

W. M. W. HAFFKINE, BACTERIOLOGIST—A GREAT SAVIOUR OF MANKIND

H. I. JHALA

Haffkine Institute, Bombay 12

(Received October 7, 1967)

Waldemar Mordecai Wolff Haffkine was a Russian-born (1860) zoologist who migrated to Paris to work under Louis Pasteur. To test his hypothesis on protection against cholera, he came to India in 1893. He shifted on to successful preparation of plague vaccine in Bombay when epidemic occurred in 1896. The laboratory set up by him is now known as Haffkine Institute after his memory. He was an apostle of prophylactic inoculation and a conqueror of plague. The life was not smooth sailing for him and he had his tragic episodes that left bitter taste in his later life. He was a brilliant scientist, full of humanity, hard work and humaneness. He passed away in 1930.

‘Lives of great men all remind us
We can make our lives sublime,
And while departing leave behind us,
Footprints on the sands of time.’

H. W. LONGFELLOW

Early Life

Brilliant and tragic life of the bacteriologist, WALDEMAR MORDECAI WOLFF HAFFKINE, is an inspiring one indeed. Born on 15th March, 1860, at ODESSA (then known as Novo Rossisk), a prosperous Black Sea Port of the Czarist Russia, he came only of a humble family of a schoolmaster. His mother, Rosalie Chavkin, died when the boy was very young and poor Waldemar grew as a lonely child. His father, Aaron, who belonged to a Jewish merchant family and had moved to Berdiansk, on the sea of Azov, had put Waldemar in a local county school in 1870. In 1872 he entered the Gymnasium (a school) where he learnt German and Russian. On leaving the Gymnasium in 1879, he entered the Faculty of Natural Science at Odessa. His education was supported by his elder brother who gave him 10 roubles a month. Haffkine learnt physics, mathematics and zoology. He got associated in the zoological excursions with Elie Metchnikoff, professor of zoology, and hence he decided to be a zoologist. In 1882 he matriculated and in 1883 he received his diploma. He presented a dissertation in zoology and was awarded a degree of candidate of natural sciences.

His school and university period was a period of great turmoil in Russia. There were uprisings against the Czar Alexander who was assassinated by

terrorists. Haffkine belonged to an organization—Narodnair Volie (Will of the People). The successor reactionary Czarist régime made scapegoat of the Jews and made it hot for them to continue their residence in Russia. Restrictions began to appear for the areas of their settlement. Their percentage of admissions to educational institutes was drastically cut by 1880. Haffkine was arrested by them for being a member of the Jewish Self-defence League. His release was possible only because Professor Metchnikoff appeared as defence witness. This left a lasting impression on his mind which enabled him to leave politics, be religious and remain attached to his faith.

After his graduation, he decided to stay in Odessa and take up a position as Curator in Zoological Museum until 1888. Since he did not embrace Christianity, he could never hope to rise to the coveted professorship. He had a modest laboratory, where he studied the nutrition and hereditary characters of the smallest unicellular forms of life. He also translated zoological book of Klans from German into Russian.

At this stage, it is necessary to mention that Odessa was a great centre for study of microbiology, a newer science that dealt with invisible microbic forms of life. Louis Pasteur had opened up this branch of science by his eminent work at Paris in the second half of the nineteenth century. Odessa produced Elie Metchnikoff, who postulated his famous theory of cellular defence by white blood-cells against bacteria. It also gave N. F. Gameliya, an eminent microbiologist, who organized the first Pasteur Institute outside France. A. M. Bezredka, who postulated theory of local tissue resistance, was a contemporary of Haffkine. Today, the Socialist Republic of Soviet Union has institutions founded after their names except one for Haffkine, whose name stands commemorated in the Haffkine Institute of Bombay, where Haffkine spent many useful years of his life. So also, Selman Waksman, the discoverer of streptomycin from U.S.A., was a Jew from Odessa. Like other scientists, Haffkine decided to migrate, as the prospects of scientific advancement were limited in Odessa. Amongst those who also migrated during this time for similar reasons were his Professor Metchnikoff and Alexander Kresilcheck, who became an eminent entomologist. Majority of Russian Jews usually migrated to Switzerland and so did Haffkine in 1888 to work as assistant in physiology under Professor Schiff at Geneva Medical School. He taught for a year and got attracted to work with Louis Pasteur in Paris. He worked with devotion at the feet of this master. His work lasted from 1889 to 1893, before he migrated to India with his limited resources for testing his discoveries.

Work at Pasteur Institute, Paris

His first appointment with Pasteur was as assistant librarian. He spent the rest of his time in the laboratory of Emile Roux. His only other



WALDEMAR MORDECAI WOLFF HAEFKINE
(1860-1930)

hobby was violin. Here he started his studies on immunity or resistance of the body to disease. He was not following the mechanism thereof as Metchnikoff did. What he studied were the ways of achieving such resistance to disease as Pasteur did. To begin with, he played about with bacteria that cause typhoid fever. He developed methods of taming them to varying artificial conditions for growth and, after taming them, he thought he could test whether they were as ferocious or vicious for the body as before. He was attracted by the methods used by Pasteur to immunize against deadly rabies or anthrax. He very much wished to use them for protecting persons from cholera.

At this time, Haffkine got a responsible assignment to work in place of Yersin, who left for Indo-China to explore the extensive epidemic of bubonic plague. Haffkine's love was cholera, but little did he know then that he was to follow the path of Yersin to eliminate or control epidemic plague from amidst humanity. He was destined to make a significant contribution to save humanity from clutches of death by his vaccine. Plague, the black death, has visited the world in pandemics since time immemorial. In India alone, plague has taken a toll of 15 million lives in the last 70 years. Plague has still not left the shores of India and smoulders in sub-Himalayan foci, on borders adjoining Andhra Pradesh, Mysore and Madras States and occasional other sites. Yet, thanks to the work of Haffkine, that plague was no more as deadly even before the newer antibiotic drugs were discovered in the last two decades. There was 93 per cent protection with the means he devised.

Coming back to his work on cholera, he had known of the discovery of curved comma-shaped bacteria of cholera from the work of eminent German bacteriologist, Robert Koch, who had visited Egypt and India and had isolated these germs from infected cases in 1883. He had also devised four simple elementary rules which go by the name of Koch's postulates regarding germs which should be satisfied before designating the same as a causative organism of a disease. By 1890, Jaime Feran, a Spanish bacteriologist, had devised a method of vaccination against cholera, which went into disrepute. The Church authorities were opposed in principle to vaccination. Koch's discovery of tuberculin, an extract of bacteria that cause tuberculosis, caught the imagination of Haffkine. He tried to grow cholera germs in current of hot air to mitigate their harmful propensities. This is based on the success that Pasteur had with anthrax organisms, which caused deadly disease of sheep and against which Pasteur devised protection.

Haffkine could as well grow bacteria in the abdominal cavity of the guinea-pigs, the small laboratory animals. These bacteria were then exalted in their virulence to cause the disease. He could devise a test in the rabbits by injecting the bacteria beneath the skin. The virulent bacteria caused

a small ulcerating pimple. If the mitigated bacteria grown in hot air were injected earlier in the rabbit, the exalted bacteria lost their virulence of producing the ulcerating pimple in the skin of the rabbits. Haffkine thought this as an index of resistance and thought that vaccination against cholera would be possible. But how is one to decide if it really protects a human being? And should there be no assurance held out of its harmlessness?

Pasteur thought poorly of Ferran's method of vaccination against cholera, but he thought much about the success of Haffkine. In 1892 Pasteur unsuccessfully tried to conduct a field experiment on human population in Russia, but permission was refused. It must have been a disappointment, but a real scientist has patience, perseverance and courage of conviction. He tried to induce the Prince of Siam to let the trials be conducted in Siam, where cholera was extensively raging. He was advised by Hirman, a French resident of Indo-China, that Haffkine will meet a lot of opposition to vaccine injection in Siam. Hirman introduced Haffkine to Lord Dufferin, a British Ambassador in France (and one of the Viceroy's of India), with a view to induce British Government to let Haffkine work in India. Haffkine went to London in November 1892 for his triumphant scientific lectures and sought permission to go to Calcutta to which the British Government agreed.

Arrival in India

No medical research would be possible without human experimentation. India was comparatively better organized than Siam. On 18th July, 1892, Haffkine had got himself inoculated with live mitigated (attenuated) cholera vibrios (bacteria). He suffered fever and discomfort for a while. He subsequently injected his Russian emigrant colleagues, with similar results. The harmlessness of the procedure was proved beyond doubt by the scientists emboldening to offer themselves as laboratory guinea-pigs. If the vaccine was harmless and gave some indication of protection in rabbits, it could now be tried where disease existed. There was no extensive cholera in France and, as such, India was the land of choice for the trials. In those days, there were no methods available to measure the protective power of cholera vaccines in animals, as no procedures were known of producing cholera in animals. Now we can test such vaccines in rabbits, mice or dogs but, even so, the exact measurement of human protection by vaccine can only be done by field trials of the type that Haffkine embarked upon.

In India, the Gangetic delta is a perpetual site for cholera. At Calcutta, in spite of the best introductions even up to Lord Lansdowne, the then all-powerful Viceroy of India, Haffkine met with difficulties and opposition which he gradually surmounted. Soon after his arrival in March 1893, he redemonstrated the harmlessness of his vaccine on himself and his associates. The Army and Civilian officers began to volunteer. Regiments, jail-inmates,

tea-gardeners, trustees, etc., began to be inoculated. There was initial propaganda against the vaccine in the press. The religious belief was against smallpox vaccination. It was difficult for Haffkine to keep pace with the demand after some time. He travelled from Bengal, Assam, Uttar Pradesh, Delhi, Kashmir to the North-West Frontier Province on invitations. Most people offered for the first injection and it was difficult to gather and reach the people for the second injection. He inoculated 22,703 persons in the first year itself. This was a splendid achievement. By 1895, 40,000 persons got inoculated. The success of the results was assessed by finding out the persons that got it in an identical area in uninoculated groups of similar age distribution. The fatality rates in the two groups were also compared. This revealed 72 to 80 per cent protection rate conferred by the vaccine to the inoculated. This assessment heartened Haffkine, convinced Koch and drew favourable comments from the *Indian Medical Gazette* and a British medical journal, *Lancet*. The report of the government bacteriologists summarized two and half years' work of Haffkine in India, giving the results of inoculation of 42,000 people.

While the above may sound a great scientific victory of the day, such trials would not stand the scrutiny of the present science. Persons who choose to get inoculated are conscious of health protection as compared to those that refuse. Hence, the lower rate of cholera and deaths therefrom may also be due to their better sanitary habits. A proper procedure in modern days is to give coded cholera vaccine and a coded blank non-cholera vaccine injection to alternate members of a family without letting the doctor or the patient know what was given and analysing the results in retrospect after decoding. However, one thing must be said in favour of Haffkine's success that until today, the scientific belief is of superiority of the live vaccine injection, though due to technical difficulties of live vaccine administration, the killed bacterial vaccine is used with lesser results.

Haffkine lost in health due to rigours of climate, difficulties of food and sanitation and heavy strain of work and travels. In August 1895, he contracted malaria and preferred to return to Europe with a promise to return for following up his work. He visited Koch in Germany and Louis Pasteur in France and addressed the Royal College of Physicians and Surgeons in London. Pasteur was almost on his deathbed. Haffkine attributed all his success publicly to his master, Louis Pasteur. The *British Medical Journal* showered immense praises for his selfless devotion, ardent scientific zeal, courage of conviction, painstaking planning and success. It urged the British Government to help him financially and to recognize his self-sacrifice and merit. This short spell in Europe enabled Haffkine to regain his health and to enable him to return to Calcutta in March 1896. He further inoculated 30,000 more people on his return.

Plague in Bombay

While Haffkine was busy with devotion and selfless work on cholera, a ship visited Bombay harbour from Hong Kong. Yunan, Canton and Hong Kong were severely affected with plague between 1894 to 1896. Some of the plague-infected rats got transported with the ship and India, which was free from plague for 200 years, became infected with plague. A widespread epidemic broke out in Bombay, as house-rats were extremely susceptible and thatch-roofed housings gave shelter to infected rats, whose fleas got transferred to humans on their death. As men fled from infected households, the infected fleas got transported with the belongings. Disease spread far and wide, not only within India but also to most of the countries of the world. Europe, Africa, Asia and Australia became infected. Yersin was busy in Siam with plague. Kitasato and Aoyama were busy in similar position in Japan. About 15th June, 1894, Yersin and Kitasato independently described safety-pin-shaped picture of plague (now called *Pasteurella pestis*) as causative organisms of plague. Based on success of Haffkine's ability to produce cholera vaccine, the Government of India summoned Haffkine to Bombay to work on prevention of plague. The unassuming scientist, interested in the good of humanity, accepted the invitation and he arrived in Bombay on 7th October, 1896. He set up a laboratory in one of the rooms of the Petit Laboratory of the Grant Medical College with a staff of one clerk and three peons. Haffkine believed in attenuating (mitigating) the virulence of the organisms. He tried drying them and heating them as Pasteur used to do. He tried adding chloroform as in smallpox vaccine or phenol (carbolic acid) as in antirabic vaccine (used to protect men from rabies after bite of rabid animals). Working for 14 hours a day and lecturing to doctors Haffkine developed a method of growing these bacteria in meat broth under a layer of molten ghee or coconut oil. Organisms grew as bacterial threads going from surface to the bottom of the flasks. These threads are now known as 'Haffkine's Stalectites' in science. He killed the organisms with heat after a fortnight of growth. This was his vaccine. But would it be effective? That was the question that needed answer.

Discovery of Plague Vaccine

Answer in science does not come by arguments or philosophy. It comes from observation and experimentation. The logic and philosophy of science are built on this latter. Haffkine inoculated 10 house-rats (house-rats are smaller than field-rats) and kept 10 rats uninoculated. Later they were mixed and an infected rat was brought in their cage. The infection spread. Nine out of 10 uninoculated rats died next day while all the 10 inoculated ones survived. His joy knew no bounds. He could demonstrate similar observations in rabbits. This was in December 1896 and by January 1897,

he published his method of plague prophylaxis. On 10th January, 1897, Haffkine inoculated himself with 10 ml. of his vaccine. He had severe reaction, but he kept working. He appealed for volunteers for his vaccine. The response was good. On 30th January, 1897, 143 volunteers were injected. As some volunteers came from prison, Haffkine kept himself in prison premises for a week. He carried out controlled human experiments at various places. One of the early places of experimentation was a neighbouring Byculla House of Correction. He also inoculated 2,200 inhabitants of Daman and 6,000 that refused formed a control group. In the inoculated, 36 died, while 1,482 died in the uninoculated. Aga Khan came forward to inoculate himself and the Khoja sect of his followers. Nearly 3,184 got inoculated and 9,516 refused. There were three deaths in the inoculated ones and 77 in those that refused.

Adjudging the scientific results, a number of papers eulogizing the scientific work of Haffkine appeared in leading British science journals like *British Medical Journal*, *Nature* and others. It was accepted that inoculation reduces incidence of plague. It diminishes death-rate from that disease. There was no immunity in the first few days following the injection, which itself was harmless in spite of reaction. The protection lasted over months. Yet, in spite of all this, the task of reaching vaccine was too great as compared to the population. Plague continued to rage and nearly a million persons were dying year after year. The British Government set up a commission that recommended certain measures with military handling the situation. Isolation of cases and contacts and disinfection can, by themselves, never succeed in infectious diseases where germs can thrive in other living things such as rats, fleas, squirrels, etc., and in the infected surroundings and carcasses. Military measures meant a lot of hardship to people, which people resented. In Poona, Chaphekar and others carried out terrorist activities against a British Plague Commissioner, who was killed. People suppressed information of plague cases. Even some scientific contemporaries like Dr. P. Simond of Agra wrote letters highly critical of Haffkine's work, while addressing Emile Roux of Pasteur Institute, Paris. However, facts cannot be suppressed for long and Queen Victoria decorated Haffkine with the order of Companion of British Empire. The Indian Plague Commission recommended Haffkine's plague prophylactic to replace military measures.

To enable Haffkine to prepare larger amounts of the vaccine, he was given a bigger place called 'Cliff' on Malabar Hill, but he was soon offered a bungalow called Khushru Lodge by H.H. the Aga Khan in Mazgaon. By March 1899, the demand for vaccine was so great that on 10th August, 1899, he entered the present premises of the Haffkine Institute in Parel, which was formally opened by Lord Sandhurst, the Governor, and named as Plague Research Laboratory with Haffkine as the Director-in-Chief. The plague

prophylactic was constantly improved upon by Haffkine and his followers and by now 50 million doses have been distributed. In 1904, the same laboratory was renamed Bombay Bacteriology Laboratory, which name continued until 1925. The plague laboratory under Haffkine (1896-1904) worked also on cholera, typhoid, Malta fever, relapsing fever, diphtheria, leprosy, smallpox, anti-snake venom, other obscure diseases and on investigations on mosquitoes, fleas, etc. It provided facilities for bacteriological training and in anti-plague measures.

It is accepted that Haffkine's discovery, while not based on new scientific principles, constitutes a great practical achievement in the region of preventive medicine. While working earlier with live cholera germs for making his vaccine, he had visualized that live bacteria do not thrive in the infected body but they are killed. The product released as a result of their death helps immunity (resistance to that disease). His plague vaccine made from killed microscopic germs of plague was not based on any other hypothesis except his own. To this extent, originality of concept must be attributed to Haffkine. Haffkine analysed the various causes of plague and reported to the Royal Society of London. He was hailed as a big bacteriologist by Joseph Lister and Almroth Wright, the eminent English scientists in the field. Haffkine excluded role of water, air and food in the spread of plague. He said that isolation and disinfection need to be supplemented by vaccination. He was hopeful of role of blood-sucking insects and incriminated bed bugs, but this was later proved incorrect. He also felt that fleas could play a role but he was not enamoured of experiments of Simond in that regard. He injected horses and sheep with plague bacteria and used their blood serum in treatment of plague with unsuccessful results.

Hurdles and Handicaps

Haffkine, however, had no easy task. In India, the British Military Régime, whose Army Medical Officers held sway in public health matters, fell out with Haffkine as he became popular with press and the people, and the military control of anti-plague measures got on decline. He was referred to as Russian spy due to Anglo-Russian differences. The Russian writers said: 'Christians must beware of him as a Jew'. Yet, the British scientists and government honoured him, even though he was only a zoologist and not a medical doctor. This is evidenced in his appreciation in contemporary proceedings of learned societies, the reviews in the journals, the conferment of title of C.I.E. and making him as Director-in-Chief of Plague Research Laboratory, Bombay, while he was on vacation in London in August, 1899.

At this stage, at the cost of little digression, let it be realized that Haffkine was working under a number of handicaps. Science had not developed as it is today. Scientific outlook was poorer. There were contemporary schools

of French, German and English bacteriologists with lot of jealousies in spite of devotion to science. Haffkine was not a medical man. He was a Russian. Indian medical profession was in the hands of Indian Medical Service, with predominance of Scotchmen. Haffkine was further a Jew. He had won the hearts of local people, his laboratory workers, and the medical press abroad, with selfless sacrifice, extreme devotion to science and the amiable nature, while the Indian Medical Service men were meeting with local opposition in press and public. There were exaggerated versions of success of Haffkine and equally of its criticism by contemporaries. Haffkine himself made no tall claims.

The knowledge about how the plague spreads did not then exist. Simond had published in reports of Pasteur Institute, Paris, that fleas may be vectors. Haffkine also incriminated blood-sucking insects including fleas, but the results of his experiments did not convince him. Today, we know that plague occurs in many other rodents besides man. It is maintained in these species as chronic unresolved focus. The rodent fleas get affected and transmit to other rodents. When infection occurs in house-rats, there are rat-falls when the rats die. The infected rat fleas leave the dead rat and come in contact with men whom they infect by sucking blood and vomiting it back in the human body. Infected flea is hungry. Blood clots in its foregut and it blocks the food path. Infected men usually get enlargement of glands in groin, armpits, neck, etc., and high temperature. He becomes incoherent and may turn unconscious. He may die in 24 to 72 hours. He may get pneumonia (infection of lungs) or septicaemia (infection in blood), both of which are serious. Before streptomycin was discovered, there was 90 per cent mortality. Except when pneumonia has set in, the infected case does not transmit plague except through pus coming out from glands. Infected rat also does not transmit disease except through fleas. The control of house-rat was advocated but control of fleas was not then known. There were no modern insect-killing agents like DDT available then.

There are three propositions in relation of epidemic: One is the control of epidemic, the other is control of the disease and the third is eradication of disease. Methodology differs for each achievement. In view of incomplete knowledge then prevailing, Haffkine could not dream of second or third step, but he was laying the first step of building the resistance of the population to infection. In doing this, he had realized the differences between the germs of cholera, typhoid and plague. His method in relation to plague was giving some protection from attack and much more protection from mortality if attack did occur. Control of disease would have occurred better if modern rodent control, streptomycin and insecticide were available. Even, then, we do not know all about lurking foci of plague in nature and we have not been able to eradicate it from either India or even America. But the

blame on Haffkine was a conspiracy by his antagonists for reasons other than scientific. In their opinion, the continuance of plague epidemic was itself a defeat of Haffkine, but they were blind to the effects of his vaccine and the popularity and demand for his vaccine in the four continents of the world. Hostility was too great until a point came when they could make Haffkine a scapegoat. Brilliant life of Haffkine was to be marred by a tragic episode.

Tragic Episode at Malkowal

In November 1902, a crisis occurred. Out of 107 persons injected with vaccine at village Malkowal in the Punjab, 19 developed lock-jaw due to tetanus and died. As it should be, Government of India appointed a Commission of Inquiry consisting of Principal of Grant Medical College, Chief Justice of Bombay and Director, Pasteur Institute, Kasauli. The commission took a turn of inquiry against Haffkine rather than inquiry into the facts of the episode. Haffkine agreed that deaths were due to tetanus. The tetanus germ could have been present in the particular bottle at the time of despatch from Bombay. Or it could have got in after it reached the field. If it had been present from Bombay, the vaccine bottle will smell of bad odour and matter would have been evident on opening, irrespective of the fact whether smelling was necessary or not and whether the record was made of smell or not. This was not accepted by the commission. His second argument was that vaccine used was a part of flask No. 63 N made on 19th September, 1902. Five batches were filled. Tetanus occurred only with one bottle used at Malkowal but not with the other four batches or with other 26 bottles made on the same day. This should convince anyone that something was wrong only in one bottle. Haffkine requested that the process of making vaccine be gone through, but instead of doing this, the commission was prepossessed against Haffkine for having omitted addition of carbolic acid as preservative after killing the plague bacteria in vaccine. Such a change of method was adopted by Haffkine on his own but government clearance on the same was not obtained, being a technical matter. Omission of this cannot introduce tetanus bacteria but should tetanus bacteria get introduced, they would be able to multiply. Blame thus cannot be fixed on Haffkine for tetanus. Granting that tetanus bacteria were introduced in September in Bombay, and had multiplied until the use of bottle in November, the vaccine would have contained so much of tetanus poison that death from tetanus would take place no sooner on injection than was the case. The deaths occurred seven days later at Malkowal. All this evidence was convincing but the commission and government chose to relieve Haffkine of the post of Director-in-Chief of Plague Research Laboratory (now Haffkine Institute) of Bombay. This was in spite of the fact that evidence had shown

that the rubber bung of the bottle had dropped on the ground from the hands of English doctor, Elliot, while inoculating the victims of Malkowal and the bung was refixed on the bottle, leading to contamination (admixture) with dust, which contains germs of tetanus.

Ordeal faced but Truth prevailed

It was an ordeal for Haffkine, who went to Europe visiting several laboratories for one year, explaining his stand to various scientists. The controversy from November 1902 to 30th April, 1904, was a period of trial and tribulation. Haffkine kept up his spirits but his limit of patience must have seen an end, as he himself preferred to proceed on leave for one year pending the decisions of inquiry. The findings of the inquiry were submitted to Secretary of State, who referred it to scientists of Lister Institute. The scientists could not care to agree with the blame being taken off from Dr. Elliot and its being placed on innocent Haffkine. Secretary of State informed Government of India of his disagreement with the findings and reinstated Haffkine. Lister, Wright and Simpson, the scientists of high order in Britain, upheld Haffkine, who was invited to rejoin. Congratulatory messages flowed from all over the world. He agreed to return, but as the post in Bombay was occupied by Col. Bannerman, he was posted to Calcutta, where he worked until the age of retirement in 1914.

The whole of this episode is full of tragedy that befell Haffkine for no fault of his. Scientists who advance the knowledge for humanity have to face such difficulties. Their work is upheld in the end. Even after the Malkowal disaster, the demand for plague vaccine was ever increasing at home and abroad from year to year. The quarantine, the military segregation and other stern measures were withdrawn. The blame for continuation of plague in spite of vaccine did not rest on Haffkine. The clouds cleared. The sky was visible with the shining merit of the truth. Is this not the price that every reformer or researcher has paid for bringing forth advance in exchange of inertia and statism? Thanks to the ultimate British fair play of justice that Haffkine's complicated case was well understood and taken and he was not treated as a mere civil servant or an alien or Jew. The supplement to *Gazette of India*, dated 1st December, 1906, issued from Calcutta, gives a file of documents related to this Malkowal disaster inquiry.

Institute named after Haffkine

The medical journals evaluated the work of Haffkine even after 1907. They suggested Haffkine's plague vaccine as the best method to counter-attack the epidemic of plague. Bulloch, the historian of bacteriology, never took kindly to Haffkine. Haffkine also in later years replied to his critics. This went on till 1929. By 1925, Brevet Col. F. P. Mackie received support

of Surgeon-General, Major-General Hooton to a proposal to rename the original Plague Research Laboratory (1899) (later changed in 1904 to Bombay Bacteriological Laboratory) as Haffkine Institute. The government concurred with this and the name was changed, following the analogy of institutes like Lister Institute or Pasteur Institute. The Haffkine Institute has such rich traditions of yeomen service to science and humanity through research and effort as millions feel grateful to Haffkine for what he has founded. On the basis of its contribution, it is a place for learning and pilgrimage for scientists, being second to none in its stature. We may feel that India has an uphill task to build science and technology but the centres like the Haffkine have provided the necessary nuclei with self-growing power for work of international stature. The centres such as these are the cradles of scientists and temples of learning which will help the country and the world solve its problems.

When Haffkine was informed of renaming of his laboratory after him, he replied: 'I am very greatly indebted to Col. Mackie for the name given to Parel Laboratory and to you for the terms in which you have written to me. Very much do I appreciate also your mentioning of the friendly attitude towards me of the other members of the Institute's staff. The work at Bombay absorbed the best years of my life and I need not explain how much I feel everything connected therewith. I wish the Institute prosperity as an active centre for work on behalf of the health organization of the country and I send blessings to the whole of the staff.' These words and the words he used in December 1895 in his lecture before the conjoint board of Royal College of Physicians and Surgeons in London are equally memorable. He had then concluded his lecture by saying: 'Mr. Chairman and gentlemen, on the day when I came back from my expedition to India, I found my former Chief M. Pasteur lying on his bed of death. Whatever might have been his appreciation of the work done in India, there can only be one desire on my part, that all the honour for the results which have possibly come out of my efforts should be referred to him, to his sacred memory.' These quotations will show the nobility of Haffkine as well as the greatness of his stature.

After-life of Haffkine

Haffkine had returned to India broken-hearted. His work from 1907 to 1914 has not been very enthrusting for this evident reason. He published 30 papers during his lifetime. There is only one in this that he published between 1907 and 1914. Despite this, Haffkine was always absorbed in research and continuously undertook problems. The last approach again was to cholera. At the outbreak of World War I, he was responsible for advising the Army to replace plain typhoid vaccine by a vaccine against typhoid and

paratyphoid, A and B bacteria. He was a tireless worker and he neglected even his health. He became an apostle of prophylactic inoculation and word to 'Haffkine' was coined for immunizing against plague. Before he passed away at the age of 70 in 1930, he had considerably changed his interests.

Haffkine settled down in France at Boulogne-sur-Seine. He gave up scientific research but remained a member of scientific societies. He wrote in periodicals from time to time. Due to World War and great October Revolution in Russia, he could not go to Odessa. He was a scholarly, lonesome, handsome man of few words. He remained a bachelor and developed profound respect for his religion. 'He is a shining example of heroism in laboratory which can be no less than heroism in battlefield' (Moynihan).

In later life, he felt that hygienic laws of his religion had scientific basis. He was attracted to orthodoxy, Bible and a movement to unite the Jews. To him, religion was a ready-made union of people with common articles of faith, common character and behaviour. Such a bond outlasts all other bonds, as it is older than centuries. The Jew has inherent ability to success and, hence, attracts jealousies and also because the jealous ones are able to form a firmer union with each other than what the Jews can, the Jew gets wiped out. He wrote: 'The Jew individually, a fairly well able man, is collectively an incredible, phenomenal fool. Were it not for his religious unity that keeps him going *malgré lui* he would have been destroyed ages ago.' He had an abiding faith in Judaism.

Haffkine revisited Odessa in 1927 to search his friends and relations. He saw tremendous changes. Being orthodox by that time, he must have still disliked this. He spent his later life in establishing schools for Jewish faith. He endowed his small wealth with a Swiss Bank for this purpose in 1929. Prior to his death, he settled down in Lausanne in Switzerland, where he hired a villa on 17th April, 1928. He died on 26th October, 1930. The Haffkine Institute and the Grant Medical College remained closed as a mark of respect to his memory. The local and foreign press hailed him as a saviour of mankind and put him along with trinity of Jenner (who devised small-pox vaccination), Pasteur (father of microbiology) and Lister (father of aseptic surgery).

While India owes a deep debt of gratitude to Haffkine, the world is still realizing his greatness. The new State of Israel proposes to honour him by planting a Haffkine Avenue. Russians and French continue to claim him. At Haffkine Institute, everyone identifies himself with his work. It was said at the Diamond Jubilee of the Institute: 'Instead of identifying Haffkine with Odessa, Paris, Calcutta, Bombay and Boulogne-sur-Seine or Russia, France, India or Switzerland, every day we feel his presence with us as an immortal man of universe as a whole giving us a constant source of inspiration in our work.'

'They do not die who have their thoughts
Imprinted on some deathless page,
Themselves they pass; the spell they wrought
Endures on earth from age to age.'

ACKNOWLEDGEMENT

The author wishes to acknowledge that he has freely drawn upon references cited below and on published biography of W. M. W. Haffkine by Selman A. Waksman (1964), Rutgers University Press, New Brunswick, New Jersey, U.S.A.

BIBLIOGRAPHY

(Publications by Haffkine)

- Haffkine, W. M. W. (1885). *Recherches biologiques sur l'Astais Ocellata n.s.* *Ann. Sci. nat. zool.* Paris.
- (1886). *Recherches biologiques sur l'Euglena viridus*, Ehr. *Ann. Sci. nat. zool.* Paris.
- (1886). On the question of nutrition of *Euglena* and *Astasia*. *Repts. Novrossisk Soc. Naturalists*.
- (1887). On the laws of heredity as applied to unicellular organisms. *Repts. Novrossisk Soc. Naturalists*.
- (1888). Le princip de l'heredite et less lois de la mecanique en application a la morphologie de cellues solitaires. *Arch. Zool. expil. genl.*
- (1890). Maladies infectieuses des paramecies. *Ann. Inst. Pasteur*, 4, 148-162.
- (1890). Recherches sur l'adaptation au milieu chez les infusoires et less Bacteries. Contribution a l'etude de l'immunité. *Ann. Inst. Pasteur*, 4, 363-379.
- (1892). Le cholera asiatique chez le cobaye. *Compt. Rend. Soc. Biol. (Paris)* (Ser. 9), 4, 635-637.
- (1892). Sur le cholera asiatique chez le lapin et le pigeon. *Compt. Rend. Soc. Biol.*, p. 671.
- (1892). Inoculation des vaccins anti-cholériques a l'homme. *Compt. Rend. Soc. Biol. (Paris)* (Ser. 9), 4, 740-741.
- (1893). Vaccination against Asiatic cholera. *Indian med. Gaz. (Calcutta)*, April.
- (1894 and 1895). Anti-cholera inoculation in India. *Trans. First Indian Med. Congr. Calcutta*, Dec. 28. *Indian med. Gaz.*, January and March.
- (1895). A lecture on vaccination against Asiatic cholera. *Brit. med. J.*, 2, 1541-1544.
- (1895). Anti-cholera inoculation. Report to the Government of India. Thacker Spink & Co., Calcutta.
- (1896). On the inoculation of coolies. *Indian med. Gaz.*, July.
- (1897). Remarks on the plague prophylactic fluid. *Brit. med. J.*, 1, 461.
- (1898). The protective inoculation against plague, Poona.
- (1898). Experiments on the effect of protective inoculation in the epidemic of plague in Undhera, Laluka, Baroda, Bombay.
- (1898). The protective inoculation against plague in the Khoja community of Bombay during the epidemic of 1897-1898, Bombay.
- (1899). On preventive inoculations. *Proc. R. Soc.*, 65, 1899. *Lancet*, June 24, 1899. *Brit. med. J.*, July 1.
- (1903). Summarized report of the Bombay Plague Research Laboratory for 1896-1902, Bombay.
- (1904). Summarized report of the Bombay Plague Research Laboratory for 1902-1904, Bombay.
- (1906). Les vaccinations anticholériques aux Indes. *Bull. Inst. Pasteur*, 4, 697-705, 737-747.

- Haffkine, W. M. W. (1913). Protective inoculation against cholera. Calcutta. (Quoted by Wilson and Miles in Topley and Wilson's 'Principles of Bacteriology and Immunology', 3rd ed., Vol. 2, Ch. 63, 1946).
- (1916). A plea for orthodoxy. *Menorah J.*, 2, 67-77.
- (1915-1917). Concerning inoculation against plague and pneumonia and the experimental study of curative methods. *J. Hyg.*, 15, 64-101.
- (1929). Notes on some passages in the treatise on 'pest' by Prof. Dr. A. Diedonne and Prof. Dr. R. Otto. *J. trop. Med. Hyg.*, 32, 309-318.
- Haffkine, W. M. W., Hankin, E. H., and Owen, C. A. (1894). Technique of Haffkine's anti-cholera inoculation. *Indian med. Gaz.*, June.
- Haffkine, W. M. W., and Lyons (1897). Joint Report on the epidemic of plague in Lower Damaon (Portuguese India) and on the effect of protective inoculation there, Bombay.
- Haffkine, W. M., W., and Simpson, W. J. (1895). A contribution to the etiology of cholera. *Trans. First Indian Med. Congr.*, 1895. *Brit. med. J.*, 2, 17-18.

(Other Publications dealing with the Life and Work of Haffkine)

- Bulloch, W. (1931). Waldemar Mordecai Wolff Haffkine. *J. Pathol. Bacteriol.*, 34, 125-129.
- Hart, E. (1896). A summary of Dr. Waldemar Haffkine's work against cholera. *J. Am. med. Assoc.*, 27, 1204.
- Jhala, H. I. (1899-1959). Haffkine and the evolution of the Institute. *Diamond Jubilee Souvenir Booklet of Haffkine Institute*, pp. 1-5, Bombay.
- Naidu, B. P. B., and Jung, J. S. (1929). The relative toxicity and immunizing value of Haffkine's plague prophylactic and other anti-plague vaccines compared. *Indian J. med. Res.*, 17, 199-213.
- Obituary. Haffkine, Waldemar. 2 (Nov. 1), *Lancet*, 995-996, 1930.
- Podolsky, E. (1956). Waldemar Haffkine and the plague eliminator. *Your Health*, 5, 261-264.
- Pollitzer, R. (1959). 'Cholera'. WHO publication, Geneva.
- Popovski, M. (1963). Sudiba doctora Chavkina (The Fate of Dr. Haffkine). *Isdat. Vostochnoi literaturi*, pp. 132, Moscow.
- Sokhey, S. S. (1899-1959). The passing of the present plague pandemic in India. *Diamond Jubilee Souvenir Booklet of Haffkine Institute*, pp. 6-11, Bombay.
- Stevenson, W. D. H., and Kapadia, R. J. (1925). Experiments on the onset of immunity after inoculation with Haffkine's anti-plague vaccine. *Ind. J. med. Res.*, 12, 553-559.
- Taylor, J. (1933). Haffkine's plague vaccine. *Indian med. Res. Memoirs*, No. 27. Thacker Spink & Co., Calcutta.
- Waksman, Selman A. (1964). 'Brilliant and Tragic Life of W. M. W. Haffkine, Bacteriologist'. Rutgers University Press, New Brunswick, New Jersey, U.S.A.