



Abdus Salam (1926–1996) **More Than a Nobel Laureate**

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Abstract:

*Mohammad Husain Abdus Salam was born in 1926 at Jhang, a farming village in Punjab, to parents of the Ahmadiyya-Moslem faith. At the age of 14, Abdus scored the highest marks ever given by the Matriculation Examiner in Punjab. In 1946, he received a scholarship for studies at Cambridge University, UK. As his English was limited, Salam got hold of an Oxford Dictionary and studied “proper English” A-Z. He was an extremely speedy reader with a remarkable memory.**

In two years' time, Abdus achieved a double First Class Honours in Mathematics and Physics. In 1951, he presented his thesis in the field of Quantum Electrodynamics, which was well received.

Back in Pakistan, Salam expressed the frustration and isolation he experienced due to lack of contacts with other scholars thus: “There must be possibilities for a scientist to remain in his own land, meet people working on the same subject, and learn new ideas. We must change the image of Science and Technology in our own countries!”

In order to “drain the brain drain”, Abdus Salam founded two important scientific bodies:

- 1) An International Centre for Theoretical Physics (ICTP), established in 1968 to promote training and research in physical sciences in the developing nations. Abdus recalled his own isolation when trying to do scientific research in his home country: “A theoretical physicist must be able to talk, to discuss, to shout, if needed.” ICTP attracted talented brains from the developing world. As science writer Behrman wrote, the pupils here do not devise ways to build better mousetraps but learn to think in terms of original solutions.*
- 2) In 1983, Abdus Salam invited a group of eminent scientists to form an Academy of Sciences for the Developing World, TWAS, with the aim to recognize, support and promote excellence in scientific research in the developing countries. Today, the Academy has more than 1,000 members from 90 nations.*

Abdus Salam was asked by the Islamabad government to become Pakistan's first Advisor on Science. In four years, Salam built Pakistan's scientific infrastructure. He became Director of SUPARCO (the Space and Upper Atmosphere Commission), developed theoretical physics

*40 years later, during a bus-ride in Italy, I asked him of the meaning of the word “coinage” He smiled and said:” I read once in a Dictionary that you coin words by putting them together and make a new term. Take “Pakistan” - it is a coinage representing the different territories of the Republic - Punjab, Afghan Border States, Kashmir, Sind, and Baluchistan...

and was responsible for Pakistan's National Research for Nuclear Energy and Weapons Program.

Salam was invited by the Imperial College in London to set up a Department of Theoretical Physics. His unorthodox research paved the way for his getting the Nobel Prize in 1979 for "the theory of the unified weak and electromagnetic interaction between elementary particles." He turned the award into a fund in the memory of his parents in order to help the brightest and most deserving pre-university students from schools in the district of Jhang, Punjab, Pakistan.

Abdus Salam's credo that "Scientific thoughts are the common heritage of all Mankind" has survived even after his death in 1996.

This essay starts with some reflections on a young man's photo. This is a "cabinet photo" which in British India was used as a supplement to a visiting card. It is dated 1940 and depicts a serious young man from the small Pakistani village town of Jhang in an agricultural district on the Indian subcontinent, established around 2,000 BC as a low-yielding agricultural area close to the fortress city of Lahore, which once defended Punjab from the wild Afghans and the looting Moguls. Lahore, with its beautiful Shalimar gardens, is the town which Ramjet Singh wanted to turn into a capital for his followers, the Sikhs, but failed. It was in Lahore that Mirza Ghulam became the prophet of the Muslim movement Ahmadiyya. In Lahore, the native army once rebelled against the European garrison and was brutally crushed by the British. Since then, the place has developed into a learned town with public libraries and research institutes and also has the oldest University in Pakistan. The violent riots against the Ahmadiyya Muslims hadn't come yet by 1940.

The boy in the cabinet photo is 14 years of age. His glasses laden face looks at you with an anticipating, thin smile. In colonial India, society was sharply divided by colour, class, caste, religion and profession. Each group vigorously defended their headwear which demarcated them from other social groups.

The black turban and the white dress are indicative of his being an Ahmadiyya Muslim and his knowledge of the Koran. His name is Mohammad Husain Abdus Salam.

Most probably, the photo would have been taken by a professional photographer in a Lahore studio. Salam's friend might have wanted to have the photos distributed for celebration purposes since at the age of 14 Salam scored the highest marks ever given by the Matriculation Examiner in Punjab. Abdus was the proud recipient of a full scholarship from the Government College. Equally proud was his father who was a pious farmer, teacher and educational officer in the Department of Education.

Abdus recalled during a meeting about a lecture given by his teacher in his remote country school at Jhang. The teacher started with the subject of gravity, "Now, we have all heard of gravity." Then he went on to say, "there is a force called electricity, but it doesn't live here, it lives in the capital town of Lahore, 100 miles to the East." The teacher had just heard of nuclear power and so he said, "It only exists in Europe." Abdus added, "This is how it was to be taught Natural Sciences in a developing country!"

Abdus' scholarship opened the doors to the Government College in Lahore. He started studying Urdu and English literature. But, Mathematics eventually became his major. Because

of Abdus' strong interest in humanism his mentor suggested that he become a teacher of the English Language. However, Abdus held on to mathematics and wrote a paper on Shrinivas Ramanujan (1887 – 1920), the outstanding Indian mathematician from Tamil Nadu, and his studies on elliptic functions and analytical theory of numbers.

Abdus Salam graduated with an M.A. in Mathematics. He completed a B.A. in Mathematics in 1944 and was looking for a job. His father urged him to apply for the Civil Services Examination for getting a job at the Indian Railway sector, "The Lifeline of the nation". Luckily, for the development of Theoretical Physics in the developing world perhaps, Abdus' application was turned down because he failed an optical test.

Two years later, Abdus Salam received a scholarship to Cambridge in the UK. Five scholarships to study abroad were available in 1946 at the Punjab Administration. Abdus adds: "If I had not gone that year, I would not have been able to go to Cambridge at all; the following year there was the partition of British India and the scholarships of 1947 simply disappeared". In 1947, Abdus received a ticket for one of the steamers filled with British families leaving before India became independent. For a non-experienced student, travelling from the country town of Jhang in British India to the University of Cambridge in the UK was a long journey in more than one sense. But Abdus remarked that he made friends on the way.

Once joining St John's College, one of the oldest colleges in Cambridge, Abdus went to the library in order to borrow a copy of the Concise Oxford Dictionary in order to learn "proper English" from A to Z.

His tutor, Fred Hoyle, perhaps one of the 20th century's greatest scientific gurus, advised the young Abdus to stay at St. John's and go into advanced laboratory research. But Abdus did not have the patience for long experiments in the laboratory.

Abdus' good grades, warm personality and popularity among fellow students rendered him the "Johnian" award, an award which Abdus valued highly. He received double First Class Honours in Mathematics and Physics as well as the Smith's prize for outstanding pre-doctoral contributions in Physics. Abdus was also asked to solve a seemingly unsolvable problem proposed by Hideki Yukawa, a Nobel laureate of 1949 from Kyoto Imperial University. The problem concerned Yukawa's prediction of the existence of mesons on the basis of theoretical work on nuclear forces. Salam found a solution which attracted the Nobel laureates Paul Dirac and Hans Albert Bethe. The doors to the Cavendish Laboratory were open to him.

Salam managed to renew his scholarship and began his doctorate studies at Cavendish. In 1951, he presented his thesis in theoretical physics in the field of Quantum Electrodynamics which was well received. In the same year, Abdus also received "the Adam Prize" - one of the oldest and most prestigious awards at Cambridge. The prize is named after the mathematician John C Adams who discovered the "blue" planet Neptune using mathematical calculations in 1846. Salam returned to Punjab in order to take up the position of chair of Mathematics at a university in Pakistan. When Salam proposed to update the curriculum in the university by offering courses in quantum mechanics, his suggestions were not accepted by the Vice-Chancellor. So, Abdus decided to give evening courses in Quantum Mechanics outside the framework of the regular curriculum. His new ideas were met with mixed feelings from the scientific community at the University. Salam's idea to establish a new research institute in

Lahore was rejected. He accepted a fellowship from PAS (the Pakistan Academy of Sciences) in Islamabad in 1953, where he became one of the first academicians in Pakistan.

Abdus writes: “As a physicist in Pakistan I was completely isolated. It was very difficult to get scientific journals and keep in touch with my subject. I had to leave my country to remain a physicist. It is the lack of contacts with other physicists that is the biggest curse of being a scientist in a developing country. You simply do not have the funds, the opportunities, which those from richer countries enjoy as a matter of course. There are no communities of people thinking and working in the same field... There must be possibilities for scientists to remain in their own country, meet people working on the same subject, and learn new ideas. You must return to your own country with a mission to change the image of science and technology in your own country.”

It is noteworthy that some 15 years later, Abdus Salam founded ICTP, the International Centre for Theoretical Physics in Trieste for young scientists from the developing world. After serious religious unrest in Punjab, the Pakistani President declared martial law in the region of Lahore in 1953. A series of vicious pogroms had taken place against the Ahmadiyya Muslim Jamaat, to which the Salam family belonged. Orthodox Muslims did not consider the Ahmadiyyas to be “real” Muslims because they adopted parts from other religions and considered Jesus Christ to be one of their prophets. The Ahmadiyyas had also adopted the St. Thomas Christians’ claim that Jesus Christ survived his crucifixion and had travelled to Kashmir where his tomb is located. To some orthodox Muslims these legends were evil information and dangerous blasphemy. Religious tension in northeast India had started again. The situation became tense in Punjab with persecution and oppression.

A law was passed by the Pakistani Parliament announcing that the Ahmadiyya Muslim Community was a Non-Muslim sect. The Salam family urged Abdus to leave. He left for England. In 1957, Abdus was invited to the Imperial College in London to set up a new Department of Theoretical Physics. His advanced methods of research were noticed not only by theoretical physicists. Leading researchers joined Abdus’s department, including scientists such as Stephen Weinberg, Thom Kibble, Gerald Guarani, C.R. Hagen and John Warred.

At the age of 33, Abdus became one of the youngest Fellows ever to be elected to become a member of the prestigious Royal Society, London. At this time, he received a fellowship in the University of Princeton, New Jersey, where he met Robert Oppenheimer, the Scientific Director of the Manhattan Project. They discussed the possibility of establishing a foundation for electrodynamics. At Princeton, Abdus Salam happened to meet Albert Einstein who asked him what kind of research he was doing. Abdus told him that he was working on the renormalization theory. Einstein answered he was not interested in that. After a few moments Einstein asked, “Have you studied my relativity theory?” Salam replied: “I am not interested in that.”

In 1979, Abdus Salam received the Nobel Prize in Physics. He shared the Prize with colleagues Sheldon Glashow and Stephen Weinberg for their contribution to “the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current.”

In his acceptance speech after receiving his Nobel Prize in Stockholm, Abdul Salam quoted from the Koran: “Thou serest not, in creation of the All-merciful, any imperfection.

Return thy gaze, serest thou any fissure. Then return thy gaze, again and again. Thy gaze, Comes back to thee dazzled.” “This,” said Abdus, “is the faith of all physicists; the deeper we seek, the more our wonder is excited, the more the dazzlement for our gaze.”

Abdus Salam turned his Nobel award into a fund in the memory of his parents Mohammad and Hajjis Hussain to help the brightest and most deserving pre-university students from schools in the district of Jhang, Punjab.

Salam had a habit of quickly jotting down anything of interest – a good joke, a new formula or plain gossip. He scribbled down his thoughts on whatever was handy – a bit of paper, a receipt, a cab note, loose sheets from a notebook or the back of an old poster or an envelope. Abdus was invited by the Queen to Buckingham Palace. After the banquet and when all guests were gone, Abdus returned, rang the bell and said: “Could I please have my napkin from the banquet table? I have some notes written on it.”

In 1980, Salam received an official invitation from Islamabad to become Pakistan’s First Advisor on Science. He accepted. From 1981 – 1984, Abdus built Pakistan’s scientific infrastructure. The Government appointed him to become director of SUPARCO (the Space and Upper Atmosphere Commission) and head of the TPG (Theoretical Physics Group). Abdus Salam was asked to develop Pakistan’s nuclear energy and weapons programme. He linked this scientific activity to IAEA, the UN International Atomic Energy Agency Promoting Safe and Peaceful use of Atomic Energy in Vienna. Salam was awarded the IAEA Atoms for Peace medal.

Born into the Ahmadiyya Muslim Community, Abdus had integrated faith into his life and research. Abdus explains, “The Holy Quran enjoins us all to reflect on the verities of Allah’s created laws of nature. However, our generation has been privileged to glimpse that part of His design is a bounty and a grace for which I render thanks with a humble heart.”

The ICTP and TWAS

It was noted by Italian scientists that some administration buildings were not used in the town of Trieste – an old seaport, founded by the Romans in 100 BC at the Adriatic Sea. This gave Abdus Salam the opportunity to create his idea, the International Centre for Theoretical Physics (ICTP). Abdus Salam negotiated with the Italian government and managed to lease the buildings for a symbolic sum. In 1968, the autonomous international Institute was established under the aegis of IAEA, UNESCO and the Italian Government.

The guidelines for ICTP promote training and research in the mathematical and physical sciences in developing nations. During the planning period, Abdus Salam underlined that he wanted to confront the issues of isolation and brain drain which continued to dim the prospects for excellence in science in the developing world. ICTP promotes science in the developing nations of the world and gives Associateship to young scientists, especially physicists.

Each year, ICTP hosts some 6,000 scientists. In cooperation with Italian science institutions, links have been built for a great number of associates, lecturers, students and university leaders.

The well known Science writer Daniel Behrman noted that the ICTP in Trieste had become a “World Rendezvous for Physicists”. Behrman writes, “The pursuit of theoretical

physics cannot be justified in terms of its immediate applications. It is the most philosophical of sciences for it is connected with the study of the very nature of matter. As such, it attracts the most talented brains of the developing world, the Einsteins, the Fermis, the Niels Bohrs of tomorrow and the day after. They will not devise ways to build better mousetraps but they learn to think in terms of original solutions.”

The Trieste centre attracted top scientists from all over the world. The main equipments - chalks and blackboards - produced more than 130 scientific papers a year in the field of elementary particles such as “High-energy physics, field theory, nuclear physics, solid state physics and plasma physics”.

The gist of developing ICTP was Abdus’ own experience of the isolation he suffered in Pakistan. “You can understand why I feel so grateful to Allah for giving me this opportunity in such a mysterious way that I was able to conduct research at a time when there was no visible means of doing so. When in Pakistan I was the only theoretical physicist in the country. The nearest colleague was in Bombay... You have no idea of what that can be like. A theoretical physicist has got to be able to talk, to discuss, to shout if needed.”

Abdus was a strong believer that “...scientific thought is the common heritage of mankind”. He added that “developing nations need to help themselves and invest in their own scientists to boost development and reduce the gap between the Global South and the Global North, thus contributing to a more peaceful world.”

And so the concept of the Third World Academy of Sciences (TWAS) was conceived and in 1983, Abdus Salam invited a group of eminent scientists from all over the world to work out the guidelines for the Academy:

- To recognize, support and promote excellence in scientific research in the South.
- To provide promising scientists in the South with research facilities necessary for the advancement of their work.
- To facilitate contacts between individual scientists and institutions in the South.
- To encourage South-North cooperation between individuals and centers of scholarship.
- To promote scientific research on major problems of developing countries.

The Academy was officially opened in Trieste in 1985 by the Secretary General of the UN. (The name of the Academy was later change to the Academy of Sciences for the developing world).

In 2011, TWAS had close to 1,000 members from 90 nations. During a TWAS meeting in 1985, I happened to sit beside Abdus and asked him: “What does coinage mean?” He looked a bit surprised, but smiled and said: “Oh dear me – it means to put words together and coin a new word – like the word “Pakistan”, and scribbled with his pen, “Look here: Punjab, Afghan border states, Kashmir, Sind and Baluchistan make Pakistan. You invent a new word by putting old words together. I know because I was born into that coinage!” Abdus smiled and we started to discuss the agenda for the day.

On another occasion, when we met in the Royal Swedish Academy of Sciences, Abdus Salam seemed to be in a tranquil mood. I asked him, “Do you have a credo, Abdus?” He looked at me and said, “My Credo? It is the same as yesterday and tomorrow. Scientific thought is the common heritage of mankind.” Abdus asked about the founder of the Academy. I told him about the world-famous botanist Carl Linnaeus (1707-1778) who through his script “*Systema Naturae*” changed the world of Botany. When I said that Linnaeus’ global classification of plants had philosophical and religious roots, Abdus became very interested. I showed him a reprint of the “*Systema Naturae*” and added that in the 1700s the relation between God-Nature-Man was a divine triangle for many of leading European scientists – among them Isaac Newton (1642 -1727). Latin was the language of Science and Linnaeus writes in the preface to *Systema Naturae*, “*Creationis telluris est Gloria Dei ex opera Naturae per Hominem solum*” which in English means “The Creation of Earth is the Glory of God, as seen from the works of Nature by Man alone.” Linnaeus believed that the study of Nature reveals the Divine Order of God’s Creation. It was his assignment to write “*Systema Naturae*”, a classification of Nature which was to reveal the Order of the Universe. Linnaeus was firmly convinced that when he was wandering to classify flowers for his herbarium, the Creator was sitting on his shoulders. “Linnaeus’ thoughts are my thoughts” Abdus smiled and gave me his Quran, saying, “This is for you and your friends.”

In November 1996, Abdus Salam peacefully died in Oxford at the centre of his family at the age of 70. Abdus Salam was a member of The World Academy of Art and Science (WAAS).

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