims. The monument incorporates a stone column from the former Nagasaki Medical University lecture hall which was broken into two parts in the atomic bombing.

Dr. Kuo and his son Fidelius Robert Kuo, a journalist, translated the "Atomic Bomb Rescue and Relief Report" by Dr. Takashi Nagai, and their manuscript is scheduled to be published by the Nagasaki Association for Hibakushas' Medical Care (NASHIM).

Richard v. Weizsäcker, former President of the Federal Republic of Germany, left the following words during a visit to Nagasaki University School of Medicine last April: "A person who forgets the past is prone to repeat what was done in the past, but a person who recalls the past inspires new courage to make a peaceful world." We, the staff of Nagasaki University School of Medicine, are determined to observe this maxim.

The untold efforts of many people are required in the publication of a book. I express my hearty thanks to Professor Yoshisada Shibata of the Department of Radiation Epidemiology and Professor Tadaomi Aikawa of the First Department of Physiology, Nagasaki University School of Medicine for their great efforts.

I hope that this book will be read by people around the world as a

scientific record of the atomic bombing and that, in this way, it will contribute to the repose of the souls of the atomic bomb victims.

Hiroshi Saito, M.D.
Dean
Nagasaki University School of Medicine

Nagasaki
March 2000

Foreword

Nagasaki Association for Hibakushas' Medical Care (NASHIM) was established in 1992 with the aim of relief of atomic bomb survivors living abroad and radiation victims who are suffering due to the tragic consequences of radiation-related accidents all over the world. We take advantage of our valuable accumulated experience and scientific data of radiation injury for treatment of Hibakusha (atomic bomb survivors and other radiation victims), and accept medical trainees from abroad, particularly the former Soviet Union. We also invite and give medical examinations and treatment to atomic bomb survivors living abroad. We endeavor to promote international co-operation through Hibakusha medical care from Nagasaki to the world.

One of our activities is a publication project for Hibakusha medical care. We had already published *Radiation Q&A* in Russian, *Nagasaki Symposium Radiation and Human Health: Proposal from Nagasaki* in English in 1995, in 1996, *The Environmental Radioactivity and the Health Status of Residents and Cattle in Mid-Kazakhstan* in Japanese, and in 1998, *The Matter of Radioactive Contamination in Taiwan* in Japanese. We also produced a video entitled *Kazakhstan Now* as well. In 1999, the 50th memorial year since the Semipalatinsk Nuclear Test program commenced, we held a remarkable picture panel exhibition for two months at Nagasaki Atomic Bomb Museum. Also, The Nagasaki-Hiroshima Atomic Bomb Exhibition was opened collaboratively for the first time at Semipalatinsk and Almaty of the Republic of Kazakhstan. We contribute to the education of the medical community and general public through enlightened medical care of the Hibakusha both internationally and domestically. Furthermore, we are continuing activities of Hibakusha medical aid commenced at the beginning of the nuclear disaster at Chernobyl, and are still collaborating with the former Soviet Union.

The publication project, this time is about publishing an English version of the priceless medical relief report, in book form, from Dr. Takashi Nagai. He pursued relief action as associate professor of the Radiology Department of Nagasaki Medical University in the chaos just after the atomic bomb explosion. At 11 : 02 a.m. on August 9, 1945, we suffered catastrophic damage by an atomic bomb which came after the Hiroshima atomic bomb attack. As a result, Nagasaki Medical University and its affiliated hospital located 500 to 800 meters away from the hypocenter were destroyed, and most importantly the staff members, students and nurses, in total 897 persons, inpatients and their helpers, 72 persons, lost their lives. Total casualties were 74,000 persons dead and 75,000 persons injured by the end of 1945. We describe atomic bomb radiation injury as an early onset and severe disorder. As for atomic bomb survivors, many are still suffering delayed onset radiation disorders such

as malignant tumors.

We have therefore decided to publish, as the NASHIM publication project of year 1999, an English version of this significant and vividly recorded medical relief report by Dr. Nagai who was a victim himself and a staff member of the only medical college destroyed by an atomic bomb in the world. Dr. Nagai published many well-known books in the short period remaining in his life and rang the bell of peace immediately after the atomic bomb exploded until he died. He was a shining example and great promoter of the peace movement during the astonishing postwar recovery. We wish more people to read the English version of books relating to the atomic bomb, and to get as many visitors as possible in Nagasaki, to see it, to feel it, in this place of unheard-of calamity caused by the atomic bomb.

In 1995, we established *The Takashi Nagai Memorial Nagasaki Peace Award* in memory of the 50th anniversary of the atomic bomb attack as an award given every two years to individuals/ organizations who have contributed to improve the state of medical care for the Hibakusha. We, furthermore, wish for people to know the real consequences of atomic weapons and learn the preciousness of peace, and we hope this will contribute to unite the international community in peace with prosperity in coexistence towards the 21st century.

Finally, we thank the Nagasaki University School of Medicine for permitting us to publish an English version of the report, Dr. Aloysius F. Kuo for translation, Mr. Fidelius R. Kuo for editing, and Dr. Stephen and Mrs. Yoko Gadd for valuable comments on the manuscript.

Tetsuya Iseki, M.D.
President
Nagasaki Association for Hibakushas' Medical Care

Nagasaki
March 2000

Preface

*We were members of a research group with a great interest in nuclear physics... ironically we ourselves had become victims... of the theory we were studying... And yet it was a precious experience for us. Placed on the experimentation table, we could watch the whole process in a most intimate way... Crushed with grief... filled with anger and resentment, we nevertheless felt rising in us a new drive and a new motivation in our search for truth. In this devastated atomic desert, fresh and vigorous scientific life began to flourish.

Takashi Nagai *The Bells of Nagasaki*

Atomic Bomb Rescue and Relief Report is one of those first seeds of the "vigorous scientific life" that Takashi Nagai wrote of. This report was written as soon as one month after the atomic bomb explosion, from Nagai's sickbed in some instances when he was not expending his remaining strength to tend to atomic bomb patients. Here, Nagai gives an explanation of the physics of the atomic bomb, a description and classification of atomic injuries, and more importantly and true to Nagai's medical spirit, recommendations for prognosis.

Few people come as close to exemplifying the spirit of scientific and medical humanism in the face of atomic warfare as Nagai, Associate Professor of Radiology at the Nagasaki Medical University. From August 9 to October 8, 1945, the 11th Medical Corps, comprised of Nagai and eleven other surviving nurses, medical students, and an associated doctor, worked tirelessly to save the lives of countless patients in and around the Urakami area of Nagasaki.

The Bells of Nagasaki thoroughly describes Nagai's activities as Captain of the 11th Medical Corps and eloquent thoughts on the evils of war. Since its publication in 1949, the work has been translated into many languages and read all over the world. However, unknown to many people, *The Bells of Nagasaki* was not Nagai's first attempt to put into writing his account of the events of that day or his scientific observations of atomic war injuries. Instead, this report, *Atomic Bomb Rescue and Relief Report* came first.

Ironically, the president of the medical university, Professor Tsunoo, passed away before he could read the report. Subsequently, perhaps, the neighbor, who was asked to transfer the report, put it away for 25 years. Nagai never even mentioned the work himself, according to Professor Nishimori Kazumasa. Why ? We'll never know for sure. What is important is that in 1970 this work was finally added to the international canon of atomic bomb literature. This translation is the first English translation of *Atomic Bomb Rescue and Relief Report.*

The reader may feel that the report is choppy in its style : a narrative

in one place, a medical description of injuries in another, a physics lesson in another, then a self–critique. However, one must remember that this is an official medical report, a document for no other purpose than to inform the president of the medical university the best course of action to take for the atomic bomb patients it would have to treat in the future, as well as his attempt to explain to other Japanese the physics behind the atomic bomb.

Readers may find that Nagai's early conceptions of the weapon and how it injured people as not entirely correct. However, one must remember the United States produced the atomic bomb in great secrecy and would not divulge many facts for many years. Therefore, Nagai could only use only what information about nuclear physics he and the rest of the scientific community knew or thought to be true.

Nagai spoke of a "secondary atomic explosion," meaning a secondary subcutaneous explosion under the skin caused by the radiation effects of the bomb. He also referred to radiation–induced burns as "pseudo" for lack of another word to describe the phenomena of a wound that seemed to be caused by something other than heat. If Nagai seems tentative in his observations, one must remember that he was treating patients such as the world had never seen before, the first of their kind : the atomic bomb victim.

In his first chapter, he refers to the concept of the atomic bomb as *so –zo*, which literally means "imagination." Why did he choose this word ? At the time, the conception of the atomic bomb really was more in the realm of imagination than in scientific possibility. Nagai and most of the scientific community were not even aware of the existence of plutonium–239, a fissible by–product of uranium. The atomic bomb dropped on Hiroshima utilized a uranium fission explosion, but Nagasaki's bomb utilized the more advanced plutonium core.

As narrative alone, *Atomic Bomb Rescue and Relief Report* is engrossing enough. This report is a first hand–account of the atomic bomb experience through the eyes of a radiologist who attempted to discern the scientific principles behind the atomic explosion, then a doctor who had to rescue and treat its patients, and finally as a righteous man trying to make sense... if not find some kind of redemption from the almost senseless apocalyptic–like destruction of the atomic bomb.

Nagai erred when he said that he himself was responsible for not preparing the university and Nagasaki for an atomic bomb attack. One must remember that before Hiroshima and Nagasaki, no country would have thought the use of atomic weapons was possible. The university was well prepared for a conventional TNT bombing attack, but not the atomic bomb, which absolutely no one could have foreseen.

Nagai was also mistaken when he critiqued himself and the Corps as "a bunch of cowards." In a truly heartbreaking passage, Nagai writes of how at one time he and the Corps members became so overwhelmed with exhaustion and injuries that they could not rise to tend to patients left lying in a field. He begs forgiveness of the reader, but if the reader

understands that Nagai and the team members were debilitated themselves, one understands it is we who should be forgiven if we are critical in any way.

The 11th Medical Corps members were never negligent of their duties. They performed their medical duties under the harshest of survivors' circumstances, an atomic wasteland. They worked when virtually all of them had been injured and should have been convalescing themselves. And they did their operations without the amenities of plentiful supplies, ambulances, and support staff. They had to literally carry many of their patients by hand. Each and every member of the Corps is a true hero already for having done as much with so little to begin with.

Nagai's justification for the bombing of Urakami and the loss of his wife and so many of his friends, students and colleagues was that Nagasaki would be a laboratory for the international community to study the medical effects of atomic weaponry, then come to the sane conclusion, supported by all the medical and scientific evidence, that atomic weapons should never be used again on people.

Atomic Bomb Rescue and Relief Report should be perceived as one of civilization's first contributions to that pool of knowledge concerning atomic medical science. It is written with Nagai in the role of physician, researcher, and a humanist who not only witnessed but also suffered the terrible effects of atomic warfare on human beings.

As we move into the new millenium, with more and more nations joining the "nuclear club" each year, let us not forget the lesson Nagai taught us by example, to work for peace.

Fidelius R. Kuo
September 1999
Potomac, Maryland USA

Notes:

*Quote from Nagai Takashi's *The Bells of Nagasaki* is from the following edition: Nagai, Takashi *The Bells of Nagasaki*, translated by William Johnston, Kodansha International: New York, 1984.

The translator, Aloysius F. Kuo, M.D., is a medical pathologist and served as Chief Pathologist of the Bureau of Laboratories Pathology Department in Washington, D. C., USA. His brother, Fang-Huei Kuo was a 2nd year student at the Nagasaki Medical University. Fang-Huei was among the 896 who perished from the medical school the day of the bombing.

The editor, Fidelius Kuo, is a former reporter for the "Northwest Asian Weekly" and the "Asian Focus."

The cover of the Atomic Bomb Rescue and Relief Report (upper panel), the list of Mitsuyama Relief Team Members (lower panel, right) and the first page of Section 1, Chapter 1 (lower panel, left).

Map of Nagasaki City and its Environs

The 11th Medical Corps left Urakami early in the morning on August 12, 1945 walking to Mitsuyama to set up an aid station. They began patient care at four o'clock on that afternoon as the Mitsuyama Relief Team and continued the relife activities for 58 days until the team was dissolved on October 8, 1945 (*cf.* Section 3, Chapter 3).

Summary

The atomic physics developed from atomic theory demonstrated the possibility of the use of atomic energy for a new source of power. A group of American scientists successfully weaponized and dropped the first atomic bomb on Hiroshima August 6, 1945. On the following August 9, the second bomb was dropped on our heads. The surrounding Nagasaki Urakami area of the university was annihilated and Japan fell as a defeated nation.

Here, I will simply explain the principle of the atomic bomb and the actual conditions of the bombing and the conception of general radiation injuries. Next, I will describe the activities of our rescue and relief team in detail which pushed us into Nishiurakami Mitsuyama-machi. We recorded our experiences and treated patients in this area. Here, we treated 125 atomic bomb patients. There were a total of 2,829 patient treatment days. The duration of the relief operation was 58 days. There were 12 relief team members. Twenty three percent of the patients died.

According to the time illnesses began they can be classified as such: sudden, early, late and delayed onset. Also they will be recorded as such: external injury, pseudo-burn, combined injuries, early onset digestive disorder, early onset blood disorder, late onset blood disorder and indirect disorder.

As for the treatment we tried an auto-blood transfusion method which we found to have a very good effect and which rescued many patients. Also, we applied mineral spring water treatment and got good results. In short, auto-blood transfusion stimulation shortens therapy time by two weeks and the mineral spring water therapy also shortens by two weeks the number of treatment days. Also, the patient-care environment is important. The patient needs a rest in the home.

I also discuss the features of the body injuries of the people at the hypocenter and several observations based on our experience of the atomic bomb.

At last, we review our activities and try to pursue responsibility for defeat. For the conclusion at this chance I sincerely feel that all Japanese should have an understanding of pure science radiation atomic physics and the desire for peaceful uses of atomic energy.

Contents

The Eleventh Medical Corps (Radiology Department Group)

List of Mitsuyama Relief Team Members:

Takashi Nagai (injured), Associate Professor, Captain
Kuen-Shan Shi (injured), Substitute Associate, Deputy
Yoshinori Seiki (injured), Instructor
Ching-Shing Shi (injured), Technician
Shiro Tomokiyo, Technician
Shisono Hisamatsu, Head Nurse
Momoye Oishi, Nurse
Chitoko Hasmimoto, Nurse
Masako Tsubakiyama, Nurse
Yuriye Moriuchi, Technician
Michio Nagai, Medical Student 3rd Year
Kazuma Tsutsumi, Medical Student 3rd Year

CHAPTER 1

Imagination Regarding the Atomic Bomb

SECTION 1

Explosion of the atom

Atomic theory

In ancient times, there was the belief, both philosophically and physically, that matter was made of continuous elements like seawater and non-continuous elements like beach sand. Later, modern science divided matter further till there was the smallest element, which could not be divided further, yet keeping space between each other like sand particles. This is atomic theory.

Atoms

Matter is made of 92 elements on the earth. The smallest unit of these elements is called the atom. The size of the atom is really very small. To understand its smallness, think that an atom on the skin of an apple when magnified is proportionally the size of an apple on the surface of the earth. It is very small.

Atomic structure and extranuclear electron

The smallest and simplest element is hydrogen. The largest and most complicated is uranium, whose atomic structure was discovered by Dr. Nagaoka of our country. According to him, the atom is made of an atomic nucleus surrounded by rotating electrons. The explosive reaction of a gunpowder bomb is by external electrons, but the atomic bomb is by nuclear fission.

The structure of the atom is as follows. A particle called the neutron, which doesn't have positive or negative charge, and another particle called the proton, which has the same weight as the neutron and is positively charged, make a mass by having the utmost bonding together. The number of protons in the nucleus is constant for each element. For example, the simplest, the hydrogen nucleus has a single proton, whereas the most complicated, uranium, has 92 protons. The number of neutrons is almost constant for each element, though it varies a little. The number of extranuclear electrons and internuclear protons is the same, so that each atom does not show electric charge. The repulsive force acts between two electric charges of the same sign.

Nuclear energy

In the nucleus many protons repel each other. There, particles must bear

great power, a potential to hold these protons inside the nucleus. Also, electrons have to rotate with constant speed in constant orbit, so they will not be drawn into the positively charged nucleus. The source of the potential rotating power must be in the nucleus.

If the atomic nucleus is broken, the separated conjugation of the neutron and proton releases its potential power, and there will be tremendous power relative to the size of the atomic nucleus. For example, the ratio of power inherent in atomic matter the size of a matchbox could blow up a battleship. This is the conception of the atomic bomb.

Decay of the atom

It is already known that uranium decays naturally and releases particles and atomic energy as radiation at the same time. Uranium changes to simpler atoms by decay, as it becomes the famous element, radium. Radium and its series elements perform natural decay violently, releasing radiation. This is the well-known power utilized for medical purposes. Since the natural decay of uranium and radium already releases tremendous power, the artificial breakdown or fission of a large amount of uranium would mean an even more terrible, powerful force of radiation. Therefore, every country looks for uranium material to make atomic bombs. However, the destruction of the atomic nucleus requires a collision with a high energy particle.

In the research stage before the war the initial fission reactor apparatus was so unwieldy that atomic bombs were not considered a useful weapon. After the beginning of the war, scientists of many countries worked to discover a simple and light apparatus for the destruction of the atomic nucleus. Of course, our country was progressing in its atomic research, but we had only a few scientists specializing in the field, as well as capable assistants who were drafted, and only a little money left for research. Therefore, with great numbers of scientists and such a large budget of $1.2 billion US dollars and reliable and serious military support, American scientists were able to complete the development of atomic bombs first.

SECTION 2

Circumstances of the bombing

Surprise bombing

There was a public announcement that a new type of bomb was dropped on Hiroshima, August 6, 1945, which resulted in substantial damage. Because the announcement did not offer further details, people were not prepared for the atomic bomb. Therefore, when Nagasaki was attacked with the same bomb on August 9, the military, government, and people were caught off guard. Even though I was interested in the atomic bomb,

I did not know of its existence until I saw the enemy's propaganda leaflets scattered that night. The truth of the situation is that the entire Japanese population was caught by the surprise lesson from the enemy.

Bombing method

It was an ideal day for bombing. From the preceding day, a few enemy planes were circling Nagasaki air space constantly. In retrospect, these were reconnaissance flights observing the weather and activities of the people.

However, all enemy planes eventually cleared the Kyushu district and the air-raid alarm ended at about 10 : 00 a.m. The people of Nagasaki came out of their shelters and started to work seriously in each of their work stations. At this time, an enemy plane, carrying the Devil, came through Shimabara from the direction of Nobeoka, and skillfully intruded into Nagasaki. At 11 : 02 a.m., the enemy plane slid into Nagasaki, stopped its engines, and dropped a bomb with a parachute at 8,000 meters altitude. The enemy plane ascended at full speed immediately after dropping the bomb and got out of the way. The people who realized it was an enemy raid hurriedly jumped into shelters. However, the sound waves from the descending bomb took a few moments to reach the surface of the ground. The bomb exploded in the next moment following the hearing of the sound. The epicenter of the explosion must have been 500 meters above Matsuyama-machi.

From a tactical viewpoint, the target point slipped to the north. Perhaps the main target was Ohato pier, but it deviated northward by mistake. If the bomb had dropped on the pier, the entire city of Nagasaki, including Urakami, would have been annihilated with only one bomb.

Experiencing the bomb blast

First, people heard the unusual roaring of an engine, followed by the flash of a very bright white light. Some people said that the earth's surface lit up red. The people called this *pika*, which means a lightning bolt from the blue sky visible to the naked eye. Moreover, anybody facing the epicenter or the opposite direction must have seen the same thing, a flashing light which must have covered the entire sky. The people in the hypocenter felt heat on their skin. Following that came the blast of the atomic bomb.

Hell on earth

Everything on the earth was shattered instantly. The earth became bare! Within one kilometer, wooden buildings were smashed. Steel concrete buildings collapsed. Factories were flattened. Tombstones were knocked over. The leaves of plants were blown away. Big or small, all trees fell down. Any living creature outside, from insects to cows, horses, humans, died instantly. People were buried by their own houses collapsing on them. In one moment, the Urakami area had changed to a hell on earth. It took only one moment.

Everywhere, brush fires started, yet there were no survivors who could fight the fire. The whole area became a sea of fire. Everybody, including the dead and injured, was burned by this conflagration. Survivors received whole body doses of strong radiation, which became a kind of radiation poisoning, because of which they could not keep up their fighting spirit. Their movements were dull.

This horrific scene has been branded on my mind. I will never forget. It is far beyond my ability to describe. This must have been the Apocalypse or a scene right out of hell. How awful was the sight of groups of people climbing the hills on the far side to avoid the fire. The injured also pulled their dying friends. Children carried their dead parents; parents held the corpses of their children, as they desperately climbed the hill. Their skin was stripped, stained with fresh blood. Everybody was naked. They kept looking back at the spreading flames, as they sought safety.

Was anyone there to help? Moaning, crying out, some of them faltered and died. Some of them became insane and just kept running around. Here and there voices called for help, screaming out from burning, fallen houses. This scene was profoundly sad. The pass on the hill to the valley was filled with dead and injured people moaning, "Please help me, please give me water." And there was no place to rest.

At first glance, perhaps 20,000 people died instantly, and several tens of thousands of injured would be numbered. The worst things were that the university's emergency medical organization and equipment, expected to perform well, were in the hypocenter. Not only was the building destroyed and burned, the president was injured, the hospital superintendent was dead, and most of the staff members, students and nurses, were dead or injured. Rescue activities were totally lost.

Immediately after the bombing, a giant and thick gas like cloud covered the entire hypocenter. Because of this, people in the hypocenter lost vision for one or two minutes. People in the far distance recognized many lightning like flashes in the gas cloud. The gas cloud gradually ascended, staying above the sky even in the night.

Two hours later, the burning fire reached its maximum intensity. The local winds often changed direction. At 1:00 p.m., the weather was still sunny. Big black drops of rain fell from the clouds. The enemy planes kept coming back for reconnaissance. The burning fire gradually subsided, but it continued to burn and spread around even into the night.

Scene in the night

The sun set. A cool new moon lighted low above Mt. Inasa. The gas cloud was still hanging in the air. The apocalyptic flames of the end of the world illuminated the city. The wind gradually calmed down. Choral singing of "Umiyukaba" arose from the valley. The hymn continued from the fields, purifying the minds of the dying people.

Patients on the hill cried for help. The patients lying next to me asked for "water, water." Survivors and the dead stayed overnight in the fields

under constantly low flying enemy planes.

SECTION 3

Function of the atomic bomb

Mechanism of action

With the above conditions described and the investigation after the bombing, the function of the atomic bomb must be hypothesized as follows : the used atom must be of the uranium or radium series. However, it would not be possible to estimate its atomic weight.

Three kinds of power

By the fission of a great amount of atoms at the same time, potent energy was released. What flew out of the explosion ? I would hypothesize the energy to be three kinds of matter : particle group, electromagnetic waves, and atomic energy, particularly atomic nuclear energy.

Particle group

First, neutrons, protons, and electrons which resulted by the complete fission of atoms ; Second, atoms of an unstable condition just prior to the fission ; Third, new elements, e.g. radium, radiation atoms created from the atomic fission ; Fourth, uranium atoms of incomplete fission. These are solid particles below the second group, which have the potential to be radioactive after decaying naturally. This is the cause of long term radiation affecting human bodies at the hypocenter after the bombing.

Electromagnetic waves

Fifth, nuclear vibrations at the time of the atomic bomb explosion were ejected as radiation. These electromagnetic waves were a mixture of wavelengths. One of them was long wavelength like a heat wave. This gave heat to skin and caused burns. Also, there was visible light, which was visible as flashes. Ultraviolet rays were probably ejected also. Furthermore, it has been theoretically known that short wave electromagnetic waves such as X–rays and gamma rays with strong penetration power were produced. In retrospect, human body disorders developed later after exposure to such large amounts of gamma rays. Also, cosmic like rays could be mixed in the ejection.

This is electromagnetic wave in contrast to previously–mentioned solid particle rays.

Atomic energy

The next is the release of energy, i.e. the main power of the atomic bomb explosion. The tremendous power of matter potentially present since the beginning of the world is released in a single stroke by nuclear fission.

This is similar to condensed air spreading with great speed when a container is broken. This spreading becomes a storm–like explosion that destroys everything. It is believed that the previously mentioned three kinds of power comprise the force of the atomic bomb : destruction is by atomic energy, primary body injury is by electromagnetic wave, and secondary body injuries are caused by the particle group.

Speed

Because the speed of electromagnetic waves is 300,000 kilometers per second, it takes one electromagnetic wave 600,000ths of a second to reach 500 meters, from the air to the ground, which is to say the time is momentary. Therefore, as soon as one sees the flashing light, electromagnetic waves have already passed through the body ; irreversible injuries are already present. So, people who jumped into the shelter after seeing the flashing light, even those not injured by the blast, had already received atomic radiation. These people were not injured initially, but developed many severe symptoms later. The speed of the blast was almost the same as sound waves. But, I do not know if the speed is exactly the same or not. The speed of this particle group is unclear. However, I would imagine that there are different speeds according to the composition of particle.

Reaching distance, distribution density, reflection interference

The flashing light appeared to be the greatest in the reaching distance. Considering the distribution density of particle, there were more groups of particle in some places, less in others. The idea that the density was not even became theoretically and practically sound considering that there was quite a difference in the prevalent rate of secondary radiation injuries in later days.

The electromagnetic wave blasts also probably had inconsistent particle density. The electromagnetic waves were probably even in each direction. Because Urakami's geographical features resemble a ship–conformation with reflecting mountains on each side, the directions of the blast became complicated and stirred up the ground. This made blast results different from Hiroshima, which is on flat ground. The interference of the blast waves by the mountains, seen in the wind's sand lines, was visible from the university playground. Also, the houses on the hillside were seen to move away from the direction of the associated and yet also from the reflected direction of the hill. Some people heard two consequent sounds of the bomb blast. There are many houses whose indoor items were stirred up.

Also, it is considered that the direction of the blast reflected off the ground and moved parallel to the ground surface. Houses a short distance from the hypocenter had their floor joists collapsed and the tatami mats on the first floor were blown up. The stone fences on the road were seen to be pushed horizontally, even towards the direction of the hypocenter. Many Western–style tombstones were also seen to have moved hori-

zontally.

Ionization

There is no question that negative and positive ions were made when short wave electromagnetic waves, like gamma rays, passed through the air. The particle group passed through next. Probably, this particle group ionized molecules in the air. On the other hand, the particle group was electrically neutral, but there were many others negatively or positively charged according to electrified bodies in the air conjugated or repelled each other, which must have started a chemical reaction. This must have been the cause of the thick gas cloud that developed. Also, many small flashing lights in the gas cloud must have been caused by the electric discharge during neutralization. The negative or positive electrified body loitered on their way like that. However, the neutrons went straightaway to exhibit their great power on the earth, without any interference.

Secondary radiation

Farther on, these electromagnetic waves and particle groups developed secondary dispersion rays as they went through the air. This secondary radiation was also electromagnetic waves and particle radiation. The radiation, which reached the ground, was primary radiation ejected from the bomb, adding to the secondary radiation.

In general, radiation penetrated substances. Ultimately it was absorbed and showed its effects. It is considered that the radiation was very powerful and destroyed the atoms of any substances it penetrated, causing a secondary atomic explosion. It is questioned if this secondary atomic explosion was powerful at the time the bombing observation. For example, the surface of the roof tiles of unburned houses became roughened. And, most interestingly, the shadows of grass were implanted negatively on electric poles. If this was from primary rays coming from above, the grass blades shadows should have been cast down onto the ground. To implant a silhouette from above on to an electric pole, from a ground source, there must have been reflection from below to above. In conclusion, the shadows on the poles must have been the result of secondary radiation.

Absorption by water

There was an interesting case regarding water absorption. Three children were swimming in the river. Two of the children were diving about half a meter deep into the water. One just floated, exposing his back to the surface. The first two had no burns, only the third child received burnt skin injuries on his back. Also, goldfish in the water tank survived. The water easily absorbed the neutrons.

In this case, neutrons were the main cause of destruction. But, heat rays will also be absorbed by 50 centimeters depth of water.

CHAPTER 2

Main Features of Radiation Disorder

Latent period

Radiation may cause destructive and regressive changes of the tissue cells. These changes take awhile to show symptoms. There is a so–called latent period.

This time, some people developed severe symptoms later, even days after they had received no apparent injuries that day (of the bombing).

Tissue sensitivity

The sensitivity of tissues exposed to atomic radiation is different for each tissue. However, the most sensitive tissues with the most severe damage appeared to be the bone marrow and the lymphatic system. At this time, blood disorder of the bone marrow was remarkable, followed next by the thymus, then reproductive gland. These symptoms were also recognized at this time.

Next the mucosa is frail (and vulnerable to atomic radiation).

This time, symptoms of disorder to the digestive systems' mucosa developed in early stages. Almost all victims developed diarrhea. Lots of people became critically ill and died. The exocrine organs and hair papilla were damaged. Depilation (hair loss) was seen quite often at this time.

The skin was quite resistant. Instant skin pseudo–burns were due to long wave heat rays. Radiation injury by short wavelength rays could develop later. Medium damage occurred to the lungs, kidneys, adrenal, liver, and pancreas.

Muscle, connective tissue, blood vessels, cartilage and bone were resistant (to atomic radiation). The most resistant (to damage) was believed to be nerve cells. However, if there were large doses of nerve irradiation at the time, the resistant tissue was also changed.

There was a correlation between the ages of the victims and their tissue sensitivity to atomic radiation. Infants and small children had more injury to their cell tissue. Cells are more sensitive when developing, becoming more resistant when matured. Also, an individual's physical constitution is related to how much cellular damage his tissue sustains.

Tissue injuries

The lymphatic cells were destroyed most severely. But, their power to reproduce was also strong. The spleen, lymph nodes, tonsils are examples of this reproductive power. In bone marrow, first the lymphatic cells were destroyed. Next, the cells of the hematopoetic system were destroyed, followed by red blood cells. If the damage was severe, the bone marrow would become fibrosed.

The reproductive organs were quite often destroyed. Irregularity of menstruation and infertility occurred. It might be temporary with a small dose of radiation, but permanently sterilizing in larger doses. There were cases of malformed infants at birth, which could have miscarried during pregnancy.

In the liver, spotty necrotic foci developed. The pancreas, which decreased its secretion, also developed fibrous scars. The kidneys also showed signs of atrophy. Their function was disturbed and water (urine) output decreased. It could have been due to nephritis. The lungs developed the pathology of pneumonia. Each secretory organ decreased its secretion. The growth of bone cartilage in small young infants was disturbed in their growth. The gastro–intestinal mucosa developed inflammation, which could form ulcers.

Symptoms of diarrhea were certain; they may be associated with bloody stool, tenesmus and frequent colic. The eyes developed cataracts. The changes to blood are remarkable. Coagulation time was prolonged. Platelets decreased. Hemolysis of the red blood cells became visible, which caused hemorrhagic diatheses. The amount of white blood cells increased slightly immediately after irradiation. Later, they remarkably decreased. And then again the white blood cells increased and could become leukemia.

Whole body injuries

The whole body injury symptoms are obvious. Subjectively, one complains of fatigue, apathy, headache, loss of appetite, and nausea. This so–called radiation sickness could happen immediately or on the following day. The duration (of illness) varies and could be prolonged up to two weeks.

CHAPTER 3

Activities of the Medical Corps

SECTION 1

The day of the bombing

Bombed

The positions of individuals at the moment of bombing were as follows : I, the captain of the rescue team, was at my desk in the Radium Room, arranging X-ray films into two piles, sorted out teaching materials and discards. Deputy Shi, with staff member Moriuchi, was developing film in the Dark Room. Staff member Umezu was servicing treatment equipment. Staff member Tomokiyo, Shi and Nurse Tsubakiyama were setting photographic equipment in the basement floor of the department of Internal Medicine. Head Nurse Hisamatsu was working on administration. Nurse Hasimoto was working at the reception desk. Everybody was working. Five nurses, Yamashita, Hama, Inoue, Oyanagi, Yoshida had just gone to tend to the potato farm field on the playground. Staff member Kozasa and Nurse Oishi were absent.

Escape

Pika, a moment of fate ! Everybody got to know his or her own destiny under the debris of equipment. There was complete darkness, nothing could be seen. Injured. It must be that they dropped a bomb in front of us. Why did we not hear the falling sound of bombs ? Are we dying ? We are injured. It will be the end if flames come around. Can we escape ? How about other people, etc ? My thinking was fragmented.

I tried to push here and there by my hands, feet, bottom and head.

The first person to escape by herself was head nurse of Medicine located in the basement and, Tomokiyo's group from the ground floor of the building. I looked outside. My vision had returned. The lumberyard of the old evacuation site for the X-ray machine had already caught fire. The head nurse drank a cup of water and gargled her throat. And with Tsubakiyama, she started to extinguish the fire with buckets of water. It was a big fire. Two people could not do the good job. Then, Hashimoto came running from the reception desk, shouting, "The chief* is buried !" Tsubakiyama said, "Well, is he safe ? What shall we do ?"

They started to run. The corridor was blown out, and they could not

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*Publisher's Note : Dr. Nagai was Chief of Radiology Department and he was called "Captain" to denote his leadership of the 11the Medical Corps of Nagasaki Medical University.

get into the entrance. They climbed up the concrete wall by a human ladder. Nurses had jumped into the Radium Room from the high window of the Pharmacy. There, the half blood stained captain patted the incoming subordinates and said, "Oh, good."

Deputy Shi was crushed by the ceiling in the developing room, his chest was pinned down, but he was able to escape, calling, repeatedly "Chief, chief." Into the Radium Room came the rescued, yet severely wounded captain.

Deputy Shi called out "Moriuchi is still buried." The captain, Tomokiyo and the deputy Shi tried to get into the developing room, but could not get by the mountain of debris. Looking in, they could see that there was no sign of people. There was no sound of moans. They must have escaped safely. Then, Umezu came out staggering from the Treatment Room. Everybody ran up to him.

His whole body was stained red. "I have lost my eyes," he said.

"What are you talking about ? You have eyes," Deputy Shi told him. "Let him sit down," he told the others.

There was a 10 centimeter laceration above the eyes and his whole body was pierced with glass splinters. With all of us helping, we pushed gauze onto the wound and applied a triangular bandage.

The chief asked, "Where is Yamashita ?"

The head nurse's complexion suddenly turned pale. "They are outside," Tsubakiyama said, "They said they were going to the playground."

"Maybe they are still there, look for them," the captain ordered.

Hashimoto and Tsubakiyama, calling the names of five unseen friends, ran towards the direction of the fire. I kept watching their backs. Yamashita, Inoue, Hama, Oyanagi, Yoshida—the faces of five people—appeared in front of my eyes, one–by–one, then disappeared. When the captain took his hand away from pressing on his right ear, red blood streamed out.

"Chief, it's blood."

"Yeah, I know."

"It's a piece of glass."

Then, Deputy Shi and the head nurse pushed a pressure gauze on to the wound and applied a triangular bandage. The white rectangular bandage stained red rapidly and blood dripped down his chin.

The artery had been severed.

"Shi–kun, Tomokiyo, how about instruments ?" the captain asked.

"Yes," the two said, and they each went to the rooms separately to check on them.

About this time, outpatients, who had been injured in the corridors of the Medicine, Gynecology, and Dermatology departments, were crawling, naked, bloody, skin stripped, face with soot and disheveled hair. It was a scene out of hell coming towards us. The captain and head nurse gave them first aid.

Soon, Hashimoto and Tsubakiyama came back crying from the

outside. Everybody was gloomy when they received them.

Where is Yamashita ?

Is she already dead or dying ?

I was thinking about our five staff members, while watching the prostrate and bloody patients die. "Everywhere was damaged. It was a catastrophe."

"The fire has flared up from the middle of the hospital. There is no way to communicate with people left behind. The roads are impassable, filled with dead and injured," each one reported.

The deputy and Tomokiyo reported that "the equipment was completely damaged, all tubes were ruptured. Electrical connections were cut off, the transformers could not be pulled out because the passage was completely blocked."

The captain was holding his own arms, saying, "The most urgent thing is right now," and sat down on the floor. The flames had already invaded the next door Pharmaceutical Dispensary, making crackling sounds. The staff, nurses, and a group of patients passed this corridor in panic. The captain glared at this group. All of the group stared and looked at the captain. After a while, my mind calmed down. A crowd of people passing by looked pitiful.

Suddenly, the captain grinned as usual. Everybody was induced to laughter. They had presence of mind. The captain shouted, "Look at each other !" Everybody laughed with one voice. The captain was wearing slippers because he could not find his shoes. Nobody was properly wearing their air–raid uniform.

"Let's dress right and get together in front of the entrance," the captain said. He stood up and went down the stairs and went out to the open space in the front of the entrance. Everybody returned to his or her own room. This time they calmly looked around their rooms. They remembered that the captain had often said *one can not fight a war if one is hungry*. They did not forget to bring out their lunches. When they came to the entrance, the captain, standing straight up and holding his arms, was gazing at the hospital in the background of the burning town. There were three treated patients lying at his feet. The captain bled quietly. Everybody had calmed down and got together in front of hospital entrance. The fire flared up ; the hot wind kept blowing.

"Help people first, equipment second," the captain decided.

Shi carried the wounded Umezu on his back, climbing to a safe rear hill. It was like during the Russo–Japanese War. The head nurse gave the captain's personal effects to the other staff. Then, suddenly, Moriuchi appeared. One person was safe, all of them voiced at once.

Kozasa, the X–ray technician of the Gynecology Department, came running from the back. She shouted, "Doctor !" Everybody called, "Oh, good !"

"How about the equipment ?" the captain simply questioned.

"It's already damaged," Kozasa answered.

"Could you bring it out ?" the captain asked.

"No, I could not." Kozasa replied.

"Well, nothing can be done," the captain said, "A hard time is coming."

"Oh, good !" "I just worry about the chief and head nurse. I don't know how I came through the sea of fire," Kozasa said.

"How about Sakita ?" the captain asked.

"Ah, Sakita–san" (Dermatology Department, X–ray technician)

"Look for him," the captain said.

"Yes, I will go to look for him," Kozasa answered.

"I will be here till the last. I will go up the hill after completing this business. Get in touch with me here or there do you understand ?" the captain said.

After a while, the relieved Kozasa got tense again. She ran through the sea of fire towards the dermatology department. For only one person to go, it would be too lonesome, so Moriuchi accompanied Kozasa.

Everybody was thinking about Kozasa. She has barely escaped from death and yet is going again into a dangerous place. The head nurse asked, "Is it alright (to go with Moriuchi) ?"

The captain answered, "It'll be training."

"Ah, it is training, it is training," the group members understood. They then divided into pairs to start taking care of the patients.

Patient rescue

The people who could move by themselves were running up the hill. The scene was one of mass exodus. From time–to–time, the captain stopped the treatment of the injured to shout at the people running up the hill, "Come down, students ! Nurses, stop !" But, nobody stopped. This was also a scene of defeat, like when the beaten troops of Daimyo Katsuiye ran away from Shizugadake. Maybe the enemy would land here. If so, we would not be able to fight like this.

"We rescued our university president," a voice said. I looked at the entrance. Technician Tomokiyo appeared. A red blood stained person was being carried on Tomokiyo's back. The captain ran close to them. The gray hair, face and white uniform were definitely those of the bloodied president of the university.

The president was still in high spirits. He told the captain, "You certainly have a big job here ! Thank you."

Fire was making the place dangerous. Deputy Shi, carrying a first aid kid, escorted the president. They climbed up the hill. A little behind, the head nurse of Medicine, started to run. The medical staff members came out too. The captain let them go up the hill. Probably, the staff of the Internal Medical Department had disintegrated.

There was such a strong unity of the staff members with the captain in the center ! Without this, we could not have carried out our jobs in this confusion. This union was not made from admonitory speech or sociality. This camaraderie was only the result of long years of close cooperation.

The captain spoke to himself, "Our soldiers have been training ten years for this one day."

In the dialect of Izumo province, the confusion and clamor meant defeat. Regarding this scene in those terms, we were definitely defeated. The superiors forgot their subordinates. The subordinates running around did not care about their superiors, only seeking their own safety. The university had totally collapsed. Of course we were in a very dangerous situation. I understood that people were ready to run away to the hills and yet they fell down. Accompanying persons tried to help them, but gave up and ran away. The fallen people below asked for help from below. Nobody looked back, just ran away.

Associate Okura of the Internal Medicine Department and about twenty medical students stopped there and started to rescue the injured under the captain's command.

The fire invaded the Patient Ward. We evacuated the admitted in-patients from the great fire and carried out the injured from the basement.

The stretchers were broken. The carrying out of the injured had to done by hand. The patients complained, "It hurts." The injured be complained of pain because these people did not know the situation. It took more time to take care of their demands. The work took time.

Somehow, we gathered the injured on the square in front of the entrance. The people came up the hill from the town below. All medical aid supplies were gone.

The hospital burns up

Below, the entire town was burning hard. The occasional west wind was pushing the fire up the hill, closer toward us. The hospital fire itself was becoming fierce. Where was a safe place we could evacuate this great numbers of patients? Reconnaissance scouts were dispatched in every direction. All of them came back and reported that everywhere was a sea of fire, only the rear hill remained untouched. It is common tactical knowledge that refugees will concentrate on getting to the hills in the event of an attack. If the enemy plane came again, it would attack the mountain.

The captain glared at the sky for a while, the wind turned slightly to the north. "Bring up the patients to the rear hill, 100 meters up the farm field," he ordered.

The usual pass was destroyed and blocked. We had to climb rocks. One by one, we brought the patients up by hand. Some died on the way. We cut off their hair as a memento. We gave the patients water. The parents of lost children had to be searched for. We worked on caring for the patients about three hours. All of the patients were evacuated to a safe field on the hill. We looked down at the hospital, we could already see that every window was blowing out fire and black smoke. Everybody said, "Ah, the Treatment Room is burning." "The fire is blowing out of the Exam Room." "My room is finished." "The three channel X-ray equipment

has burned up."

The time had been spent on rescuing patients and lost for saving equipment. We had loved and maintained the equipment as if they were our own babies. And, now, they were going up as fire and smoke in front of us. We members of the Corps looked straight on at this scene in sorrow. Numerous memories and hopes disappeared in the smoke—"It is the end," the captain whispered in a low voice. The nurses were moved to tears.

Clerk Tomonari brought up prepared emergency food from the basement. It was dry biscuits and canned food. Everybody got together. We ate seated. After eating, our minds became calm. We became energized, rearranged bandages, applied triangular bandages, and gave the patients water. We were busy working.

Evacuation

At 4:00 in the afternoon, the front half of the hospital was engulfed in flames. It was hopeless. We must evacuate. The captain insisted we should hang a flag. Associate Okura went into the Patient Ward at last and brought back a big sheet. Then, I painted the *Hinomaru** with my blood and hoisted it up on the bamboo pole.

Nagai of the medical school pushed it up bravely, his head lapped with a white headband. The captain and his subordinates followed him, left the burning hospital behind, and climbed to the rear hill. Thus, our hospital and our department were totally destroyed.

The national flag, painted red with blood, climbed up through the sea of fire and smoke and the dreary battlefield. White gas clouds and black smoke covered the sky. Here and there, survivors were lying, covered by the grass. We heard no voices. This was a disheartening situation. A member of the medical corps shouted, as we climbed up the hill.

"Be cheerful! Hold on!" we said.

"Oh, we are holding out."

There was a scene of people waving their hands. They must have noticed the *Hinomaru*. I felt that the sight must have awakened and inspired them on this battlefield.

The university president was lying in the potato field on the hill. Rain dropped on the coat covering him. Associate Professor Osajima and Head Nurse Maeda accompanied Deputy Shi, also working beside him. Professor Shirabe was also in the action.

The captain reported, "The patients are all around the front of the hospital. All evacuation is complete. The staff of the X-ray Department has assembled in the lower valley to prepare for the next step." The Hinomaru flag was planted on the hill.

"Here is the headquarters!" "Our president is okay!" "Everybody, keep your spirits up!" the captain and his staff shouted out all around.

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*Translator's Note: The rising sun of Japan's national flag, a single red circle on a field of white.

"The Third Medical Corps is here," voiced Associate Professor Egami. He was answered from the middle of Mt. Anakobo.

"Hold on, Otorhinolaryngology Department!" we responded to them.

Looking down, the hospital and town were in a forest of fire. Rome, burned by Nero, could not have looked like this. The buzzing sounds of an enemy plane circled the sky again.

The captain finished the report, went about ten steps, and staggered. There, Umezu was lying, escorted by Tomokiyo and Shi. The captain took his pulse and said, "You are okay Umezu!" and he tried to stand up. His face was cyanotic and completely pale. A big bloody clot hung down from the triangular bandage. Even so, he tried to stand up, but toppled over at the edge of the potato field.

Deputy Shi shouted, "Press the carotid artery!"

The head nurse applied pressure on the artery and tried to ligate the blood vessel, but the blood vessel could not be caught in such a deep wound. Upon hearing of the emergency, Professor Sirabe came up. The artery was tied and the bleeding stopped. Everybody felt relieved.

Kozasa brought back spring water from the top of the mountain and gave us a drink. The captain shouted, "Men make shelter, women cook dinner!" and fell asleep. With injured legs, X-ray Technician Kaneko, of Shirabe's Surgical Department limped in, and took care of me. It was 5 : 00 p.m.

Camping out at night

At 7 : 00 p.m., the night camp was prepared. Umezu and the captain were carried into the sick ward, which was prepared with straw scattered onto piles of lumber placed on the edges of a rock wall in the valley. Using a helmet as a cooking pot, pumpkin and wax gourd were cooked deliciously. Associate Okura brought the pumpkin first to the president, he was delighted.

Everybody sat around the fire in the field. The recovered captain looked at each person and said, "Is that all who have survived?" Everybody felt newly perplexed for the first time in their lives (that of horror and amazement).

The sun set down and the crescent moon shone for a while. I was thinking about the samurai Yamanaka Shikanosuke who prayed for the crescent moon when he was in distress. We must bear this indescribable hardship and fight to overcome it. We who have survived are the honorable fighters. We the people still alive look to meet the land of glory.

Mitamiware ikeru shirushiari, Ametsuchino sakayurutokini ayeraku omoeba

The members of the corps sang as loud as they could. For years, this song was chanted in the morning ritual. Now that the members had changed since this morning, only a few were left to sing.

Yamashita... Inouye come back if you hear our singing. If you are dying, go in peace, hearing the voices of fighting friends if you are already

gone from this world... At the end of the song, there was crying.

Then, Professor Seiki of the Pharmacy School appeared, half-naked, walking with a cane, and breathing hard. "Oh you are alive!" "I am the only one," he said. He fell down on his bottom. "I was buried alive, lost consciousness, then came out at last. About twenty students are dying in the bomb shelter of the pharmacy school. Please give them a shot, we cannot let them die."

"Please eat some pumpkin," we said.

"No, no, students are dying. Please come right away," he asked.

The deputy, head nurse, Hashimoto, and Kozasa went, carrying the first aid bag.

Professor Seiki was saying, "The university is gone, everybody is dead. It's a disaster." He returned to the sea of fire with the help of the head nurse, walking unsteadily.

Then, the deputy and Kozasa attempted a reconnaissance of the Urakami area. The road leading there was blocked with a screen of fire; it had changed the road. Wherever we stepped onto empty ground, there were fallen trees. There were groups of corpses.

"Yamashita-kun, Inouye-kun," we were shouting as we went, looking at the faces of each corpse. There were many charred bodies on the playground. Nothing moved in response to our calls. Flames were spreading everywhere. As a result, both forward and backward routes were impassable.

They had to stay overnight with mixed groups of refugees in the rear area of the Urakami Cathedral. The cathedral burst into fire in the middle of the night. A palace of God, the biggest in the Far East: it burned up nevertheless. Here and there, Christian prayers were heard from the bushes. It must be the end of the world.

The other site, the valley camp, received injured people. Associate Professor Ishizaki, with burns on his face and hands, was carried in on his back. Fukui, Deputy Director of Student Affairs, also came in, carried by Professor Seiki.

The passerby patients came in, one-by-one. At the rescue site, members stayed over night around the fire. Nagai of the medical school and Tsutsumi passed through dangerous fields to get in touch with the Prefecture Headquarters and brought back hard bread for 500 people at the start of the night.

Twice an enemy plane came, circled above in the sky for a long time, and dropped leaflets.

SECTION 2

The second and third days afterward

Scene in the morning

August 10, the night of bad dreams was over, but yesterday's tragic drama was not a dream. The fire had almost burned out. I felt as if my whole body was limp.

For the morning ritual, we stood on the farm field, bowed eastward, read the imperial proclamation of war, then sang *Mitamiware*. They read the imperial rescript for the young students, then the captain gave an admonitory speech. Today's duty is to take care of the patients around the Pharmacy School and search for Yamashita and the five others.

The corps moved into action immediately. Helping the injured chief and Umezu, the members went down the mountain pass, then up again and then down again. On the way, dead and wounded victims were scattered in the bottom of ravines, some in the shade of a stone fence.

Finally, we arrived at the Pharmacy School, crossing Ebira Pass. Urakami was totally changed! The university's Basic Science Building... nothing. There was only an open land of ashes. Urakami was a brown hill without houses, the morning sun skimming above it. The cathedral had just burnt down in that red blaze!

The members of the small rescue team looked for their own houses in silence then looked down again. There was nothing. Their family members must have been totally annihilated.

Rescue around the Pharmacy School

Wounded and dead students were scattered around the inside and outside of the Pharmacy School shelter. The corpses were covered with soil, the living were shaded with boards or sheets from the sunlight.

We let the wounded victims drink water and fed them cooked pumpkin and rice gruel. We let them chew on broiled beans. We asked them, "How is the taste?" We also said, "Hold on, as soon as we can get in touch with the rescue squad, we will send you to the aid station." We tried to keep people's spirits up.

Upon hearing the news of the evacuation of the wounded to Isahaya by train from Ohashi, I sent a team member to keep communication open. He came back to report that the trains were full of wounded and could not transport all of them. The remaining wounded were lying on a grass field. I gave up.

I negotiated with the Prefecture headquarters for transportation of the wounded by car. I was told that would be difficult to arrange that day.

The director of the prefecture's Public Health Department and the president of the Medical Society paid a visit to provide encouragement and to observe the situation. They said, "The army is coming to help,

tonight." Everybody was delighted with joy. It was like meeting Buddah in Hell.

The captain went to the university and saw a newly set up army field hospital in front of the hospital's main entrance, at the Main Building, and brought back some of the team members. I decided that the patients would be transferred to the army early in the morning.

Search for the missing

On the other hand, the search for missing members continued. The head nurse found corpses on the playground believed to be that of the five nurses.

That night, I slept in the shelter of the Pharmacy School. The moaning wounded survivors, friends, both dying and those already dead, all slept together in rows in the narrow shelter. I could not sleep well. I dozed off in a dream. At midnight the head nurse called her friend's name, "Ohyanagi–san, Ohyanagi–san," in her sleep, talking in middle of the night, and everybody was scared.

August 11, the third day, we carried the patients to the army field hospital, which was set up in the front of the hospital entrance. We made instant stretchers with burnt left over pieces of board, but that did not work well. Because we had to carry the patients over knocked down trees or burned up houses, it took over an hour to traverse a 400 meter road. Little–by–little, we finished the evacuation by noon.

Enemy planes constantly circled above in the sky. The heat from burned up debris and the sunlight with no shade made an inferno–like hell.

Burial

In the afternoon, we mourned the corpses of Yamashita and other nurses of our department. We recognized Yamashita instantly ; the skin on her face looked charred. We recognized small pieces of clothing on Inouye's and Yoshida's bodies. The bodies of Hama and Ohyanagi were determined by the size of their corpses. The family of Ohyanagi came and said, "This must be the one." Ohyanagi was cremated instantly and the ashes were given to her family. The four corpses were carried up to the Pharmacy School, and temporarily buried on the grounds.

We had to take shelter several times as we were working on the burials. Everybody cried when covering the bodies with soil. Here we had lost compatriots and friends to this war.

Activities of the headquarters

After the burial, I reported to the headquarters. The president, Dean Takagi, and Professor Yamane were severely wounded and lying in the shelter of the Surgical Department. Professor Sofue, Professor Kunifusa were also severely wounded. Professors Umeda, Ikeda, Okura, Naito, Kiyohara of Basic Science and Superintendent Naito were instantly killed.

Professors Kitamura and Hasegawa were lightly wounded. Professor Koyano was slightly wounded. The only one uninjured was Professor Shirabe.

The day of the bombing, Professors Kageura, Takase, and Sano were absent. They came back intact, actively working under Acting Dean Koyano. The families of students and employees came to join the search. There was great confusion.

The captain gave the order to make a list dividing the people into four categories: survivors, dead, wounded, and missing. He set up a poster with this command on each school and department. The military troops and police force were mobilized and started to clean up, collect corpses, and accommodate the wounded. There were several hundred refugees on Mt. Kompira. We could not guess the exact number. In the ruins of the medical school, the charred bones of students lay in rows.

The corps got permission to set up the Mitsuyama Relief Team with Professor Koyano in charge. Shirabe Surgery also opened up a relief station at Nameshi.

At 6:00 p.m. all members carrying medicine, surgical supplies, and rice, departed from the university and got into Ueno-machi, the chief's house being on the way.

The home of my family* was found in the ruins. I saw the bones of my family and cremated them. I then ate supper. The roads were impassable because of the corpses, collapsed houses and trees. The sun finally set. All members of the rescue team slept in the air-raid shelter of the ruins.

SECTION 3

Mitsuyama Relief Team

Geographical features

The reason for setting up an aid station at Mitsuyama was as follows. The towns of Mitsuyama-machi and Kawabira-machi, in the valley along the river, start from Mt. Mitsuyama in the eastern half of the Nishi Urakami area. These towns are named after those areas incorporated into the city. Actually these areas are just a few scattered houses which comprise farm villages: Azebetto, Kawadoko, Tobita, Ohtoge, Inutsugi, Koba, Kodani, Rokumaiita, Fujinoo, etc. These villages make up the town of Mitsuyama -machi. Kawabira, Akamizu, Toppomizu, Uchibira, Menoto... these villages make up the town of Kawabira-machi.

The length of the main valley in the Mitsuyama area is 8 kilometers

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*Translator's Note: Although Nagai uses the word "family," he is only referring to his wife, Midori. His mother-in-law and two children had already evacuated to Mitsuyama and were not present in Urakami the day of the atomic bombing.

long, and the few branching valleys create a width approximately one kilometer wide. These valleys extend from the north of the hypocenter and turn to the east. Therefore, many of the wounded must have taken refuge there. These areas were shaded from the hypocenter by the high grounds of Mt. Kompira and Mt. Tenjiku. Also this area was not touched by downwinds, therefore the patients who took refuge there were not affected by residual radiation. The area must be in good condition for observation.

These farming villages had plentiful food supplies, and the markets which would have bought from them had had most likely collapsed; therefore, food was in good supply and satisfied the needs of our patients' nutritional requirement. The biggest reason to have been in the Rokumaiita Village is that it has gushing mineral springs—the best treatment for burns since ancient times. Mineral treatment should be tried for these patients.

In this present situation, we of the Radiation Therapy Department had to perform our duties. There was no other way.

Moving

On the fourth day, August 12, we left Urakami in the early morning. There were corpses on the road. We heard groaning voices from the roadside cave shelters. An offensive smell greeted our noses. Enemy planes often passed over our heads. Many of the people whom we met on the way were bandaged. Everybody carried his or her belongings.

When we got to Mitsuyama Valley, the scenery totally changed. The contrast of the gray desolate hypocenter area with the greenery of the mountain here impressed us. Everybody stopped stiffly and took a deep breath. We felt our bodies becoming refreshed every time we took a breath.

There was an isolated house on the site of an old gold mine company in the Fujinoo of Koba Village. We decided to set up headquarters for two months here. I went through the woods below the house, down the stream, and took a bath. I found several wounds when I took off my clothes. As I noticed them, I began to feel pain. My legs under the trousers were bloody. I washed away the dirt of war with clean water, then lay in a stream with a rock for a pillow and looked up at the sky, the blue sky lying between the wooded mountains of summer on both sides, and the white clouds passing. I felt alive for the first time.

I came back to the house, lay down on a tatami mat and fell into a deep sleep.

Patient care begins

At 4 : 00 p.m., patient care began. We attended to the neighborhood leader; he was already wounded, lying on the bed, and saying, "There are many patients. I don't know where they are." I decided to go around from house –to–house.

First, Kawabira Elementary School was assigned to be used as our aid station, but this place was also damaged and it could not be used. Because enemy planes constantly kept reconnaissance, gathering many people in one place would be dangerous.

For environmental therapy, we decided to let patients rest in their own homes. We members of the Relief Team decided we would make house calls. We visited a row of houses. In every house there were wounded people. Certainly, there were patients in the rooms hanging mosquito nets to protect themselves from flies.

All of the relief team members were active irrigating wounds, performing surgeries, bandaging, recording, giving nursing instruction, etc. We were not finished at Inutsugi Village until 10 : 00 p.m.

On August 13, the summer heat and enemy planes disturbed our rounds as usual. We had to hide every time we heard a buzzing sound. From Rokumaiita to Kawabira, the area is eight kilometers long. The surgical supplies ran out in the middle of treatment. The head nurse and Tsubakiyama went back to the university for supplies. Nurse Oishi came back and joined us.

That day, Kozasa was absent. He was severely wounded in his house. We were told he was in a serious condition. Nurse Hama's family visited us. We cremated Hama and gave the family her ashes. At 10 : 00 p.m., the day was finished.

A miserable group

How could you have described the walking figures of our relief team ? A group of poor gypsies pushed out by fire with no house, no boarding house, no dormitory... The clothes we had were only what we were wearing on our bodies. We barely escaped with life.

Look at him... the captain... with a bandage wound around his head, holding a cane with his right hand, his left hand leaning on Tsubakiyama's shoulder, walking awkwardly ! Instructor Seiki was breathing hard due to the chest pain he got when he was buried alive. He was holding a long cane. Deputy Shi was cyanotic. The head nurse, Hashimoto, Tsubakiyama, all short, wore blood soaked pants and carried baskets made by leaves of reed. This was the house call bag. Technician Shi was exhausted. Medical student Nagai was in good spirits, with a white headband and a rolled up sleeve. Tsutsumi had lost his eyeglasses, so his activities were unsteady.

Everybody wore any kind of footwear they could get. Feet were injured by sharp objects such as nails and they jumped up every time they stepped on pebbles. We were a pathetic group, we had no handkerchiefs. We sweated and had to wait for our perspiration to dry itself.

"Oh, a bomber plane. Hide... It passed overhead, let's go." We lay down, hiding on the rocks, then ran. We could not go forward as planned.

August 14, we made the rounds of the upper valley area, Azebetto, Kawadoko, and Tobita. This time, returning in the setting sun, we were

hungry, tired, and sick with radiation. We had to walk in pairs, supporting each other with arms over each other's shoulders.

Up the mountain road, then down again, it was a hard slog. When we visited a patient, not only was the patient pleased, but also their whole family. Their fear disappeared at the end of our visits. We went from house–to–house, climbing the mountain road, feeling satisfied.

From that day till October 8, 58 days, the Mitsuyama Relief Team continued its operations. The patient care area was further expanded to other villages. Of course, we were busy at the beginning. Later, the number of the patients decreased, prognosis stabilized, new patients became fewer, the work became less troublesome.

The team members also alternately reported to the university headquarters. When the headquarters was located in Urakami in the early stage, there was a day less than when ten people, including nurses, reported to work under the Acting President Koyano.

One team member stayed in one of the ruined rooms of the Shirabe Surgical Department and worked on anything. Sometimes we went to Unzen to get medical supplies, another day we would help transfer patients. The relief team was always in Mitsuyama.

The team members collapse one by one

All of the team members had been in the hypocenter and were injured. We received relatively mild injuries due to the fact we were in the room with concrete walls, but we developed radiation injury symptoms: stomatitis, decreased white blood cells, hair loss, high fever, diarrhea, etc.

Some team members could not move due to wound infections. These members fell into sick beds one–by–one. The team members came back from the rounds, took care of the colleagues the whole night and went out for rounds the next morning. The work mates who had collapsed recovered.

Around that time, nursing colleagues took turns getting sick; take care... be taken care of... give injections to each other. Mentally and physically, we worked together. He, the captain, became critically ill due to high fever and bleeding. Once it seemed that the situation was totally hopeless, but he recovered due to the sleepless care of team members, night and day. At night, we prayed that the dead mate's souls rest in peace under the light of the lantern. Cremated bones were given to each family. To think of our dead compatriots made our difficulties as the living survivors appear as nothing.

Employee Kozasa finally died. Umezu barely survived, but recovered. After two months of legally designated medical relief, we completed our duty as a medical establishment. The Relief Team was dissolved on October 8. I will describe the results of this period in the next chapter.

CHAPTER 4

Symptoms Shown by the Patients at This Time

SECTION 1

Classification of symptoms

Characteristics of symptoms

The human body is injured by the atomic bomb in two ways : by the blast of air pressure and by radiation. The difference from an ordinary gunpowder bomb is that in an atomic explosion there are no fragment wounds, but there are radiation injuries. Also the gunpowder bomb has effects only at the time of bombing. The atomic bomb exhibits great power not only at the moment of bombing, but afterwards with the continuous ejection of secondary radiation, which causes prolonged radiation damage. This is a specific feature of injury by the atomic bomb. Also, there are many symptoms of instant onset, but radiation injuries also have a latent period. The appearance of late symptoms is also a specific feature of atomic bomb injuries.

Direct injuries and indirect injuries

The symptoms were many and variable. We observed these from each angle and classified the following. Functional source injuries were divided into direct injuries and indirect injuries. The former is the direct injury by the atomic bomb, the latter is a little different. Some people developed eczema of the skin by handling the grass irradiated by the atomic bomb. Also, injury resulted from eating irradiated vegetables. People lost their bodily resistance from the bomb and easily developed suppurative papula from mosquito or flea bite.

Primary injuries and secondary injuries

Also, radiation injuries could be classified as primary and secondary. Injury by the bomb explosion is a primary injury. The effect of long term residual radiation around the hypocenter resulted in secondary type injuries.

Some people living in the shelter at the site after receiving primary injuries, also developed complications of the secondary type. Some people developed secondary injuries only because they came to the site to clean up after the bombing. All secondary injuries are caused by radiation.

Classification by onset

Classifying injury symptoms by onset can be as follows : instant, early, late and delayed. Injuries received at the time of explosion were

instantaneous : i.e. sudden death, radiation burns, external wounds, mental abnormality, and radiation sickness. The symptoms of early onset began usually within in a week. In some cases on the following day there was suppurative papula of the mouth and lips, stomatitis, enteritis of digestive organ disorder, epistaxis (nose bleeding), hematemesis (vomiting blood), hemorrhagic stool, blood disorder of coagulation factors and anemia. These symptoms were serious, progressed rapidly, and turned deadly within a week.

After the third week, subcutaneous bleeding spots, gingival bleeding, nasopharyngeal ulcer, high fever, depilation (hair loss) developed and became critical in general. Also, suppurative papula of mosquito or flea bite like lesions developed around this time.

Some people started to show symptoms of kidney atrophy. These symptoms were hard to call late onset. The delayed onset symptoms took place after more than one year, some developed after several decades : skin ulcers, skin cancer, or birth defects due to reproductive organ damage.

SECTION 2

Each symptom in detail

As you know, we lost all instruments and had only one surgical instrument bag and set of emergency aid supplies. We will describe our observations of these symptoms, but we could not carry even carry out very simple blood tests. Therefore, we cannot say our observations are academically accurate.

(A) Sudden death

Instant death, blast pressure death

Within one kilometer of the hypocenter, on the roads, farm fields, gardens and rooftops, people whose whole bodies were exposed died instantly or within a short time. The majority of these instantaneous death victims were estimated to have died as a direct result of the blast. Exploded eyeballs and abdominal wall rupture were also seen. These symptoms must have been from the pressure of the explosion.

Some victims were knocked down onto the ground. Some were blown away and hit objects. There were many observations of skull fractures, organ rupture, and internal hemorrhaging in the corpses.

Thermal death

Was there anything such as the so-called *thermal death* or *burning death by heat wave* ? I don't know, because I didn't see the corpses in the hypocenter. The face of our department's Nurse Yamashita, who died 700 meters away from the hypocenter, was charred black, but her hair was not charred or frizzled. She was not wearing a hood. Of course, the skin of the

whole body was separated from the flesh. A wide range of whole body skin injuries due to radiation was one of the causes of death, but blast pressure must have been the main reason.

Crushing death, burning death

And burial deaths due to fallen, collapsed houses and burning deaths are included in this instant death category. Our Head Nurse Hisamatsu choked due to the thick gas, which developed from the explosion, and she had to gargle her mouth with water. Perhaps there was asphyxiation death by the gas.

(B) Pseudo-burns

Burns

Skin exposed to the bomb within three kilometers showed a special kind of injury. In general, it was called a burn injury because the skin received strong heat rays, which developed into a burn injury. But, we think something other than heat rays added to the injury. My impression of the skin condition of many patients rescued immediately after bombing gave me an impression that their injury was different from a thermal burn.

Stripped/separated skin burn injury due to blast pressure

We believe that the negative vacuum pressure caused by the bomb explosion stripped skin off. At first, we speculated that it was the powerful vacuum pressure of the blast wind alone, which did this, as well as finely tear up and blow off clothes. But, we were mistaken. If this were the case, not only the side facing the explosion, but the whole body would have shown this had it happened.

We must consider two factors, thermal heat as well as the negative blast wind or pressure. This means that thermal rays came first, causing burns on the outside of the skin, which made the skin fragile. Next, the powerful blast arrived and acted on the skin. The healthy part of the skin remained intact, burned parts were stripped off. Thus, skin injury resulted from the combination of thermal burns and blast pressure.

Black part-strong reaction

Thermal rays were reflected by the white part of an object and absorbed into the black part. For example, we examined our Nurse Inouye's corpse. She died with both eyes open. The white part—the conjunctiva — was normal ; the black part—the cornea with iris—was burned and perforated. She was a brave person for she must have been looking directly at the enemy plane when it came and received thermal rays afterward.

We also saw a person whose burn patterns matched those of his clothes.

Condition of hair

Hair burning occurs at extremely high temperatures. So, why did we not see curly hair burned? Was burned curly hair blown out by the blast? Even so, everybody still had long hair. Since the hairs were black, they should have had a stronger reaction than the skin. So, why was the hairy part of the skin not damaged and the hair in good condition? How can we explain this?

Conditions of skin injury

Now, I will describe the condition of skin injuries. The face was irregularly lacerated. The limbs were torn longitudinally in several strips, attached only at the joints or hanging with one end shorter than another. These skin strips were separated from the base, just like par-boiled shark skin. They were shortened, hanging shredded rags. The separated skin bled. The color of the skin surface changed to purple like the other parts of the body, but the hanging skin strips were not particularly congested by blood. The skin blisters were almost invisible at first.

No patients ever complained that it was "hot." However, everybody uniformly cried, "Cold, cold!" For them, it was chilly at midday in mid-summer. Are not these symptoms different from those of ordinary burns?

Secondary atomic explosion

Now, what was the cause of the following symptoms? There was the phenomenon of a secondary atomic explosion of the skin and subcutaneous tissue. For example, the particulate group, the neutrons from the bomb, were projected with great speed, collided with human skin, and infiltrated deep into the tissue at the subcutaneous tissue level. The speeding neutrons continued on to collide with atoms of the tissue and caused a secondary explosion there. Or, its energy was changed to other types of injury, which destroyed the tissue.

These processes stripped the fragile skin damaged by the preceding thermal rays that had arrived a little earlier. This hypothesis is totally our speculation. I would like to have a critique of this theory from my peers. In any case, we recognized that this kind of skin injury was more than a simple thermal burn, I would not simply call it a burn; I would call it a "pseudo-burn."

Burns by the particle group

Also, there was one very special case where a particular burn was said to have been caused by two drops of fire matter from the blast. The size of the drops seemed to be about the tip of a thumb. Looking at the wound, we saw that the skin was widely damaged around the center where the fire drop struck it. With continuous treatment, the peripheral portion of the area was healed quickly, but the spot where the drop of fire touched could not heal easily.

What was this drop of fire? A piece of hot radioactive fragment?

Then it should have developed into an ulcer by radiation. Was it a simple bomb fragment or did the enemy plane drop incendiary material at the same time ?

The feeling of receiving a burn injury, our member Shi explained, was like being hit by a stick. Even so, the size of the injury on his left upper arm was only four square centimeters. Instead of thinking this feeling was caused by electromagnetic waves of thermal rays, he likes to believe it was caused by the collision of a solid substance of the particle group.

There were also ordinary burns by fire.

(C) External wound

The majority of external wounds happened to people buried under collapsed houses or fallen equipment and cut by pieces of glass. Because there were almost no rescues of the severely injured, only the mildly injured managed to escape and receive help at the aid station. Almost all of the severely injured were burned to death by the overwhelming wave of fire. Therefore, there were very few severely wounded in the atomic bomb attack as compared to the numbers in a conventional gunpowder bombing raid. There were fewer people wounded by glass than in a gunpowder bombing raid as well. The penetration power of pieces of glass was relatively more powerful in this atomic bomb attack.

(D) Mental derangement

Immediately after the bombing, in the middle of the confusion, there was a nurse staggering around the corridor. She would not respond to my patting her on the shoulder. She had vacant eyes and keep stumbling around. There was a naked old woman sitting stiffly on the passing road, muttering, "My children, children" for three days. At Junshin Girls School, a naked young woman sat on the handrail of the school's altar house before the emperor's portrait. She waved and sang continuously in a beautiful voice. In general, the people's activities slowed down. Their fighting spirit markedly diminished. Many apathetic people were seen.

(E) Whole body symptoms

One hour after the bombing, one's whole body felt limp, a sense of detachment and exhaustion. The sensory nerves system of the whole body must have stopped functioning properly. These symptoms got worse as time passed. Everybody was just lying, like living corpses. The next day they lost their energy. There was insomnia and loss of appetite. It was like mild radiation sickness after one receives X–ray irradiation. One of the changes to the people's bodily functions was decreased urinary output. This was remarkable. Thirsty mouths complained quite often. Were the salivary glands damaged ? Sweating decreased that day and the next day.

(F) Early onset digestive organ disorders

These symptoms appeared in the people who been buried by collapsed houses, but rescued after a few hours and enjoying their safety. Their symptoms deteriorated rapidly and turned deadly during the second week. Namely, within one or two days after the bombing, a few to as many as ten pustulous vesicles the size of a soybean developed in the mouth and on the lips. Around the following day, the symptoms developed to stomatitis. Gradually, their body temperature rose due to mouth sores and eating disorders, but they felt fine due to mild whole body symptoms. Soon, symptoms of appetite loss and abdominal pain appeared and they developed diarrhea in the end. This diarrhea was watery, sometimes mixed with mucous, rarely mixed with blood.

The symptoms of severe tenesmus presented the problem of frequent defecation. The patients' body temperature ranged between 40 to 42 degrees Celsius. Debilitation in patients became progressively more severe. Most of the patients died within a week to 10 days after the onset. All treatment effort was in vain; therefore the mortality rate was 100%. These main symptoms of radiation illness were progressive, from the mouth and the lips and inflammation of digestive organs mucosa, went down to the rectum (the large intestine). Alternatively, entire mucosa was inflamed at the same time, but the onset of symptoms was delayed.

Fatal doses of radiation

At the beginning, eating pumpkins from the contaminated premier hypocenter was believed to be the cause of these symptoms. We think that this resulted in the whole body receiving lethal doses of radiation. Only symptoms of digestive organ mucosa appeared markedly (of course it resulted nutritional disorder which sped the victim's death). Thus, the people buried under collapsed houses for long hours received a lethal dose of secondary radiation from the fallen houses. Their symptoms appeared after a short latent period. Even that was called a fatal dose of radiation, radiation injury by electromagnetic waves must absolutely have a latent period; therefore, there were no instantaneous deaths. Also, if there was more than a lethal dose of radiation, I would like to state that any treatment was of no use. These symptoms were seen with people who were uninjured or injured. These phenomena happened to people buried by fallen houses near the hypocenter.

(G) Early onset blood disorder

There may be a different opinion regarding the classification of the symptoms of blood disorders into early onset and late onset. Either way, it resulted in damage of the hematopoetic system (blood cells forming organ). Some people may say that this category should be omitted, yet clinically all late onset symptoms should be included. But, clinically, the symptoms of early onset showed marked severe bleeding, it appeared even before the end of the chaotic period of the bombing. Then, the situation

gradually calmed down. When we thought that every patient was under control, the patients who looked well suddenly showed symptoms of agranuloyctosis, which turned deadly. Again, this made people fearful. The time periods of the two symptom onsets were quite different. Therefore, we will describe the two categories separately.

Cause of bleeding

On the second week, there were a few cases of sudden bleeding that turned deadly. This was seen among the people with gradually worsening anemia after the bombing. Death by uncontrolled epistaxis (nasal bleeding) and a case of hemorrhagic stool from a duodenal ulcer patient was also observed. There must have been a platelet disorder causing hemorrhage. I heard indirectly that there was a case of hematemesis.

(H) Late onset blood disorder

From the beginning of the fourth week to the eighth week, patients with marked subcutaneous hemorrhagic spots continuously appeared. These were the people who had received whole body dose of sparkling light 500 meters to 1 kilometer from the hypocenter, or the people buried under collapsed houses for several hours, or the people living in shelters or temporary huts for long periods of time in the hypocenter area after the bombing. Most of these people were previously in good health and worked to clean up.

For those patients with late onset blood disorder, their complexion became anemic. Fatigue gradually increased. Suddenly their body temperature rose. Several painful pustulous blisters the size of rice grains developed in the gingival and oral mucosa, and progressed to stomatitis. The gingival bled easily, developed foul black–purple necrosis on those spots, then suppuration occurred. The pseudomembrane developed ulcers in the tonsil or its surrounding area. The patient had difficulty eating or found it impossible to eat due to severe pain.

The whole skin seemed greenish and deathly pale, and scattered bean size spots appeared. At the beginning, these spots occurred on the trunk and upper shoulder and spread to the whole body, many on the thighs. The size of these spots ranged from the tip of a pin to a rice grain. Most of them were of bean size, some the size of a small fingertip. Also, there were a few cases of bloody blisters. There was a slight tendency for the blisters to fuse together. With treatment, these disappeared without scars after a short period.

There was no case of pain or itching pain. These symptoms reminded me of agranulocytosis. It must be that the number of white blood cells markedly decreased. The children got sick early, and in the elderly it developed late. There was difference in the severity of symptoms. The cause of difference was the dose of irradiation first, but also the individual's physical constitution, age, and health condition. The mortality was high in the other aid station. Among our patients, the

mortality rate was 20%.

Complications
There were two cases of pneumonia as a complication. These cases developed into aspiration pneumonia by the aspiration of sputum after prior development of pharyngitis. There was digestive organ disorder. The loss of hair was seen frequently. The observation of these symptoms not being seen among the pseudo-burn patients must be pointed out.

(I) Indirect disorder
Dermatitis
Plant vegetation also withered and died from the bombing. A farmer developed itching red vesicles on his both arms, legs and shoulders from cutting and carrying this withered grass on the following morning. It looked like his skin had erupted. We observed only one case, but it was said that there were others.

Suppuration
Several weeks after the bombing, the cases of pustulous vesicles from flea and mosquito bites continuously appeared. Also, small wounds easily suppurated. These were easily interpreted to be due to the decreased level of the body's resistance.

(J) Others
The above we described were our observed cases only. They were very small in number. Many of the other symptoms were observed by other relief organizations.

CHAPTER 5

Patient Statistics

SECTION 1

Statistics in general

(A) Number of patients

We took care of patients at Nishiurakami, Koba, Kawabira, from the fourth day after the bombing to the second month afterward.

Number of patients	125 cases

(B) Sex

There was no difference in the numbers between males and females.

Male	62 cases
Female	63 cases

(C) Age

There were only a few children and elderly. This reason was not only from evacuation, as the children mostly died within three days. Whereas the elderly were insensitive to the radiation.

Children (below 15 years)	26 cases
Adults (16 years–60 years)	94 cases
Elderly (61 years and above)	5 cases

(D) Distance from the hypocenter

Within half a kilometer, survivors were few. There were the most survivors from a half to 1 kilometer. Patients showed mild symptoms at a

Within half a kilometer	3
1 kilometer	90
2 kilometers	11
3 kilometers	16
4 kilometers	1
5 kilometers	0
6 kilometers	0
7 kilometers	4

distance of 7 kilometers. Between 5 to 6 kilometers, lay the mountains where nobody lived.

(E) Prognosis

There was great fear in the community (about death), but the mortality rate was only one fourth of the patients. Within two months, more than half of the patients had recovered and returned to work. The severely wounded and those not completely recovered, or recently ill people, all got better. Some of them transferred to other aid organizations.

Completely recovered	79 cases
Partially recovered	10 cases
Dead	29 cases
Transferred	7 cases

(F) Treatment days

Activity period

From August 12 to October 8, outpatient clinical rounds were done.

Duration	58 days

Treatment days (Aggregate patient numbers)

We counted the days of treatment for all patients.

Aggregate treatment days	2,829 (person) days

Treatment days of the completely recovered

From the day of onset to recovery, the average number of required days for the 79 patients was a little over one month.

Average number of days to complete recovery	34 days

Days in bed till death

The duration from being wounded to the onset of sickness and death for 29 patients was an average of two weeks.

Average days in bed till death	14 days

(G) Symptoms

Classification by types of injuries

The same patients developed complications in addition to the primary injury. These were counted as two cases. Therefore, the total number of cases exceeds the number of patients.

Direct	Instant onset	External injury	47 cases
		Pseudo-burn	36 cases
		Mixed injury	9 cases
	Early onset	Blood disorder	6 cases
		Digestive organ disorder	15 cases
	Late onset	Blood disorder	24 cases
Indirect		Indirect disorder	2 cases

Presence of injuries

About a quarter of non-injured at the time of bombing developed late onset disorders.

Wounded	External wound	47
	Pseudo-burn	36
	Mixed injuries	9
	Total	92
Non-wounded	Buried but not wounded	15
	Non-wounded	18
	Total	33

SECTION 2

Statistics by type of injury

(H) External wound

Number of patients

Patients with mixed injuries in the last table are included because some of them had external injuries.

Number of patients with external injuries	56 cases

Sex

Male	25
Female	31

Age

Children	7 cases
Adults	47 cases
Elderly	2 cases

Distance from the hypocenter

Injury by collapsed houses, shattered equipment and fragments of glass. The majority of these injuries occurred within a short distance from the hypocenter.

Within half a kilometer	3 persons	(3 deaths)
Within 1 kilometer	51	(12 deaths)
Within 2 kilometers	2	(0 deaths)

Treatment days (Excluding dead and out-migrants)

Longest	61
Shortest	14
Average	33

Classification by type of wound

Abrasion	19
Contusion	14
Cut wound	13
Miscellaneous wound	6
Stab wound	4

Prognosis

Complete recovery	34
Partial recovery	4
Dead	15
Out-migrants	3

The dead

Mortality was relatively high. The majority of the patients showed later symptoms of radiation injury, fewer died of wounds.

Number of external wound deaths	15
Mortality	27%

Causes of death

Wounds	3
Digestive organ disorder	7
Blood disorder	5

Ages of the dead

Children	2
Adults	12
Elderly	1

(I) Pseudo-burn
Number of patients

Number of pseudo-burn patients	45

Sex

Male	27
Female	18

Age

Children	8
Adults	34
Elderly	3

Distance from the hypocenter
Pseudo-burns were the result of direct exposure. The people in close proximity to the hypocenter died early. More survivors were at a greater distance compared to those within close proximity to the hypocenter.

Within half a kilometer	0
Within 1 kilometer	20 (5 deaths)
Within 2 kilometers	10 (1 death)
Within 3 kilometers	15 (0 deaths)

Treatment days (Excluding dead and out-migrants)

Longest	61
Shortest	16
Average	31

Prognosis

Complete recovery	36
Partial recovery	3
Dead	6
Out-migrants	0

Injured regions

Most injuries occurred to exposed regions. The lower half region of the body covered by air-raid clothes had fewer injuries. The upper half region of the body with open summer clothes exposing skin received more injuries. Injury by burning of the scalp was seen only in one male.

Head	1
Face	29
Neck	10
Chest	10
Abdomen	1
Back	4
Arm	30
Leg	15

Deaths

Number of dead	6
Mortality	13%

Causes of death

There were many poisoning deaths due to the decomposed substances of the skin of pseudo-burns. It was characteristic that there was no late onset disorder.

Debilitation (poisoning)	5
Digestive organ disorder	1
Blood disorder	0

Ages of the dead

Children	2
Adults	4
Elderly	0

(J) Early onset blood disorder
Number of patients

Number of early onset blood disorder patients	6

Sex

Male	5
Female	1

Age

Children	0
Adults	6
Elderly	0

Distance from the hypocenter
Most cases of acute whole body radiation disorder occurred a short distance away from the hypocenter. There was one case in the far distance. The patient had a history of duodenal ulcer, which bled due to a mild blood disorder, but soon stopped bleeding, then migrated out.

Within half a kilometer	2 (2 deaths)
Within 1 kilometer	3 (3 deaths)
Within 2 kilometers	0
Within 3 kilometers	1 (0 deaths)

Prognosis

Complete recovery	0
Partial recovery	0
Dead	5
Out-migrants	1

Symptoms

Epistaxis	4
Hematemesis	1
Hemorrhagic stool	1
Wound bleeding	1

Presence of injury

External wound	3
Pseudo-burn	0
Buried but no injury	1
No injury	2

Deaths

Number of dead	5
Mortality	83%

Days of survival
Number of days from the bombing to death.

Longest	18
Shortest	8
Average	14

(K) Early onset digestive organ disorder
Number of patients

Number of patients with early onset digestive organ disorder	15

Sex

Male	5
Female	10

Age

Children	4
Adults	11
Elderly	0

Distance from the hypocenter
Early onset digestive disorder was seen in the patients a short distance from the hypocenter, probably due to acute whole body radiation disorder.

Within half a kilometer	1
Within 1 kilometer	14

Prognosis
All dead. It was said that all the out-migrants died soon after.

Complete recovery	0
Partial recovery	0
Dead	13
Out-migrants (died afterward)	2

Symptoms
Diarrhea and high fever were the most obvious symptoms.

Diarrhea	15
High fever	15
Oral pustulous blister	4
Stomatitis	5

Days of survival
From the bombing till death, the average number of days patients survived was more than 10 days.

Longest	21
Shortest	7
Average	12

Presence of injuries
Many of these injuries were seen in patients buried by the collapsed houses but were uninjured.

External injury	6
Mixed injury	1
Buried but no injury	7
No injury	1

(L) Late onset blood disorder
Number of patients

Number of late onset blood disorder patients	24

Sex

Male	9
Female	15

Age

Children	6
Adults	18
Elderly	0

Distance from the hypocenter

Within half a kilometer	0
Within 1 kilometer	20
Within 2 kilometers	0
Within 3 kilometers	1
Within 4 kilometers	1
Within 5 kilometers	0
Within 6 kilometers	0
Within 7 kilometers	2

Prognosis

Complete recovery	15
Partial recovery	4
Dead	4
Out-migrants	1

Symptoms

High fever	24
Anemia	24
Subcutaneous hemorrhagic spots	22
Gingival bleeding	7
Stomatitis, Pharyngitis	7
Hair loss	9

Time of onset

From the bombing to the onset of disease, the average number of days was within four weeks. The earliest was in infants, those especially developed very early. These types of patients appeared continuously, showing severe symptoms, which became most noticeable by the fourth week.

Earliest	13th day
Latest	54th day
Average	29th day

Days till complete recovery

Treatment days of completely recovered patients who had received stimulating auto-blood transfusion were very short. Others took more than one month.

Longest	38 days
Shortest	7 days
Average	22 days

Days in bed till death

The course of death was very rapid. From the onset, patients became critical and died soon.

Longest number of days	14
Shortest	5
Average	9

Days of survival till death

For the patients who received lethal doses of radiation, these are the

Longest	32
Shortest	17
Average	22

numbers of days of survival from the bombing until death.

Presence of injury

Note that many patients in this category were not injured. These symptoms were especially not seen in the pseudo-burn patients. There was some substance present which stimulated the hematopoetic system (blood cells forming organs) to prevent progression of symptoms in the pseudo-burn patients. Our idea of using auto-blood transfusion for blood disorder patients was based on these findings.

External injury	4
Pseudo-burn	0
Buried but no injury	7
Non injured	13

Location of patients after bombing

The course of these symptoms was not due to primary radiation, but we need to consider secondary radiation showing long term effects at the site.

Evacuated to other places in one or two days	14
Remaining in temporary housing on site	9
Absent at time, but moved back afterward	1

(M) Indirect disorder

Number of patients

These symptoms were mild. It was difficult to recognize their relation to the atomic bomb based only on the patients' complaints. The relationship must be defined based on the results of diagnosis. Or, it may be true that there were no other types of patients such as these.

Number of indirect disorder patients	2

Distance from the hypocenter

7 kilometers	2

Symptoms

Skin injury	2

Prognosis

Complete recovery	2

SECTION 3

Statistics concerning the dead

(N) Total number of dead

Total number of dead	29
Mortality	23.2%

(O) Cause of death

External injury	3
Pseudo-burn	4
Mixed injuries	1
Digestive organ disorder	12
Early onset blood disorder	5
Late onset blood disorder	4

(P) Sex

Male	12
Female	17

(Q) Age

Children	9
Adults	19
Elderly	1

(R) Mortality by age

Children	34.6%
Adults	20.2%
Elderly	20.0%

(S) Date of death

1st week	5
2nd week	14
3rd week	6
5th week	3
8th week	1

(T) Survival period

Longest	57
Shortest	6
Average	15.2

(U) Distance from the hypocenter

Within half a kilometer	3
Within 1 kilometer	25
Within 2 kilometers	1

(V) Environment

Own house	7 deaths in 53 people	13%
Temporary housing	5 deaths in 10 people	50%
Temporary evacuation to another house	17 deaths in 62 people	27%

CHAPTER 6

Treatment

SECTION 1

Environmental therapy

Prognosis and environment

It is an already known fact that the patients' recovery environment will affect the prognosis. As said in (V), Section 3 of Chapter 5, the mortality rate was high among people who lived in temporary housing at the site and low among people resting in their own homes. It was interesting to see that people evacuated to other people's houses had a mortality rate twice that of those who stayed in their own homes. This must have been due to the lack of miscellaneous instruments for nursing care at the temporary housing sites. Also, too many people crammed into a small room meant that the patients were unable to maintain bed rest. Possibly, they had difficulty in purchasing food. Their nutrition was also inadequate.

The people living in shelters or temporary huts on the site not only continuously received radiation, also leaking rain drops, blowing wind, etc, but had unsanitary living conditions. It was natural to see a high mortality rate. Wherever you stayed, there was no better place than your own house and nothing better than being taken care of by your own family.

Usually, a well–equipped hospital was better than one's own home environment. However, after the big bombing, the temporary aid station was inadequately equipped, without enough manpower for many patients, and placed in a room with visitors continuously coming and going. Due to so many patients being placed together, there was a bad smell which attracted flies. It was not a good place for convalescence.

The patients were selfish, always had to have their way. The self–discipline of a patient affected the prognosis of his illness. For example, you can freely break wind in your own house, but you have to suppress that with great difficulty in a big patient ward.

We took environmental therapy very seriously and encouraged home convalescence. The results were believed to be much better than if we had the patients come to the aid station. It was a great, heavy burden for the Relief Team to make rounds of the houses one–by–one in the mountainous valley. But, we enjoyed the success of our work.

Convalescence

We ordered absolute bed rest for the patients. We did not know which

organ systems would cause severe symptoms because of the uncertain nature of radiation effects, so the order was a precaution in any case. We chose the brightest room for patients, opened the windows, and allowed filtered sun light, including ultra violet light, to enter the room. However, direct sunlight was to be avoided. Mosquito nets were hung day and night to prevent flies and mosquitoes from getting in. Other requirements for nursing were introduced to the members of the victim's family and rigorously instructed.

These areas were made up mostly poor farms. Each home was not well equipped, but all family members took good care of their patients. A few helpless patients were saved. On the contrary, most of the patients carried out by hand-drawn cart to the far away aid station returned as cremated ashes.

The place was in the high lands and dry. Every morning, the fog came up from the streams of the valley, left the top of Mt. Mitsuyama, and floated as white clouds in the blue sky. These are thick green mountains as far as you can see. The people coming from ruined, bombed out Urakami sat there feeling reborn just to look at the scenery and to breathe fresh air. Here was the best environment for convalescence.

SECTION 2

Mineral spring therapy

Effectiveness of mineral spring water

It is a well-known fact from ancient times that mineral spring water is very effective for the treatment of burns and wounds. The molecular structure of underground virgin water is altered by high pressure and high temperature. The water gushes out from the ground with its normal atmosphere and normal temperature changed. The alteration is straightforward. Its atomic structure then returns to normal, but with some weak radiation. It is understood that this remnant energy is effective for treatment. This time, the pseudo-burns are a kind of radiation disorder. For the treatment of radiation disorder, stimulation by other kinds of weak irradiation is a good method of treatment.

We adapted mineral spring therapy for the treatment of pseudo-burns. Since there were too many patients with too few supplies, mineral spring treatment was useful for saving treatment supplies. Also, it was helpful for the resident people to understand mineral spring therapy.

Rokumaiita Mineral Spring

In Rokumaiita, Koba, Nishiurakami, there was a mineral spring (a cold spring), which has been flowing up since ancient times and a spring inn had been set up there. However, the same place was found to have a gold mine. The flowing water was stopped and the inn business was

abandoned. At the present time, the mineral spring water flowed out from the area of the old abandoned gold mine, 200 meters west of the old flow source site.

The present outlet, located at the foot of the bank of rice field, is about 30 centimeters in diameter with weeds growing around. The amount of flow is 5 liters per second. It flows out as small stream between the weeds and pours into a small river. The spring water has no color, is transparent, has a temperature of 10 degrees Celsius tastes slightly acidic, and smells slightly of sulfurous hydrogen.

Efficacy

The mineral spring water was warmed to body temperature and used in a hot bath or warm fomentation three times a day, one hour at a time. After the bath or fomentation, the wound was cleaned with hydrogen peroxide and applied vegetable oil. The results were great.

If the cleanliness of the wound was kept, it did not get infected. Granulation tissue looked normal, skin growth was rapid.

For the people living far away from the spring's water source and unable to get to the water daily or for the people who doubted the effectiveness of mineral spring therapy, the duration of their complete recovery was markedly decreased (excluding the dead).

Thus, there was an average of two weeks for an early recovery. Also, mineral spring water therapy was effective for the treatment of external wounds.

Number of days for treating patients with pseudo-burns		
Mineral spring therapy	Average of 20 cases	24 days
Control	Average of 19 cases	38 days

SECTION 3

Auto-blood transfusion stimulation therapy

Method

For the late onset blood disorder, Dr. Shi put in practice and recognized the great effect of the auto-blood transfusion stimulation therapy. The method was simple.

Sodium citric acid (an anti-coagulant) of 0.2 cc was taken up a 2 cc syringe. Then using this same syringe, we withdrew 2cc of intravenous blood from the patient, mixed (the blood and sodium citric acid) to prevent coagulation, then immediately injected the mixture into the patient's buttock, and massaged with warm compresses.

The patient may have complained of local pain but no side effect. The treatment was done every other day. A course of auto-blood transfusion

therapy was finished after the procedure was performed several times.

Results

Symptoms subsided suddenly on the third day after the first injection. And other symptoms recovered rapidly. Thus, the progression of pharyngeal ulceration stopped, followed by a separation of the pseudo-membrane and the ulcerative surface becoming clean. The pain disappeared and healed. The subcutaneous hemorrhagic spots did not recur. The spots disappeared gradually. Body temperature came down. The patient felt better. The duration of time for a complete recovery and a return to work in this group was much shorter than the control group's.

Number of days for auto-blood transfusion stimulation therapy		
Auto blood transfusion therapy patients	Average of 12 cases	17 days
Control group	Average of 7 cases	31 days

There were no cases of death for auto-blood transfusion treatment.

Number of patient deaths with blood disorder	
Auto-blood transfusion therapy patients	0
Control group	3

This therapy has advantages of being effective, simple, and easy to self-apply. Donors are unnecessary. There are no side effects. We will recommend it highly to the public.

We think that the principle of the function of auto-blood transfusion therapy was the same as therapy for any other diseases. Details remain unclear until we can perform tests. At present, we have no ability to do that. We think that the blood of pseudo-burn patients can be treated for late onset radiation disorders. But, the tests have not been done yet. We hope that the peers will do the research.

SECTION 4

General treatment

(A) External injury

The majority of externally wounded patients were rescued from being buried alive. Therefore, their wounds were not clean and were filled with coagulated blood or dirt. First the wounds were irrigated repeatedly with warm Creasol. Next, the penetrating residual fragment of glass, wood, bamboo, metal, dirt, concrete, clothes were searched for and picked out. Then, hydrogen peroxide, mercurochrome, or iodine was used for regular antiseptic measurement. The large lacerated wounds were then sutured. This made the first stage of wound healing complete. For the last stage,

limaon ointment and fish liver oil were used with good results. Tetanus and gangrene vaccines were not used, and it was likely that no cases of either happened.

(B) Pseudo-burns

As mentioned above, mineral spring therapy was given. The control group was given applying oil or mercurochrome. As homeopathic treatment, persimmon, mashed cooked rice, potato, pumpkin and fresh soil of clay were used. These had very little effect.

(C) Early onset blood disorder

The anti-coagulants and Vitamin C were of no use. Any other therapies had no effect.

(D) Early onset digestive organ disorder

The patients who had only pustulous blisters on their lips seemed to be in good health at the beginning yet developed stomatitis as if caught off guard. The healing methods of gargling or applying sodium solution or boric acid solution were of no use. Silver nitrate, lugol, mercurochrome and honey, etc. were tried to no avail. Diarrhea, tenesmus, also did not respond to anti-diarrheal drug and patients suddenly died to no avail.

(E) Late onset blood disorder

A small amount of Fowler's solution was given. This was effective. The critical patient partly recovered from the critical condition. We paid special attention to nutrition and recommended liver and vegetable food therapy. It was a time of food shortage. The liver of cow, goat, chicken, and eel were purchased. Bone marrow soup was relished. The period was also a shortage of green vegetables. Cucumbers were used quite often.

For fruit therapy, we purchased pear and persimmon. These were given in large amounts as sources of vitamins. Potato, pumpkin and wax gourd were the main foods of subsistence.

The nutrition was enough for home convalescence therapy. This also played a large role in the treatment of diseases. Not particularly, Vitamin C and Vitamin B injections were given quite often. For high fever, Phenacetin was given. Also, the head of the patient was cooled with water. Sulfa drugs were of no use.

The gargling of Boric acid solution was recommended for stomatitis.

As for folk medicine, there was the use of extract of persimmon leaves, Houttuynia cordata Thunb, Adlay, Nandin, Aloevera, Perilla, Geranium nepalense Sweet. Some people said that drinking vinegar was useful. Was there any relation between that and the concentrations of hydrogen ions in the body fluid? Also, there were cases of hopelessly, severely ill patients who got better by drinking large amounts of Japanese sake.

(F) Medical materials

These medical materials were supplied by the city government : dressing, gauze, cotton ball, stitches, bandages, mercurochrome, limaon, Creosol soap solution, lysol, hydrogen peroxide, alcohol, sesame oil, antacids, phenacetin, sodium carbonate, boric acid, Vitamin C, Vitamin B, vitacampher, digitalis, narcopon, sodium citrate, acrinol, thrombogen, ephedrin, lard, etc.

CHAPTER 7

Future Prediction and Counter Measurement

SECTION 1

Question of habitability at the hypocenter

Questions needing answers

The question of habitability in the hypocenter area can not be decided until more research results are obtained. This was the first announcement by the creators of the atomic bomb. Therefore, we would like to know what materials were used, how the bomb exploded, and what was the result of the preliminary test ? There is also the question if there was any residual radioactivity at the hypocenter, and if any still remains, is it possible to clean it up ? How many times greater was the amount of residual radioactivity than our estimate ? Also, what kinds of radioactive elements were there ? How strong was their penetration power ? How thick should protective devices be ? These questions should be answered.

According to our estimates, there would be no problem if all the atoms of the atomic bomb had exploded immediately, but parts of the atoms did not undergo fission or they underwent fission incompletely and fell on the ground as radioactive mass. If the source of the atom was a light element, its length of radioactivity would be short, but uranium and thorium are heavy element substances. Their radioactive period by natural fission is very long.

For example, the radium of the series has a half-life of 2,000 years. We can't wait and do nothing. That half-life is not just 75 years as well. Therefore, we would honestly like to be informed the name of that element.

Counter measurement of radioactivity

Next, we need to use a sensitive detector to measure the precise amount of radioactivity at the hypocenter. The strength of radiation is the inverse square of its distance from the hypocenter. Therefore, in a wide area, if we just did spot checks, we could miss the radioactivity. You must take many small samples throughout the whole area, one by one, so that the radiation spots can be detected. Perhaps, these radiation spots are very small and cannot be seen by naked eyes. But, they can be taken out by a spoon. If we don't discard these, but collect and purify them, we may be able to recycle a large amount of radioactive substances, like radium.

If all matter in the hypocenter received powerful primary radiation at the time of the atomic bomb explosion, they would be endowed with radioactivity artificially, and still emit radiation. We have to measure how deep the ground is contaminated. The thickness of the contaminated

ground must be excavated in large scale. But if we wait, this radioactivity will disappear in a short time.

Because I did not perform any experiments, I cannot say all this with certainty, but if small animals like ants were not eliminated from the earth, there is nothing to worry about radiation close up. The ants of an atomic field are ones to be watched.

This is also a simple test method to detect radiation. Photographic film can be wrapped in black paper, left on the ground or underground for a week, and developed thereafter. If it's exposed, there is radiation. Anyway, although the place is livable, it is still better to have a thick floor. It would be safer to have lead plates beneath the floor. Also, it would be better to paint the floor with Barium like plaster and lay the tatami mat above it. A floor of more than 30 centimeters thick of concrete is good. Also, raise the floor higher, keep the distance from the ground greater is also one of the methods.

When glass receives radiation, it changes to purple or brown. If the glass panels in the house changes color in the future, the area will be known to have radioactivity.

What kind of disorders will develop if one lives under constant weak radiation ? The prediction is leukemia, infertility, dry skin, etc. The white blood cells will decrease initially but increase later. This is the radiation induced chronic myelogenous leukemia. Its prognosis is not good. Infertility is mainly due to the destruction of reproductive cells. General secretary gland are damaged and one could have dry skin.

SECTION 2

Disorders developed in human bodies

Late onset disorders

A symptom that will appear in the near future is the lowering of immunity to fight bacteria causing pustulous abcesses and other microorganisms based on the decrease of white blood cells. Thus, the bite site of a wound as small as a mosquito or flea bite can easily become suppurative and will not heal easily. And combined with easily transmitted infectious diseases from unsanitary conditions in the hypocenter area, epidemics of all kinds of infectious disease are expected.

Of course, an increase in white blood cells will help one regain the resistance of the body at first. If we do not set up a community toilet, sanitary operations*, and the building of residential houses with gov-

*Translator's Note: Sanitary operation refers to city sanitation workers removing night soil or human waste each morning from residential areas. Usually, the night soil was used for crop fertilizer. In Nagai's time, sewage and plumbing was not available in all areas in Japan.

ernment assistance immediately, the situation will soon be disastrous. The typical post war product, an infectious disease epidemic, is unnecessary, to be avoided, but now we have a new chapter added to the usual post-war story, the decreasing of white blood cells as a result of radiation. We have to take great precautions.

Also, we have to worry about kidney disorders. This disorder means one will have frequent urination at night. With the development of atrophic kidney edema, nephritis can be expected. Those people who receive strong radiation in the adrenal glands could develop abnormal pigmentation of the skin.

The regeneration of hair loss will happen, but perhaps it will take a long time. And it may be incomplete.

How about the growth of children ? Bone growth will be impaired if they receive a large amount of radiation. The amount of bone growth is related to the amount of radiation it receives. Even a small amount of radiation will impair bone growth.

There were complaints of irregular menstruation and impotence, but these symptoms will recover gradually. Thus, infertility is not permanent.

Delayed onset disorders

Long term problems are delayed onset disorders. First is the generation of keloid or pseudo-burns. This is the low resistance part of the skin. If you scratch or give stimulation to them often, apply medication, or the injury will not heal easily. We have to worry if this type of pseudo-burn will become an ulcer. Therefore, keloids have to be watched carefully and protected. One must speak to the patients specifically about this precaution. This is the possibility of a malignant change from an ulcer to cancer after a long time.

The second is the matter of the hematopoietic (blood cell forming) system functional restoration. It is early October, two months after (the explosion) and new occurrences of blood disorder in-patients are rare. Patient symptoms have healed or are getting better, but is this the end ?

In general, radiation disorders will appear in waves as primary, secondary, and tertiary stages. There was a case where a subcutaneous hemorrhagic spot appeared twice within a two-week interval. Thus, we worry that the patient will deteriorate after getting better temporarily. Also, there is the possibility of the transformation to a chronic blood disorder. These questions have to be determined periodically by blood tests of the resident people.

SECTION 3

Agricultural products

In an experiment, the growth of plants was enhanced by a very small

amount of radiation, disturbed by a large amount. Plants wither and die with a very large amount of radiation. If radioactivity remains in the hypocenter, the growth of agriculture products will be no good.

We think that the eating of agricultural products grown in the hypocenter should not be harmful. Once, the pumpkins of Urakami were said to be poisonous. They must have been blown up the blast, lying on the ground with the hot sun shining on them, and decomposed.

CHAPTER 8

Observations

SECTION 1

The bomb

Materials

The utilized elements were uranium and plutonium, both heavy elements. These are very difficult to get as raw materials. If the mechanism of the explosion had been changed, even lighter elements could be used, such as aluminum. The substance emitted from the bombs was thought to be atomic energy, electromagnetic waves and particle groups.

Radiation

Tactically, atomic energy aims for destruction, and heat rays for fire are required. The results were exactly as the scientists calculated in their minds. This was not a question of humanity (but destruction). There was nothing we could do as victims of war. This was war. We did not particularly resent it. However, later on, after the end of the war, as patients passed the latent period, particularly as the question of living with residual radioactivity appeared, we were drawn to think about humanity. Those by–products of radiation, electromagnetic waves and particle groups caused body disorders, which came to our attention.

From the beginning, the neutron, a part of the particle group, was taken seriously and even propagandized. But we think the gamma rays played the most important role.

Fallout

A part of the particle group emitted directly to the ground right after the explosion had a great effect on human bodies, but other parts lost their moving energy, floated into the air, were blown down by the wind, and had to come down gradually. These particles became residual radioactive substances later. We think that the main portion of the white cloud, which developed immediately after the bomb explosion, was these particles.

Flash

How bright was the flash ? It must have been tremendous. People felt that the flash was even brighter than a magnesium gun going off on a bright, mid–summer day. People perceived different color complexions of the flash. The majority of people said it was "close to a white color." Also, there is a person who claimed to have seen seven colors like the rainbow. One said that the earth, lit up red in the flash, was as beautiful as the earth

illuminated in the light of a setting sun.

Were these differences in perception due to the difference of each person's optic nerve ? Or was it due to inaccurate perceptions due to the sudden emergence of the flash ? Were differences in the electromagnetic waves due to the different directions the flash went ? For those who did not experience the flash directly, but only as diffused light, they were not blinded.

Explosion sound

Within one kilometer of the hypocenter, we did not hear the sound of the explosion. However, people far away heard a tremendous, large boom sound several to ten times as great as that of a usual bombing. Indeed, a few of us had our eardrums ruptured.

Blast pressure

The attack of blast pressure was not momentary. After a few seconds, we felt like we were in the middle of a tempest. At the beginning, it was relatively weak, about the level of a storm for a second, followed by an even more powerful blast, which lasted for about two seconds, then I think it quieted down.

The bombsite reflected the blast pressure off the mountainous slope. The site was attacked twice (by blast pressure) in each interval. This must have been related to the process of the atomic explosion. Look at the site of the explosion, the blast pressure moved downward from above, was reflected by the ground, and blew up again. It was as if the head was struck in one direction, then the legs were kicked out from the opposite direction. There was lots of evidence of horizontal movement just above the ground. Big stones moved horizontally just above the ground.

How strong was this power ? Probably due to blast pressure, the people outdoors or in corridors inside lost their clothes in a moment. Belted or tied portions or thick pleated skirts were left on, but other loose clothes were blown off. Some people found their own clothes blown off and torn up in the far away distance. Anyhow, at that moment, men and women, young or old, who had been dressed in various clothes in front of us, were suddenly naked. It was quite shocking, but we also felt it was little bit funny.

Cause of fire

There are several things to be considered for the cause of fire. It is said that the temperature at the time of atomic bomb explosion was higher than the sun's. Thus, within 500 meters, a short distance, even if it was just a moment, the heat had the power to burn up everything on the ground.

Even though the lumberyard was empty and there was no concern that it could catch on fire, the yard still burned up. The lumberyard must have simply burned up from the heat rays emitted by the bomb. Of course, if there were fires, most likely they came from heating devices that were

burning within the buildings before they collapsed. But if we look at the entire area of the hypocenter, we see that the fires did not start at the same time but from different ignition points scattered around. Why was that?

First, we think, the heat ray came at once and evenly. Its functional time was momentary and short; it could not ignite everything on the ground. Yet, black colored items easily absorbed heat. Also items with typically low combustibility yet next to more combustible items also caught on fire.

The next idea was that the distribution of heat rays was not even in some places. In some places, a large amount of heat rays were emitted and a fire ignited. This was due to the heat rays of long length electromagnetic waves. In another case, many people saw that a fireball fell down and ignited the fire. These phenomena were observed at the places far from the hypocenter.

The fireballs were not too big, many just the size of a finger tip. They came flying out at the same time of the blast pressure. Were these heated fragments (atomic mass) from the bomb itself? Or were they incendiary materials being spread at the same time?

Darkness

Why did we lose our vision immediately after the bombing? Most people thought the optic nerve function was lost temporarily due to the blinding flash. Our impression was different. It may have been that the thick dust of everything broken up on the ground. There was complete darkness. Was this due to primary radiation and secondary radiation built up on the ground, which formed a special gas in the air? Or, was it that the sunlight was completely shut down by the thick gaseous cloud in the air? The last thought was the most logical because one or two minutes later, the clouds moved out and the bright sun shone again. At the moment of darkness, many people thought they had become blind.

Difference between the gunpowder bomb and the atomic bomb

We think the difference between the atomic bomb and gunpowder bomb is as follows:

Difference between the two types of bomb		
	Atomic bomb	Gunpowder bomb
Mechanism of explosion	Physical	Chemical
Main Part	Atomic nucleus	Extranuclear electron
Product	Particle group, electromagnetic wave, atomic energy	Gas, heat, fragment
Power	Enormous	Small
Amount of material	Small	Large
Function	Mechanical (destruction) Physical (radiation)	Mechanical (destruction)
Duration of function	Continuous, decaying	Momentary
Human body injury	Blast wound, external wound, radiation disorder, burns	Blast wound, external wound (fragmental wounds)
Time of disorder onset	Instant onset, late onset,	Instant onset
Prediction of prognosis	Difficult	Easy
Complication	Yes	None
Radiation sickness	Yes	None

In the future, we in the medical profession can distinguish the injuries from an atomic bomb if a small atomic bomb is used. Thus, the atomic bomb causes many burns whereas the gunpowder bomb causes fragment wounds. This difference is important to note because in the case of the atomic bomb, the people at the site require rest and convalescence in consideration of late onset disorders.

SECTION 2

Human body injuries

Classification of symptoms

The radiation disorders in this chapter were based on cases of whole body irradiation. There was a primary and large amount of momentary irradiation and secondary small amounts of repeat irradiation. All organs received injuries. The radiation had some differences in severity. Symptoms of the digestive system and hematopoetic system appeared markedly, but this was not because these organs received especially large doses of irradiation. The tissue of these organs had different sensitivities to radiation.

Latent periods were different. Reactions of the tissue to radiation

were also different. Also the importance of how each organ related to life was also different. At present, other organs were not assessed seriously. Thus, it would be wrong to classify these disorders according to body system type, e.g. digestive system type or blood type. If a patient with digestive disorder lived longer, instead of dying in the early stages, he or she might develop a blood disorder. There are the disorders of two organ systems combined.

Also, taking a good look at late onset blood disorder patient, we see that these patients were going through mild digestive organ disorders. It wasn't serious enough to warrant attention because the symptoms were mild. Everybody developed symptoms in this order: whole body, digestive organ, and then blood disorder symptoms.

Then, there were these questions: the digestive organ disorder progressed mildly, but why was the blood disorder severe and was this difference due to the sensitivity of the different tissues? Disorder to the digestive organ caused mild symptoms, but symptoms of disorder to the hematopoetic organ caused fatal changes.

The patient who received large doses of irradiation developed severe symptoms and got sick early, but those who received small doses had only mild symptoms. Thus, it would be useful to classify the doses of radiation as follows: large, moderate, and small.

Determination of prognosis, radiation doses

The relative importance of symptoms was determined by radiation doses, constitutionality, age, and extent of health. The irradiation dose is the most important factor though. The fate of almost all patients was decided by this factor. Other factors had very little effect. For example, I had one case of six patients in a family with early onset digestive organ disorder. They all died on the same day even though there were some variances in terms of health, age, body constitutionality, and convalescence environment.

The speed of progress was almost constant if the members of a family received the same large doses. The time of death was the same if the family received the same doses of irradiation at the same place. For the people who received more than lethal doses of irradiation, any kind of treatment was to no avail.

Distance

The strength of radiation doses was determined by the distance of the victim from the bomb, the body surface area exposed and infiltration, as well as the residual radioactivity. The duration the victim stayed in the hypocenter is also clearly relevant. The bomb was exploded in the air; therefore, the distance from the point of explosion cannot be measured in terms of horizontal distance. That distance would need to be calculated with trigonometry. The most important exact point of the hypocenter and the high point of the epicenter are estimates. These calculations are

meaningless.

Penetration

Penetration of substances is another important consideration. The penetration of the substances by radiation was related to its element, thickness and density. On the other hand, the penetration power of the radiation was also a factor. In this case, people shielded by a concrete wall received only mild injuries.

Our members of the 11th Medical Corps were in the hypocenter. Yet, we received relatively milder radiation injuries compared with that of our university colleagues. One explanation is that we were shielded by several thick concrete walls.

Also, we worked in the radiation room, constantly exposed to radiation.

Regarding shelters, we think the thickness of the cover, the nature of the soil and its moistness had a great effect on the penetration power of the radiation.

The severity of symptoms in terms of age was also clearly demonstrated. Children developed severe reactions. There were many families left with only old people living and young people dead in the same family.

We shall compare X-ray irradiation for medical use and atomic bomb primary radiation.

Differences in irradiation		
	Atomic bomb	X-ray
Frequency	Once	Once or divided
Duration	Momentary	A few minutes to about 20-30 minutes
Doses	Very large amount	Below lethal dose
Type of wavelength	Mixed wavelengths	Within the same wavelength
Distance	Far (several hundred meters)	Short (20-30 centimeters)
Infiltration	Indefinite	Constant
Radiation area	Whole body	Lesion
Object	To kill people	To save people

Irradiation by the secondary residual radioactivity in small continuous doses results in whole body irradiation. This type of irradiation resembles radium radiation. Speaking in detail, this is a radium emanation bath, like repeatedly taking a hot spring bath in radium irradiated waters.

The people spoke about their radiation disorder in terms that they had "drunk the blast wind," that they had "aspirated a gas." These beliefs stemmed from the idea that all illness enters the human body from the mouth.

People had no knowledge of radiation, how it could get inside the body without stimulating sensory nerves and causing disorder. People thought that sick people got ill from chemical poisoning caused by the radiation, and a so-called "detoxification treatment" was called on for this physical disorder.

SECTION 3

Treatment

Stimulation therapy by auto-blood transfusion was retested and good results were realized. The mechanisms of this therapy must be studied in future. We would like to try auto-blood transfusion therapy on patients who developed leukemia as a result of clinical X-ray or radium irradiation.

Superstitious therapy was not carried out. There is no mystical way to go against the genius of science (the atomic bomb). The general population raised their scientific standards during the war.

CHAPTER 9

Review

SECTION 1

Preparedness

Leaders' mistakes

Nagai had been instructing the review and relief operations of the Civil Defense Corps at the request of the Nagasaki Prefecture Civil Defense Department since 1940. In retrospect, he recognized that he was completely mistaken at the end of the war. He asks to be pardoned and assume responsibility as the leader.

Namely, Nagai emphasized the importance first of external injuries, the second poison gas, the third microbiological warfare, and was instructing within this scope, but never considered the atomic bomb. The medical leaders in general were working at the direction of the Interior Department. Their responsibility was to just go back to the Interior Department, but Nagai had majored in Radiology, a field related to the atomic bomb and did not study countermeasures against atomic bombing, therefore, he did not give rescue instructions concerning such an attack.

This poor judgement of our leaders, their obstructive perspective, insufficient study of the enemy, and smugness were exposed, and he blames himself for the defeat of the war. Now, he feels amazed and ashamed to be a leader without knowledge of the enemy, for having spoken so arrogantly and without humility. Furthermore, the situation was not stopped by his confession. Tens of thousands of lives were lost. How can he compensate for this responsibility ?

From ancient times, the enemy's winning of a war was dependent on the use of an unknown weapon. This time Japan was completely surprised by the atomic bomb. Did our intelligence get any information ? Also, after the bombing of Hiroshima, why was the true picture not caught up with yet ? The leaders were surprised to see the effectiveness of the bomb, which was to end the war. Yet, instead of telling the people the truth and giving warning, the government simply announced that, "Hiroshima was bombed by a new type of bomb, that there was substantial damage." Why did the government make this announcement, which was like a rumor in another country ?

Well, he may be like a soldier of a defeated army talking like a commander who should be blamed.

The university

There are people who said that the staff of the university and its resources

should have been scattered, distributed, and stored. But, this is just talk in retrospect. We didn't have any concept of the atomic bomb. We were rushing for lectures, studying, as well as preparing defenses for an air raid all at the same time.

How was the defense of the university? That day, the air raid warning had just been turned off and a lecture had already begun. On civil defense duty in the hospital was the 6th (Shirabe Surgical Department), the 10th (Psychiatric Department) and the 11th (Radiology Department) Medical Corps. Professor Shirabe took command for the sick absence of Professor Takase of Psychiatry, and Associate Professor Nagai and Associate Professor Kido were under his command. We were well prepared for an ordinary bombing.

Two medical college students with alarm bells as surveillance stood watching the sky on the hill behind the university. We heard the two students shouting, "A strange looking plane is intruding," repeatedly, but in the next moment there was the loud engine sound of the plane accelerating, then *Pika*! The world ended.

SECTION 2

After the bombing

An unguarded moment

It was at mid-day during mid-summer. It was hot. Because the air raid alarm was called off, everybody relaxed and took off their heavy air raid clothes and helmets. Then we were attacked by surprise. The wounds were severe. People tried to get dressed but their clothes were buried under the debris or blown up and they could not find them. The people who jumped out without wearing shoes were wounded by stepping on nails.

What was the use, preparing air raid clothes for so long? Poor security is the greatest enemy. Our preparation didn't work at the most important time.

Judgement of the situation

At the moment of explosion, we did not lose consciousness. We were thinking calmly. Everybody thought the bomb had exploded nearby. And we were thinking about what to do while buried alive. We could not expand our vision even after getting out from under the debris and looking outside. Namely, we were calm, but we didn't get the true picture. Thus, our activities after the explosion were not well suited to what had just happened.

Equipment was not carried out

If we had any idea that it was an "atomic bomb"... He still recalls his

memory with deep regret. If we knew, we would have taken out radiation measuring instruments under any circumstances. If we had them (particularly the Geiger counter), we could have measured the radiation close up right after the explosion and in the following intervals to get any valuable data.

If we had taken out photographic equipment, developing materials and film could have been taken out. We could have measured the sensitivities of exposure or took pictures of the patients. We lost this once in a lifetime opportunity. We must apologize to the scientific community.

Should we save the people or should we take out equipment, we were thinking for a while? While we were thinking, a few injured people crawled to our feet. He thought about this question again while trying to stop their bleeding. And he went into the room again. The room was in disarray. There was nothing he could do.

Large equipment could not be moved through obstructed passageways, small equipment had blown up and was broken. The fire had not closed in yet, therefore, he decided to save the people. And we started first aid for the injured. While we worked without knowing the time, we brought up the injured to the hill behind the hospital.

There was a person shouting, "The X-ray Room is burning!" He looked at the X-ray room, which was blowing out flames. It must have started to burn the film. Then every window flared up with flames. There were injured still in the basement. We rescued our colleagues one by one from the burning basement for the sake of human life, rather than for the equipment. But, what was the result? Almost all of the patients we rescued died. How many people survived? Our desperate rescue operation meant nothing.

If in any case, they were going to die, leave them alone. We should have brought out important measuring instruments. We might have saved tens of thousands of lives, but there was no choice. We just could not leave the injured people alone.

Rescue scene

You may imagine that the rescue operation was carried out courageously and rapidly, but that was not the truth. Our activities were slow because we ourselves were wounded to some degree just after coming out from being buried and had no vital power. Also after complete evacuation of the hospital patients to the safe location, the injured continuously crawled up to the hospital from the town and collapsed in front of the entrance.

After we moved to the safe area, the fire closed in. Again, we had to move the patients to a safe place. We were getting tired. The patients complained. We had to listen to them. We had to go around to fulfill their requests. We were working with fatigue two hours later. However, the patients kept coming and coming. In retrospect, we break into a cold sweat now whenever we think of those patient cases. Our treatment was inadequate. We apologize for the water we gave to the dying patients,

such as a dirty pail of water.

We abandoned the patients overnight on the open farm field where it was safe from fire. We were human. We thought of ourselves only. That night we did not take care of the patients, but fell asleep, after we filled our stomachs eating pumpkins.

The second day was worse. We were lying down all day due to increased fatigue from radiation sickness. Furthermore, we did nothing for the critical patients moaning on the ground in front of us. Because no surgical supplies were left, we did not have the will to take care of them, only ask, "How are you ?" and let them drink water or eat pumpkin. Please forgive me.

Nagai had several experiences of confusion on the battleground and duplicated previous lessons he learned about commanding subordinates. Therefore, he stood right in front of the entrance immediately after the bombing, and subordinates came along with the exception of five dead. The survivors, carrying the wounded, unified in all of five minutes. What happened to the other units of the rescue team ? We saw the scene of defeat here.

Self-criticism

We must recognize our failure as professionals in our activities. That was, we failed to warn people to evacuate from the hypocenter until it was safe to live as determined by the results of tests for residual radioactivity. We should have noticed that this was an atomic explosion and contacted the Kyushu University Physics Department for confirmation. Residents 500 meters away from the hypocenter should have been moved without delay. If we did, so many people sheltered in the hypocenter would not have been sacrificed later. This showed a fault of the scientists' lack of community consciousness.

Fear

Even brave people once injured will become cowards. We were not particularly courageous people, this was especially true. From the instant the world had ended with the *Pika* to the small number of planes flying at a high altitude, we became so nervous that we jumped into a shelter every time, if even just one plane came. Our activities were interrupted quite often. The commander acted in this way. It could be criticized that the relief operation was conducted by a bunch of cowards. It was lucky that the war ended and that there were no more air raids. If the war had continued, what would our condition be ? He imagines that it would have ended disastrously for the relief group.

Atomic bomb disease is an unprecedented new disorder. The research laboratories of the local university were totally destroyed. With the war's end, the Japanese Airforce bombers had no more missions to perform. So, why did they not transport the many patients from Ohmura (Naval Hospital) to every university hospital in the nation with permission of the

Allied Forces ? If we could have done it, how many patients would have been saved ?

How much research was done ? We regretted the research resources lost with valuable human life altogether.

Even regarding the question of blood transfusions, there were no unaffected donors without radiation disorder in Nagasaki City. Why is it that the national government didn't recruit blood donors from other cities throughout Japan ? The activities of wartime national public health organizations were totally inactive. In this critical time, when executives were sent, they just chatted about their own memories of the bombing or conditions of their relatives and did not seriously discuss future projects.

From our own indecision, how many of our subordinates lost direction. Everybody did not know what to do. There were no clothes, no living accommodations, and nothing to eat. Staff members left us. Once the staff members had left us, there was no way to get back control. This was all the fault of the commanders, who had no experience of working together for life or death on the battleground. There are several things to be considered for working harmoniously and unified in the middle of a confused battleground.

First there should have been clear directions for the members to raise their spirits. Second, the responsibility of each member should have been clearly assigned. Third, the members' needs for clothing, food and shelter should have been fulfilled. Fourth, award and punishments should have been clearly defined.

We picked Mitsuyama and Nishiurakami to fulfill these conditions. The results were the almost complete achievement of the objectives.

We regret not making thorough rounds of the patients due to the members' getting wounded and ill with radiation disorder and falling into their sick beds one-by-one.

CHAPTER 10

Conclusion

In 1895, Dr Roentgen discovered the X–ray, followed by Becquerel who found natural radiation in uranium ore and Madame Curie who found radium. Hence, the foundation of radiology and atomic physics was built. From that time till now, 50 years later, a small number... a few superior scientists... contributed to the development of the progress of science and this been a great contribution for mankind.

The nuclear physics was considered to be an essence of Pure Science, it didn't seem to be too related to general society. Some people paid respect to the scientists' interesting work, yet despised it on the other hand. Then, suddenly, the atomic bomb exploded. This, in the sky above Hiroshima and Nagasaki, terrified the world like a thunder bolt in the blue sky. Also, at the same time, it terrified the minds of the scientifically sleeping Japanese community... like a thunder bolt in the blue sky. The importance of natural science, particularly theoretical science, was understood at this time. People came to know how important the results of scientists' research work could be even if it appeared to have little to do with society. They must have felt guilty for cold–eyed neglecting and looking down on these scientists.

Japan will never be saved if the people do not change their attitude towards science and scientists. After the bombing, many people questioned us about the atomic bomb. I was surprised that when I tried to explain it, people did not understand the contents of my explanation. I was surprised and felt loneliness over how low the scientific standards of the Japanese were.

Scientists strived hard for many years for the theme of utilizing free atomic energy. This time fell into the confusion of war, and the Americans achieved its solution first. At this time of tragedy, it shows the triumph of science. How can I face this fact ? We cry for the people, but we celebrate for academics. It is a victory for the scientists and a defeat for our motherland !

The atomic bomb took tens of thousands of lives in a split second. Furthermore, it left horrible injuries to tens of thousands of people. How do the souls of Roentgen, Becquerel, Curie, and Rutherford, who developed the foundation of this science, think in heaven ? What are the feelings of Joliot–Curie who discovered the neutron. Or Bohr, de Broglie, Planck etc, pioneers in this field ? They worked hard for research, for the benefit of mankind. But their work was used for the killing of human beings. There is nothing we can say. This is the work of descendants who ate the fruit of the Tree of Knowledge in Eden and of Cain who killed his younger brother.

The names of leading scholars Lawrence of the United States and Millikan of cosmic ray theory will be coming out as well. Did they participate in this work ? I hope that these respectable scholars were not participants in this inhuman and cruel abuse of science.

But the atomic bomb was made by our fellow atomic physicist colleagues. Are they really murderers ? We would not like to see that. They had the hands of the devil but the heart of Buddha. They hoped for the early termination of the war and the return of world peace. They must have wished for the saving of more lives on the earth with the sacrifice of Hiroshima and Nagasaki. These things were emphasized in several announcements. We believed it, and we would like to tell our nation about the agony of our fellow American physicists and radiologists.

Everything was finished. Our mother land was defeated. Our university had collapsed and classrooms were reduced to ashes. We, one by one, were wounded and fell. The houses we lived in were burned down, the clothes we wore were blown up, and our families were either dead or injured. What are we going to say ? We only wish to never repeat this tragedy with the human race.

We should utilize the principle of the atomic bomb. Go forward in the research of atomic energy contributing to the progress of civilization. A misfortune will then be transformed to good fortune. The world civilization will change with the utilization of atomic energy. If a new and fortunate world can be made, the souls of so many victims will rest in peace.

List of Patients

Nishiurakami, Mitsuyama, Kawabira-machi

Note
(P) : Pseudo-burns, (E) : External injury, (EB) : Early onset blood disorder
(DO) : Digestive organ disorder, (I) : Indirect disorder, (LB) : Late onset blood disorder
C : Complete recovery, D : Dead, PR : Partial recovery, M : Migrated out

No.	Name	Sex	Age	Distance (km)	Immediate injuries	Late onset disorder	Prognosis	Date of onset	Date of Prognosis	Duration (days)
1	R.O.	F	43	2	Face, Chest, Limbs (P)		C	Aug. 9	Aug. 28	20
2	S.S.	M	11	2	Face, Hands (P)		C	Aug. 9	Aug. 26	18
3	M.S.	M	12	2	Face (P)		C	Aug. 9	Aug. 26	18
4	S.Y.	F	73	2	Face, Chest (P)		C	Aug. 9	Aug. 29	21
5	T.N.	F	53	1	Face, Left hand, Back (P)		C	Aug. 9	Sep. 25	48
6	N.N.	F	23	1	Face, Neck, Hands, Knees (P)		C	Aug. 9	Oct. 5	58
7	A.N.	F	15	1	Face, Limbs, Chest (P)		C	Aug. 9	Oct. 5	58
8	S.I.	M	49	1	Head, Neck, Right hand (P)		C	Aug. 9	Aug. 24	16
9	T.Y.	M	20	1	Face, Neck, Right arm (P)		C	Aug. 9	Sep. 21	44
10	S.F.	M	26	2	Back, Chest, Arms (P)		C	Aug. 9	Sep. 13	36
11	N.O.	M	54	2	Face, Neck, Forearms (P)		C	Aug. 9	Aug. 28	20
12	R.O.	F	46	2	Face, Chest, Arms, Right shin (P)		C	Aug. 9	Aug. 26	18
13	K.T.	M	43	3	Face, Feet (P)		C	Aug. 9	Sep. 11	34
14	M.O.	M	48	3	Face, Shins (P)		C	Aug. 9	Sep. 8	31
15	M.I.	F	54	2	Face, Neck, Left forearm (P)		C	Aug. 9	Sep. 1	24
16	S.T.	F	66	3	Chest (P)		C	Aug. 9	Aug. 24	16
17	H.K.	M	34	1	Face, Neck, Arms (P)		C	Aug. 9	Oct. 5	58
18	T.H.	M	16	3	Shoulder blade (P)		C	Aug. 9	Aug. 28	20
19	T.M.	M	45	3	Forearms (P)		C	Aug. 9	Sep. 2	25
20	I.W.	M	53	3	Face, Neck (P)		C	Aug. 9	Aug. 28	20

List of Patients (continued)

No.	Name	Sex	Age	Distance (km)	Immediate injuries	Late onset disorder	Prognosis	Date of onset	Date of Prognosis	Duration (days)
21	I.W.	F	59	3	Buttocks (P)		C	Aug. 9	Aug. 25	17
22	H.W.	M	21	3	Upper arms (P)		C	Aug. 9	Aug. 25	17
23	Y.H.	M	60	3	Face, Right abdomen, Feet (P)		C	Aug. 9	Sep. 10	33
24	C.H.	F	58	3	Face, Right leg (P)		C	Aug. 9	Sep. 1	24
25	T.N.	M	47	3	Face, Forearms (P)		C	Aug. 9	Aug. 28	20
26	H.Y.	M	12	3	Right forearm, Back (P)		C	Aug. 9	Aug. 26	18
27	M.N.	M	6	3	Face, Forearm (P)		C	Aug. 9	Aug. 25	17
28	F.T.	F	18	3	Chest (P)		C	Aug. 9	Aug. 20	12
29	E.N.	F	28	3	Forearms (P)		C	Aug. 9	Aug. 25	17
30	S.I.	F	41	1	Face, Back (P)		PR	Aug. 9	Oct. 8	61
31	T.I.	M	8	1	Face, Forearms, Legs (P)		PR	Aug. 9	Oct. 8	61
32	S.M.	F	55	1	Face, Chest, Forearms (P)		PR	Aug. 9	Oct. 8	61
33	J.H.	F	25	1	Face, Back, Hip, Right forearm (P)		D	Aug. 9	Aug. 14	6
34	M.A.	M	1	1	Right forearm, Right shin (P)		D	Aug. 9	Aug. 15	7
35	K.I.	F	13	2	Legs, Elbows (P)		D	Aug. 9	Aug. 14	6
36	T.I.	M	47	1	Face, Shoulder, Forearms, Right foot (P)		D	Aug. 9	Oct. 3	56
37	S.T.	F	39	1	Head, Chest (E)		C	Aug. 9	Sep. 4	27
38	H.K.	M	9	2	Right shin (E)		C	Aug. 9	Sep. 14	37
39	T.I.	M	38	1	Left forearm, Chest (E)		C	Aug. 9	Aug. 26	18
40	H.O.	F	32	1	Left arm (E)		C	Aug. 9	Sep. 28	51
41	Y.T.	M	17	1	Feet (E)		C	Aug. 9	Aug. 28	20
42	T.T.	F	21	1	Right arm, Feet (E)		C	Aug. 9	Aug. 26	18
43	M.O.	F	31	1	Right hand (E)		C	Aug. 9	Sep. 20	43
44	Y.F.	F	19	1	Right loin (E)		C	Aug. 9	Sep. 5	28
45	M.S.	F	17	1	Face, Left foot, Right forearm (E)		C	Aug. 9	Sep. 12	35
46	E.M.	F	20	1	Face, Hands, Left foot (E)		C	Aug. 9	Aug. 27	19
47	M.M.	M	21	1	Head, Left forearm (E)		C	Aug. 9	Oct. 3	56
48	N.Y.	M	20	1	Head, Right upper arm, Left elbow (E)		C	Aug. 9	Sep. 9	32

List of Patients (continued)

No.	Name	Sex	Age	Distance (km)	Immediate injuries	Late onset disorder	Prognosis	Date of onset	Date of Prognosis	Duration (days)
49	M.M.	M	35	1	Hip, Left arm (E)		C	Aug. 9	Aug. 22	14
50	Y.M.	M	49	1	Knees (E)		C	Aug. 9	Aug. 17	9
51	N.N.	F	54	1	Left abdomen (E)		C	Aug. 9	Sep. 11	34
52	M.Y.	M	17	1	Right foot (E)		C	Aug. 9	Aug. 25	17
53	S.T.	F	19	1	Head, Back (E)		C	Aug. 9	Aug. 24	16
54	K.M.	F	18	1	Left forearm (E)		C	Aug. 9	Sep. 2	25
55	Y.K.	F	17	1	Left forearm (E)		C	Aug. 9	Aug. 24	16
56	G.N.	M	46	1	Left forearm (E)		C	Aug. 9	Sep. 1	24
57	S.T.	F	3	1	Right forearm (E)		C	Aug. 9	Sep. 4	27
58	K.M.	F	4	1	Right forearm (E)		C	Aug. 9	Sep. 6	29
59	G.H.	M	17	1	Right side of body (E)		C	Aug. 9	Sep. 7	30
60	I.M.	F	18	1	Right leg (E)		C	Aug. 9	Aug. 29	21
61	K.F.	M	17	1	Right shin (E)		C	Aug. 9	Aug. 22	14
62	M.I.	M	11	1	Upper body (E)		C	Aug. 9	Oct. 6	59
63	T.M.	F	20	1	Face (E)	(LB)	C	Aug. 9 Sep. 1	Sep. 20 Sep. 25	43 25
64	M.O.	F	21	1	Head, Right leg, Right foot (E)		P	Aug. 9	Oct. 8	61
65	E.O.	F	34	1	Face, Right forearm (E)	(LB)	P	Aug. 9 Sep. 1	Oct. 8 Sep. 30	61 30
66	Y.E.	F	46	1	Buttocks (E)		P	Aug. 9	Oct. 8	61
67	T.	M	30	1	Left leg (E)		P	Aug. 9	Oct. 8	61
68	T.W.	M	32	One half	Face, Left leg (E)	(EB)	D	Aug. 9	Aug. 20	12
69	Y.K.	M	19	One half	Face, Arms (E)	(EB)	D	Aug. 9	Aug. 16	8
70	M.K.	M	18	1	Whole body (E)	(EB)	D	Aug. 9	Aug. 22	14
71	T.T.	F	32	1	Left fingers (E)	(LB)	D	Aug. 9 Aug. 23	Sep. 7 Sep. 7	30 14
72	T.T.	F	23	1	Left forearm (E)	(LB)	D	Aug. 9 Aug. 30	Sep. 9 Sep. 7	32 10
73	S.U.	F	55	1	Face (E)		D	Aug. 9	Aug. 24	16

List of Patients (continued)

No.	Name	Sex	Age	Distance (km)	Immediate injuries	Late onset disorder	Prognosis	Date of onset	Date of Prognosis	Duration (days)
74	C.F.	F	5	1	Buried, Whole body (E)		D	Aug. 9	Aug. 18	10
75	M.H.	F	13	1	Left forearm, Chest (E)	(DO)	D	Aug. 9	Aug. 23	15
76	S.H.	F	55	1	Back, Face (E)	(DO)	D	Aug. 9	Aug. 21	13
77	S.K.	F	70	1	Head, Neck, Right hand (E)	(DO)	D	Aug. 9	Aug. 29	21
78	F.K.	F	20	1	Head (E)	(DO)	D	Aug. 9	Aug. 15	7
79	U.H.	F	47	1	Left shoulder (E)	(DO)	D	Aug. 9	Aug. 19	11
80	Y.M.	M	17	One half	Right forearm, Head (E)	(DO)	D	Aug. 9	Aug. 17	9
81	I.M.	M	3	1	Right forearm (E)		M	Aug. 9	Aug. 15	7
82	T.T.	M	5	1	Head (E)		M	Aug. 9	Aug. 13	5
83	E.F.	F	27	1	Face, Right forearm (E)		M	Aug. 9	Sep. 8	31
84	N.M.	F	30	1	Hip (E), Left thigh (P)		C	Aug. 9	Sep. 9	32
85	S.K.	M	67	1	Left shoulder (P), Face (E)		C	Aug. 9	Aug. 28	20
86	Y.M.	M	22	1	Right knee (E), Face, Chest, Left forearm (P)		C	Aug. 9	Sep. 3	26
87	M.K.	M	54	1	Left shoulder, Face (P), Chest (E)		C	Aug. 9	Sep. 11	34
88	K.M.	F	20	1	Right upper body (P), (E)		C	Aug. 9	Sep. 17	40
89	T.N.	M	58	2	Hip (E), Right forearm (P)		C	Aug. 9	Sep. 9	32
90	T.K.	M	18	1	Head (E), Right limbs (P)		C	Aug. 9	Oct. 1	54
91	H.N.	F	34	1	Face, Left forearm (P), Hip (E)	(DO)	D	Aug. 9	Aug. 18	10
92	S.N.	M	32	1	Left side of body (P), (E)		D	Aug. 9	Aug. 17	9
93	S.T.	M	11	1	Buried	(DO)	M (Later died)	Aug. 9	Aug. 12	4
94	H.T.	M	20	1	Buried	(DO)	M (Later died)	Aug. 9	Aug. 14	6
95	R.M.	F	4	1	Buried	(DO)	D	Aug. 9	Aug. 19	11
96	S.U.	F	39	1	Buried	(DO)	D	Aug. 9	Aug. 20	12
97	Y.U.	M	1	1	Buried	(DO)	D	Aug. 9	Aug. 19	11
98	F.	F	25	1	Buried	(DO)	D	Aug. 9	Aug. 20	12
99	H.K.	F	20	1	Buried	(DO)	D	Aug. 9	Aug. 21	13

List of Patients (continued)

No.	Name	Sex	Age	Distance (km)	Immediate injuries	Late onset disorder	Prognosis	Date of onset	Date of Prognosis	Duration (days)
100	R.H.	M	10	1	Buried	(DO)	D	Aug. 9	Aug. 16	8
101	I.M.	F	50	3		(EB)	M	Aug. 12	Sep. 7	27
102	M.K.	M	20	1		(EB)	D	Aug. 13	Aug. 29	17
103	N.N.	M	31	1	Buried	(EB)	D	Aug. 9	Aug. 26	18
104	T.M.	M	5	1		(LB)	D	Aug. 21	Aug. 25	5
105	M.T.	F	14	1		(LB)	D	Aug. 30	Sep. 7	8
106	H.S.	M	34	1		(LB)	PR	Sep. 1	Oct. 8	38
107	R.T.	F	10	1	Buried	(LB)	PR	Aug. 28	Oct. 8	41
108	M.M.	F	21	1		(LB)	PR	Sep. 5	Sep. 6	2
109	S.T.	F	24	1		(LB)	C	Sep. 10	Sep. 16	7
110	S.M.	M	17	1		(LB)	C	Sep. 8	Sep. 20	13
111	H.M.	M	56	1		(LB)	C	Sep. 5	Sep. 30	26
112	M.O.	M	7	1		(LB)	C	Sep. 1	Sep. 30	30
113	A.M.	F	28	1		(LB)	C	Sep. 25	Oct. 2	8
114	T.N.	F	25	1		(LB)	C	Sep. 1	Oct. 3	33
115	H.I.	F	42	1		(LB)	C	Sep. 1	Oct. 3	33
116	O.E.	F	20	1		(LB)	C	Sep. 8	Sep. 27	20
117	F.T.	M	55	1		(LB)	C	Aug. 30	Oct. 3	34
118	S.H.	M	16	1		(LB)	C	Sep. 3	Sep. 25	23
119	T.H.	F	20	1		(LB)	C	Sep. 15	Sep. 30	16
120	I.M.	M	15	1		(LB)	C	Sep. 20	Oct. 3	14
121	E.M.	M	52	4		(LB)	C	Sep. 15	Sep. 24	10
122	M.U.	F	33	7		(LB)	PR	Oct. 1	Oct. 8	8
123	Y.T.	F	12	7		(LB)	C	Sep. 28	Oct. 7	10
124	K.K.	M	61	7		(I)	C	Sep. 15	Sep. 30	16
125	N.Y.	F	12	7		(I)	C	Aug. 10	Aug. 16	7

APPENDIX A

The Life and Work of Dr. Nagai

The Life and Work of Takashi Nagai
The Man who Loved Others as Himself*

Takashi Nagai was born in Matsue City, Shimane Prefecture in 1908, the first son of Hiroshi and Tsune Nagai. His father was a physician, and Nagai grew up in an affluent environment. Aspiring to the medical profession, Nagai entered Nagasaki Medical University (predecessor of Nagasaki University School of Medicine). While a student he was a member of the college basketball team. After graduation he entered the Radiology Department.

Nagai was dispatched to China after the Manchurian Incident. Finding a catechism in his comfort kit, he took a keen interest in Catholicism. He was baptized after his return to Nagasaki and took the Catholic name Paul. It was around this time that he met and married Midori Moriyama. Nagai returned to China as a military doctor but came back to Nagasaki in 1940 to become associate professor at Nagasaki Medical University and chief of the Radiology Department. Takashi and Midori Nagai had to live apart from their two children during World War II. In June 1945, Dr. Nagai was found to be suffering from leukemia and given only three years to live. He had developed the disease as a result of occupational exposure to radiation. This was only the beginning of tragedy.

At 11:02 a.m., August 9, 1945, an atomic bomb dropped from an American B-29 exploded over Nagasaki and assailed the city with a ferocious blast and blinding flash of light. Dr. Nagai was in his office at Nagasaki Medical University, only 700 meters from the hypocenter. Despite his own illness, he had devoted himself to the care of the many people injured in past air raids.

"The explosion of the atomic bomb came altogether unexpectedly. I saw the flash of light in the radium laboratory. Not only my present but also my past and future were blown away in the blast. My beloved students burned together in a ball of fire right before my eyes. Then I collected my wife, whom I had asked to take care of the children after my death but who now had become a bucket-full of soft ashes, from the burnt-out ruins of our house. She had died in the kitchen. For me, the injury to the right side of my body and acute atomic disease caused by the atomic bomb were added to my chronic radiation illness, disabling me far sooner than expected." (from *Kono Ko wo Nokoshite* [Leaving These Children Behind])

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*Reproduced and modified with the permission of the Nagasaki Municipal Government from their Internet Homepage (http://www.us1.nagasaki-noc.ne.jp/~nacity/na-bomb/nagai/nagae05.html).

Dr. Nagai suffered a tremendous loss in the atomic bombing. But faced with the reality of the situation, he resolved to devote himself to the relief of the survivors. Waiting for him was a subject of study that no one before him had ever tackled : atomic bomb disease. There were immense numbers of injuries and cases of atomic bomb disease, and people were dying left and right. Dr. Nagai strove to help the victims but soon succumbed to injuries himself and had to suspend his relief activities.

Dr. Nagai suffered numerous cuts on the right side of his body as a result of flying splinters of glass. The cut on his right temple was so deep that it severed an artery and caused blood to spurt out like a fountain. Dr. Nagai continued his relief activities with a bandage around his head but finally collapsed as a result of blood loss. The symptoms of atomic bomb illness appeared around September 10, and Dr. Nagai lost consciousness as a result of the necrosis of his wounds and high fever.

Miraculously surviving, Dr. Nagai resumed relief activities and returned to the lectern. He continued to go out on rounds even after becoming a professor in 1946. During one of his trips he collapsed at Nagasaki Railroad Station and had to be carried home by a friend. After that he was confined to bed and his condition worsened day by day.

"From that day to the present the illness has gradually gained momentum. Now I have to rely on other people even to fetch pieces of paper for me. I barely have the strength to look into a microscope, let alone to examine patients. Fortunately, though, my topic of research—atomic bomb disease—is right here in my own body." (from *Kono Ko wo Nokoshite* [Leaving These Children Behind]) Dr. Nagai continued his battle with atomic bomb disease by placing his own body on the research table. Although confined to bed, Dr. Nagai continued his research and writing on atomic bomb disease.

Nyokodo (As Yourself Hermitage) was constructed in the spring of 1948 when people were beginning to put up makeshift shacks on the atomic wasteland. It was built by donations from the church and from the people of Urakami. The tiny house was called *Nyokodo* (As Yourself Hermitage) after the Christian maxim "Love others as you love yourself." From the tiny two-tatami-mat room (about four square meters in area), Dr. Nagai produced one famous work after another as a way to encourage the people of Urakami. He published paintings and collections of Japanese poetry in addition to novels and essays such as *Rozario no Kusari* (The Rosary Chain), *Kono Ko wo Nokoshite* (Leaving These Children Behind), *Seimei no Kawa* (River of Life) and *Nagasaki no Kane* (Bells of Nagasaki). *Kono Ko wo Nokoshite* was later made into a movie, and *Nagasaki no Kane* inspired a hit song that is still popular today.

"Nyokodo, my place of lodging, has an area of only two tatami mats. My bed takes up one mat, and Makoto and Kayano live on the other... I happily came to live here, considering it God's blessing. The people of Urakami love others as they love themselves, truly a blessing for a person far from home and weary from the hardships of the way. That is why I

called this house "As Yourself Hermitage" and why I constantly offer prayers of thanks." (from *Kono Ko wo Nokoshite* [Leaving These Children Behind])

Dr. Nagai's two children Makoto and Kayano escaped the atomic bombing because they had been evacuated to the countryside. His deep distress over the fact that they had lost their mother and would soon lose their father as well became the driving force behind his prolific writing.

"I have to postpone the moment when these children become orphans, even by one day or one hour. Even if it is only one minute or one second I want to reduce the length of time they must suffer loneliness." (from *Kono Ko wo Nokoshite* [Leaving These Children Behind])

Dr. Nagai wanted to stay with his children for as long as possible.

"I was pretending to sleep and Kayano relaxed and put her cheek against mine. I could feel my cheek gradually warming. Then, as though enjoying a tiny treasure that she did not want anyone else to know about, she whispered, "Daddy." She was not actually calling me. Some delicate thought was just spilling, barely audible, from the depths of her heart." (from *Kono Ko wo Nokoshite* [Leaving These Children Behind])

Dr. Nagai's spleen swelled as a result of the leukemia, causing the danger of internal bleeding and making it impossible to share contact with his children. Most of Dr. Nagai's income went for the benefit of poor children and people suffering from atomic bomb disease. In the midst of extreme chaos and poverty after the war, there were many children in Urakami who had lost their parents in the atomic bombing or who were too poor to receive a proper education.

Dr. Nagai led the effort to establish a private library for these children. Called *Uchira no Honbako* ("Our Book Case"), the library provided a place for children to play and read books. Dr. Nagai's philosophy of "Love others as you love yourself" affected many people and resulted in contributions from as far away as Brazil. The works Dr. Nagai produced in his tiny room in Nyokodo touched the hearts of people around the world and brought fame both in Japan and abroad. Among his visitors were Emperor Showa, Helen Keller, a messenger of the Pope and many other friends, acquaintances and well-wishers.

The end came suddenly on May 1, 1951. With his children at his side, Dr. Nagai died in his former work place, Nagasaki Medical University Hospital, after praying in a strong voice. He was only 43 years old.

"From here I can see Makoto preparing to carry away broken roof tiles in a straw basket, and Kayano playing house by herself and using the fragment of an Arita vase to arrange flowers. I wonder how these children will comment on my way of thinking after they grow up. In 50 years time they will be much older than I am today. Perhaps when they read this book they will sit together and rattle their false teeth, saying things like 'Dad certainly had a youthful outlook.' " (from the final chapter of *Kono Ko wo Nokoshite* [Leaving These Children Behind])

Publications of Takashi Nagai

Books

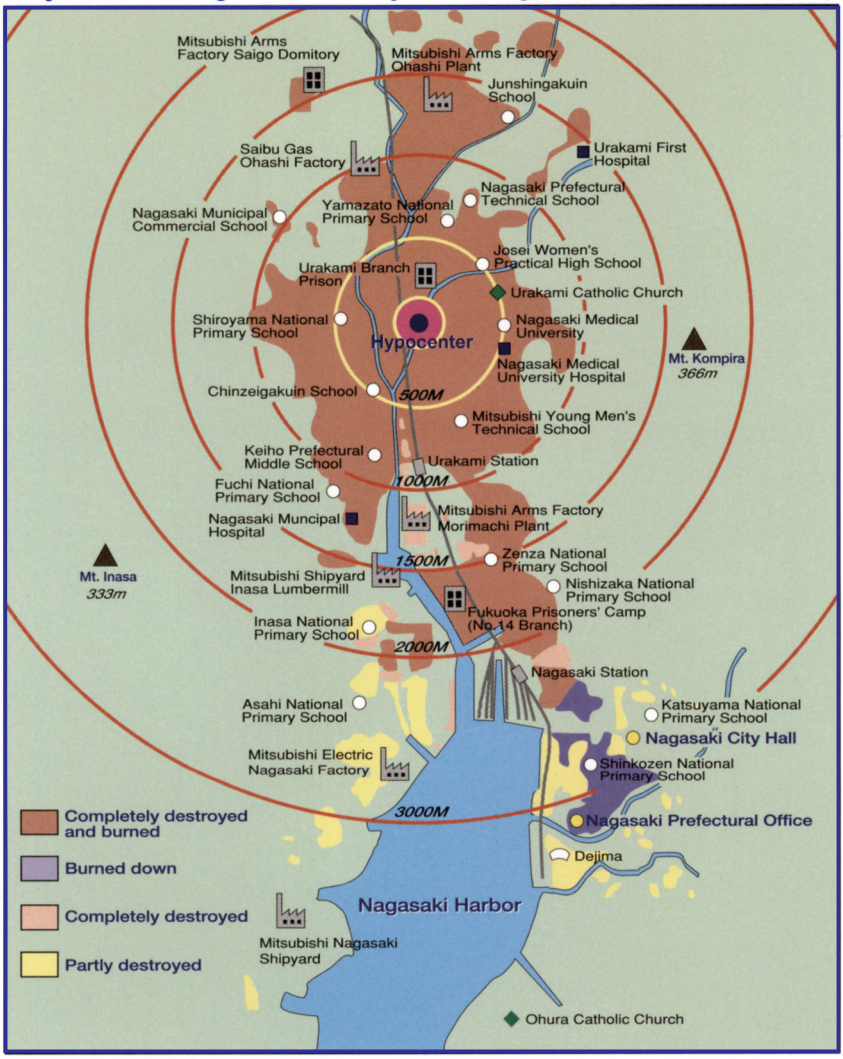
Nagasaki no Kane (finished August 1946, published 1949)
English version is available:
The Bells of Nagasaki, translated by William Johnston, Kodansha International, Tokyo, 1984
Rozario no Kusari [The Rosary Chain] (finished March 1948)
Kono Ko wo Nokoshite [Leaving These Children Behind] (finished April 1948)
Horobinu Mono wo [Something Imperishable] (finished January 1948)
Seimei no Kawa [River of Life] (finished August 1948)
Nyokodo Zuiso [Essays from Nyokodo] (published December 1957)
Otome Toge [Otome Pass] (finished April 1951, published September 1952)
Itoshigo Yo [Beloved Child] (published October 1959)
Genshiya Rokuon [Recordings on the Atomic Wasteland] (published as a series in Seibo-no-Kishi journal 1947 to 1951)
Heiwato [Peace Tower] (published in November 1979)
Son'i [Village Doctor] (published in April 1978)
Nagasaki no Hana [Flower of Nagasaki (Vol. I, II, III)] (published as a series in Tokyo Times in 1950)
Genshigumo no Shitani Ikite [Living Under the Mushroom Cloud] (published in 1949)
Watashitachi wa Nagasaki ni Ita (published in October 1952)
English version is available:
We Of Nagasaki The Story of Survivors in an Atomic Wasteland, translated by Ichiro Shirato and Herbert B. L. Silverman, Victor Gollancz Ltd., London, 1951

All of the above titles are now published by SAN PAOLO (1-5, Wakaba, Shinjuku, Tokyo 160-0011, Japan; Tel: +81 3 3359 0451; Fax: +81 3 3351 9534) except for *Nagasaki no Hana* which is published by Seibo-no-Kishi (196 Hongochi-machi, Nagasaki 850-0012, Japan; Tel: +81 95 824 2080; Fax: +81 95 823 5340).

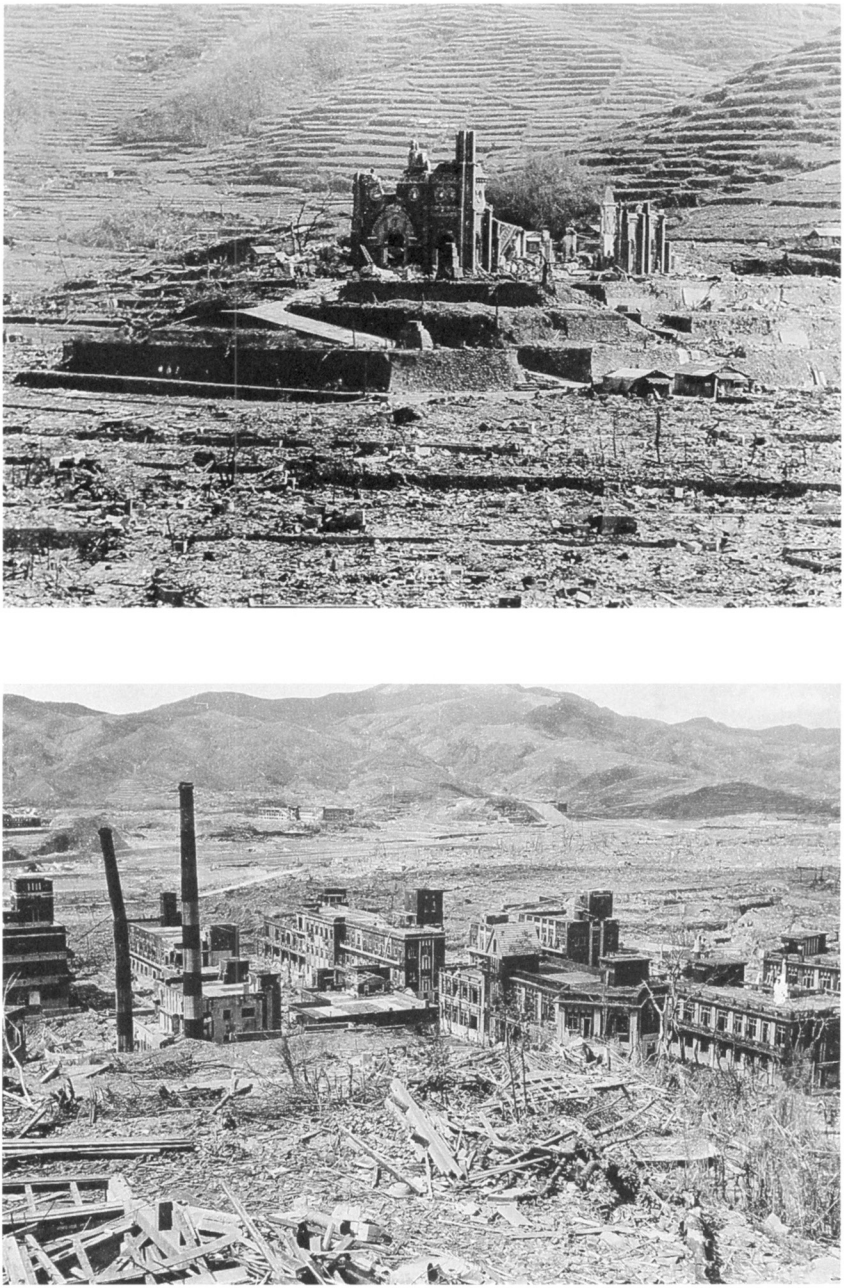
APPENDIX B

The Nagasaki Atomic Bombing

Physical Damage Caused by the Nagasaki Atomic Bombing



The foremost characteristic of the physical damage caused by the Nagasaki atomic bomb was the tremendous, instantaneous destruction wreaked by the blast wind and the subsequent fires. These fires broke out simultaneously with the destruction of buildings over a wide area. The complete destruction and burning of buildings extended a distance of two kilometers beyond the hypocenter.



The Ruins of Urakami Catholic Church (upper panel) and Nagasaki Medical University (lower panel).

The Nagasaki Atomic Bombing*

Circumstances of the bombing

At 11 : 02 a.m. August 9, 1945, two B29 bombers flew from Kumamoto north towards the west over the Shimabara peninsula and intruded from the northeast of Nagasaki city and dropped an atomic bomb at the north of the city, then flew out immediately. The atomic bomb was dropped at an altitude of 9,600 meters, and it exploded at a point approximately 500 meters above ground. On that day, it was a clear sky, also quite hot, but almost calm.

1. The energy of the atomic bomb

The energy of the plutonium bomb dropped on Nagasaki is estimated to be 21 kilotons of TNT. A huge fireball was created immediately after the explosion, an extremely powerful heat wave and radioactivity were emitted from the epicenter and the great expansion of air around the epicenter became the bomb blast. Those energy yields were estimated to be about 35% heat wave energy, nearly 50% blast energy, and the rest of about 15% radioactive energy.

2. The power of the heat wave

As explosion of the bomb occurred, the fireball reached millions of degrees Celsius at maximum and its volume rapidly expanded, then after 10 seconds, it lost brilliance. From the instant of explosion, the size and temperature of the fireball increased as follows : 0.1 milliseconds later, the diameter was about 28 m and the surface temperature was uniformly distributed at about 300,000C°; 10 milliseconds later, the diameter was about 180 m and the surface temperature was about 1,700C°; 0.3 seconds later, the surface temperature again increased to about 7,000C°; 1 second later, the diameter reached its maximum of about 280 m at 5,000C° surface temperature, and the temperature gradually diminished reaching 1,700C° by 3 seconds later. About 99% of the heat wave emitted from the fireball severely affected the ground only from 10 milliseconds to about 3 seconds after the explosion.

It was infrared rays emitted from 0.3 to 3 seconds after the explosion that caused burns on human bodies. The thermal burns on uncovered parts of the body were observed in people exposed to the bomb up to 4 km from the hypocenter. Furthermore, people who were exposed to the bomb without any shielding suffered lethal thermal burns and approximately 20 to 30% of deaths are estimated to be due to thermal burn injury.

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*Reproduced and modified with the permission of the Nagasaki Prefectural and Municipal Governments from their reports entitled "Summary of the Atomic Bomb Survivors Affair Activities" published in 1999.

3. The power of the bomb blast

Hundreds of thousands of tons of impact pressure was instantly created by the explosion, and expanded air formed the bomb blast. The fringe of the blast developed as a shock wave which is a wall of high pressure air propagated at the speed of sound or faster. Ten seconds after the explosion, the shock wave reached approximately 3.7 km, and by 30 seconds, it reached about 11 km distance from the epicenter, eventually losing power.

The deaths and external injury cases caused by blast mainly came from collapsed structures and flying fragments. Within a 1.3 km radius distance from the hypocenter, casualties by blast were significant and 20% of the deaths there are considered due to the blast.

Furthermore, the damage was amplified by composite effects of heat wave, blast and secondary fires and many people burned to death under collapsed buildings.

4. The power of the radiation

In addition to the above-mentioned damages caused by heat wave, blast and secondary fires, the atomic bomb added a new type of scourge, never experienced by a conventional bomb, that of radiation exposure. Radiation itself could kill many of the people who were irradiated at greater than or equal to 4 Gy over their whole body. The atomic bomb survivors have persistently suffered mentally and physically due to composite interactions between radiation injury and thermal and external injuries.

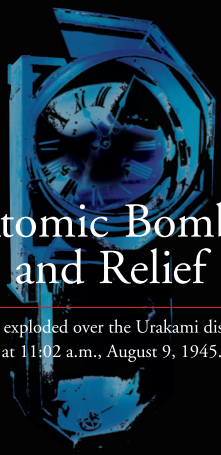
State of damage

The damage reported by the Committee of Atomic Bomb Scientific Data Registry in July 1950 is as follows:

The dead	73,884 persons
The injured	74,909 persons
Number of victims	120,820 persons[a]
Number of damaged houses	18,409 dwellings[b]
Completely burned down houses	11,574 dwellings[c]
Razed houses	1,326 dwellings[d]
Partially razed houses	5,509 dwellings[e]

[a]The number of permanent residents whose dwellings were within 4 km radius of the hypocenter and were completely burned out or razed.
[b]Number of dwellings within 4 km radius of the hypocenter and was about 36% of total dwellings in the city.
[c]Number of dwellings within 4 km radius from the hypocenter and was about 1/3 of the total dwellings in the city.
[d]The dwellings within 1 km radius from the hypocenter were regarded as razed houses.
[e]The dwellings between 1 to 4 km radius from the hypocenter were regarded as partially razed houses.

As of October 1, 1950, a total of 131,050 persons in Japan were noted as Nagasaki atomic bomb survivors by the supplementary survey of 1950 National Census, and the population of Nagasaki City just prior to the atomic bombing is estimated at around 210,000 persons.



Atomic Bomb Rescue and Relief Report

An atomic bomb exploded over the Urakami district of Nagasaki at 11:02 a.m., August 9, 1945.

NASHIM