

# WHAT REMAINS INVARIANT: LIFE LESSONS FROM ABDUS SALAM



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WITH AN INTRODUCTION BY AHMAD SALAM

# WHAT REMAINS INVARIANT: LIFE LESSONS FROM ABDUS SALAM

AN EXPANDED VERSION OF THE TALK  
DELIVERED AT THE

MEMORIAL MEETING FOR NOBEL LAUREATE  
PROF. ABDUS SALAM'S 90TH BIRTHDAY

AT NANYUNG TECHNICAL UNIVERSITY, SINGAPORE  
ON 25TH JANUARY 2016

BY TASNEEM ZEHRA HUSAIN

WITH A SPECIAL INTRODUCTION BY  
AHMAD SALAM

For Abbu,

Who taught me to look beyond facts and events  
to patterns and causes.

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# INTRODUCTION

# INTRODUCTION

When Professor Michael Duff first mentioned Tasneem Zehra Husain to me, I was intrigued. Here was someone who had never met my father, but had studied him so closely that she could write with certainty and purpose.

I have read as much as I can about my father over the years, to see how others viewed him. I have inevitably disagreed with some of the authors and some of their conclusions. I have also noted many factual errors in their work, but with Tasneem, I found very few which is a testament to the quality and depth of her research.

In addition Tasneem has only commented on facts presented to her. She has not trivialized nor tried to downplay any parts of his character. Equally she has not been sycophantic nor has she ‘sugar coated’ the story of Abdus Salam.

I believe the work Tasneem has completed here could and should be adapted for a younger audience: an audience who have not been allowed to hear of, nor know of, the wonderful story of Abdus Salam.

I feel all young scientists, be they in the developing or developed world, deserve to hear this inspiring story. As the late Nigel Calder put it, and I cannot improve on his words;

*“Here is a wonderfully romantic story of a young lad turban from a market town in the Punjab, that nobody had ever heard of, who became a leader in physics and faced up to politicians as a champion of the world’s poor. He wore the same kind of turban as he had worn as child, to collect his Nobel Prize from the King of Sweden.*”

*The thought I want to leave you with is that his story should be told to every child in the third world.....the story will inspire young people with the idea that, wherever they come from in the world, they too can make careers in science, or indeed any profession dominated by the rich countries.”*

Tasneem’s book is a welcome step in the long road to bring the story and example of Abdus Salam to young people in the developing world, and beyond.

We owe Tasneem a debt of gratitude.

Ahmad Salam  
London  
January 2017.



70th ANNIVERSARY CELEBRATION  
OF THE INSTITUTE OF MANAGEMENT STUDIES

100th Anniversary of the Institution of Engineers

100th Anniversary of the Institution of Mechanical Engineers

YU NIP NANYANG UNIVERSITY

# 1. SINGAPORE



## CHAPTER 1

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# SINGAPORE

When I received the invitation to speak at the memorial meeting, commemorating the 90th birth anniversary of Professor Abdus Salam, I was delighted and concerned, in equal measure.

Over the years, Salam had become one of my personal heroes, so I was thrilled at the opportunity to put my sentiments on record and pay a public tribute to him, but a single glance at the list of speakers cast me in doubt. Here was a group of truly distinguished scientists, several Nobel Laureates among them, all of whom knew Salam extremely well. I recognized the names of many of Salam's students and collaborators, and from what I gleaned about the others, it was obvious that everyone who took the stage in Singapore would have shared a deep, decades long association with Abdus Salam, either personal, or professional, or both.

I, on the other hand, never having set eyes on Abdus Salam, had no personal anecdotes to share. And to make matters worse, since I cannot claim any real familiarity with the intricacies of his research, a technical talk wouldn't make sense either. In fact, the more I thought about it, the less sense it made for me to speak in such company - but I really wanted to do it.

I considered long and hard what I could possibly say. I respect Abdus Salam enough that I did not want to show up unless I felt I could make a meaningful contribution to the conversation, yet I knew that any personal or intellectual episode I could uncover through my research, someone at the conference would probably already know from direct experience. I didn't want to merely recite a watered down second-hand history, so I struggled with what to say for quite a while, until I realized that the very fact that I feel such a deep intellectual and emotional bond with Salam - despite never having met him, or even having worked on his theories - is in itself worthy of exploration.

And that is why I came to talk about how a young scientist who grew up in Pakistan decades after Salam left the country, came to look upon him as a mentor, and why I feel he could play that role for so many other young people, particularly in the developing world.



## 2. DISCOVERING ABDUS SALAM



## CHAPTER 2

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# DISCOVERING ABDUS SALAM

My initial awareness of Abdus Salam had much in common with his early impressions of the weak force. In Salam's own words:

“When I was in school in about 1936, I remember the teacher giving us a lecture on the basic forces in Nature. He began with gravity. Of course we had all heard of gravity. Then he went on to say, ‘Electricity. Now there is a force called electricity but it doesn't live in our town Jhang. It lives in the capital town of Lahore, a hundred miles to the east. He had just heard of the nuclear force, and he said ‘That only exists in Europe’. We were told not to worry about it.”

Growing up, I didn't hear all that much about Abdus Salam. The lack of public discourse was largely attributable to the political ramifications that came from his sect being declared non-Muslims, and the abstract nature of his research put it out of the realm of most social conversations. There was, however, a small group of people who either knew him personally, or knew enough physics to appreciate his



stature, and among them, he was a larger than life figure. As my interest in theoretical physics grew, I began to come into contact with some of these people - college and university professors, mainly. Many of them had spent summers in Trieste, and all of them revered Salam. The stories they told were my first real introduction to him.

By the time I arrived at the ICTP, Salam was no longer physically there - but his presence was still tangible. Most daily affairs were conducted as if under his invisible eye. “Professor Salam would want it this way,” or “Professor Salam would never stand for this,” were phrases that could effectively end a debate. His office in the library lay untouched, as if waiting for him to walk in at any moment. Everyone had a story - or ten - to tell about him and, steeped in that atmosphere, studying the theories he had worked on, I began to piece together a image of Abdus Salam, the man.

However, it was not until I returned to Pakistan as a founding faculty member in a new school of Science and Engineering, that I truly came to appreciate Salam. In those early days, when issues of education and institution building were very much on my mind, I discovered *Ideals and Realities*, a compendium of Abdus Salam’s writings on many varied topics. Thus far, I had known Salam only second-hand, through stories and anecdotes related by others; this was my first direct interaction with his mind. Reading his words, thinking through his thoughts, I came to feel a distinct intellectual kinship with him.

I saw a multi-dimensional man who straddled research and institution-building with enviable flair; he was both religious and iconoclastic, a true citizen of the world yet deeply nationalistic, a scientist and a lover of literature, a villager and a cosmopolitan. I was struck by the breadth of his concerns and the depth of his analysis, and I couldn’t help but admire the generosity of spirit that shone through the page.

I began to toy with the idea of making a short film on Salam, both to make him better known among the public, and to show young people from all backgrounds that it is possible to start from a “humble” beginning and rise all the way to the top. In order to tell his story compellingly and effectively to high-school students, I had to

take a step back and view Salam's life and career as a whole. I had to articulate exactly what I thought a young aspiring scientist today could learn from Abdus Salam.

That project never got beyond the fund-raising stage, but it gave me two gifts. First, in the process of planning the film, I went through archival footage and videotaped interviews and 'saw' Salam for the first time; second, it planted the seed for this talk.



# 3. THE INVARIANTS

## CHAPTER 3

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# THE INVARIANTS

Our attempt to understand the laws of Nature is, in part, an effort to gain control over a world that sometimes seems completely random. A physical theory is said to explain certain phenomena if it models their behavior in such a way that it is able to predict the outcome of a situation; given a system in a certain initial condition, the theory should be able to tell us what comes next.

Some of our most brilliant and most successful theories - like the Standard Model - are gauge theories. Such theories are formulated in terms of invariants; quantities that remain fixed despite shifting appearances and changed circumstances. Identifying these invariants goes a long way towards dictating the form of the theory, and consequently, predicting the evolution of the system.

I sometimes wish we had such theories for life; that there were equations we could churn to calculate the outcomes of situations in which we find ourselves, that there was a degree of mathematical certainty to the evolution of personal circumstance.



Such a formulation is probably not forthcoming, but in the interim, there is still some wisdom to be gleaned from gauge theories. They remind us to look beyond the vagaries of fate and fortune to the invariant essence of life, to the qualities and principles that can anchor us, as we navigate this wildly variable waters of this world.

That's where Abdus Salam comes in. I know of few others who have covered as much ground, both intellectually and physically. Salam rose from what he called "humble beginnings" all the way to the top, and the breadth of his interests and concerns was almost inexhaustibly vast. While the specific details of his life belong to the man alone, his experiences exemplify certain values, attitudes and lessons that are universal.

And so, I sat down to analyze Salam's life in an effort to extricate the invariants; the principles that apply to us all.

Here's what I came up with:

## CULTIVATE A WIDE INTELLECTUAL CURIOSITY

That might seem a strange place to start, but his lively curiosity gave Abdus Salam a unique edge. Salam was so much more than a brilliant scientist. He was almost a one-man corporation! He was able to juggle so many things because he was deeply and widely curious, he was genuinely interested in how things work.

Most of the time, those of us who pursue the natural sciences don't focus much on the humanities. This is particularly true in the developing world where you typically choose to study one at the expense of the other. In my personal opinion, that's a huge mistake. History, literature, and philosophy might not equip you to perform surgeries, help you make technical calculations or design tangible objects, but they enable you to reach out and make connections to people, which is an equally crucial ability.

The ability to communicate is a skill Salam valued highly, and honed relentlessly. In his personal notebooks, he underscored the importance of writing with clarity: "To write, to learn to write, to convey to others the vision of your knowledge, your learning, your wisdom. To write fluently, effortlessly."

Good writing, of course, comes from extensive reading, and Salam read up voraciously, on all sorts of subjects, from ballroom dancing to how to fly a plane, from the Marx brothers to Punjabi poetry. Salam's daughter Aziza mentions how "sometimes seemed that reading was second only to breathing to him ... He loved to buy books, old and new. There was no room in our house, including the bathroom, that did not have bookshelves in it filled with books on every subject. My father would come home from traveling the globe with his suitcases splitting from the weight of the books he had bought, and my mother would worry about where to put them."

Abdus Salam had been a lover of English literature long before he set foot in England, but during his first year in Cambridge he apparently decided that his general knowledge was unsatisfactory, and so, he set out to remedy the situation. Salam read widely about the history of civilizations, and the different religions of the world.

His familiarity with the humanities and his wide range of interests served Salam well, whether he wanted to convince officials with decision making powers, or educate and empower the masses.

Salam's facility with literature and mythology shone through in what is perhaps the most engaging and accessible description of parity violation I have ever heard. Constructing an analogy between the neutrino and the cyclops, Salam said, it is as if we live in a world where all cyclops have eyes on the left side, and no right-eyed cyclops are allowed to exist. When a (necessarily left-eyed) cyclops looks into a mirror, it sees nothing - its reflection being ruled out by the laws of Nature!

Salam was always able to speak to his intended audience in their own language, weaving in little cultural nuggets that put people at ease. During an interview in Pakistan, Salam spoke reverently of a much loved folk tale; in an article for a British newspaper, he wove in the quintessentially English humor of P.G.Wodehouse; during a lecture he delivered in Turkey, he quoted examples from their illustrious history, and the list goes on. Whatever the cause, whatever the occasion, Salam always made people feel as if he was buying in; he was listened to because he spoke as an insider.

## HONOR YOUR ROOTS, BUT GROW WINGS.

The turban he wore to the Nobel award ceremony is an obvious symbol of the value Abdus Salam placed on his cultural heritage. Salam wore suits almost every day of his life; his decision to don traditional clothes was a deliberate statement about his pride in his roots. It was as loud a tribute as he could pay to the country of his birth.

Salam's love for Pakistan ran fathoms deep, and yet was never far below the surface. This national pride shone through in subtle ways, illuminating his gestures with grace. As a case in point, a journalist once asked Salam how he felt about the fact that his extraordinary accomplishments had now branded Jhang as the birthplace of one of the greatest scientific minds of the century, whereas previously the only claim to fame this small village had, was due to the folktale of Heer Ranjha. With characteristic wit and humility, Salam answered, "There are over 325 Nobel laureates in the world, but only one Heer." In that single, succinct, sentence Salam conveyed his love for his culture and his respect for his heritage.

Despite being treated extremely shabbily by the Government, Salam continued to go back 'home' at every opportunity. On one such trip, after he won the Nobel Prize, Salam gave an interview in Punjabi (the local language of his region) so that he could connect with people who might not necessarily be very well educated (and hence not be comfortable with the national language, Urdu). He never became too proud to bend, to make gracious gestures like that. In this interview, Salam answered basic questions, very patiently for hours. Salam honored the humblest part of his background, but he never let it hold him back.

Salam was firmly committed to the cause of science in Pakistan, and he worked tirelessly to increase the exposure of, and create a better intellectual environment for,



Pakistani scientists. He played a critical role in establishing Pakistan's Atomic Energy and Space Research agencies PAEC and SUPARCO, and even initiated an annual physics conference in the hills of Nathia Gali, to which he attracted many international luminaries. Salam was the beloved mentor for an entire generation of Pakistani students, some of whom (most notably the twin brothers Riazuddin and Fayyazuddin) become physicists of international repute in their own rights.

But while Salam's nationalistic zeal brought out his generosity and spirit of service, it did not limit his outlook. One of his most famous students was the Israeli physicist Yuval Ne'eman, who pursued a PhD under Salam's supervision while serving as Israel's Defense Attache in the UK. Where others might have seen this as a source of conflict, given the prevailing tensions between Israel and Pakistan, Salam viewed neither political nor religious differences as boundaries. Although a devout Believer, he did not feel the need to either apologize or proselytize - a quality that is far too rare in the world today.

Leaving Pakistan was probably one of the most difficult decisions Salam ever had to make - for those of us who come from the developing world, it is an all too familiar dilemma. Each of us grapples with the consequences of leaving our countries. We struggle uneasily with the question: If I go abroad, am I abandoning my people? Salam managed to walk this tightrope to perfection, performing the ultimate balancing act.

Salam's solution to the dilemma was this: if there is a way to stay and contribute, by all means one should do so, but the crucial component that will drive change in our countries is our ability to make positive contributions, not our decision to stay rooted in the soil. Salam knew that if he stayed on at Government College, he wouldn't have access to the facilities that he needed to do research, so he made the choice to return to Cambridge. He realized that if he established himself and came from a position of strength, he could do far greater good to Pakistan - even from a distance - than if he stayed on and stagnated.

Salam moved on, but he never severed the tie. He kept on giving back.

## BE OPEN TO CHANGE. RESPOND TO THE WORLD

View life as a conversation, not a prewritten script. Don't walk into situations with a prepared speech in mind. Let the people you meet and the circumstances you face, influence you.

At the beginning of his academic career, Salam's intention was to join the Indian Civil Service. He studied Mathematics because this was a subject in which it was possible to achieve a perfect score, and thus gain a competitive edge in the Civil Service Exams. But, even though he set off in pursuit of a definite goal in mind, Salam was not closed-minded. While in England, he had discussions with many people, Dirac among them. The greater Salam's exposure to physics, the more he responded to it, until eventually he came to the realization that this was what he wanted to do.

Had Salam not been open to new ideas, had he been unwilling to explore previously unconsidered opportunities, he could have spent his days as a bureaucrat in India - or Pakistan. Salam dodged that fate because he was alive to possibility. He moved through the world deliberately, fully engaging with his surroundings. As his son Umer put it, "Everything touched him. Everything reached him."

## ACKNOWLEDGE YOUR DEBTS.

Salam always acknowledged his debts; a rare quality, and one for which I respect him immensely. To declare yourself indebted, you must be secure enough to not feel diminished by the power dynamic that is implicit in such a statement; you must be just enough to admit that your successes are not solely due to your own “superhuman” efforts; and you must be honorable enough to not attempt to hide your tracks. Abdus Salam had all these qualities.

Unlike most ‘grand’ people who gloss over the non-glamorous parts of their past, Salam made it a point to acknowledge everyone who had helped him along the way. He repeatedly expressed his gratitude to the teachers at whose hands he learnt in the modest Government-run school he attended in Jhang.

“It was my good fortune that I had some of the exceptionally learned and most affectionate teachers assigned to me. The foundation of my academic career was laid in this college. I believe that I owe all of my later accomplishments to this institution and to its hard-working teachers. I firmly believe that a teacher’s affection and his proper attention can make or break a student.”

In gratitude for the education he received in this humble school, Salam arranged for books and laboratory equipment to be sent to his alma mater, until the end of his life. While his teachers doubtless deserve credit, gratitude - like beauty - can also be in the eye of the beholder. Salam’s graciousness in acknowledging his alma mater is a window into his values as much as it is a statement about his school.

When Abdus Salam visited Jhang, after receiving the Nobel Prize, he sought out his primary school teacher, who was by then so old he could not even sit up. Salam put his Nobel prize on his teacher's chest and said “this is for you.” The respect Salam bestowed on others was not limited to any particular institution or benefactor.

Each time he went back to Lahore, Abdus Salam paid his respects to his professors at Government College and Punjab University. In giving voice to, even emphasizing, their contribution to his life, he gave his teachers the rare and generous gift of showing what they had meant to him, and by doing so, he raised the esteem in which society held them.

## BE LOYAL

Salam was deeply loyal, but what truly set him apart was his ability to be loyal to many different institutions. When his alma mater in Pakistan, Government College, celebrated its 150th Anniversary, Salam was at the peak of his career; he had won the Nobel Prize and was running the ICTP. Despite all the demands on his time, he wrote a piece for the commemorative version of the Ravi: the college magazine of which he had been an editor.

From Government College in Lahore, Abdus Salam went on to St John's College at Cambridge, and he was equally loyal to that too. Most of you know the anecdote about Salam being offered a fellowship at the more prestigious Trinity College, but electing to stay at St John's, saying "the roses here are so beautiful that I don't want to leave." I heard that version many times before I learnt the corollary, which for me, changed the entire tone of the story; after praising the roses at St. John's, Salam added, "and there is also something known as loyalty."

Salam believed in nurturing institutions. Not that St John's, or for that matter, any college in Cambridge, needed nurturing but that was the general principle according to which Salam lived his life: when an institution gives to you, you give back. That's how nations are built, that's how societies grow.

Salam did the same again with Imperial College. Imperial was far sighted enough to keep him on as faculty, despite the fact that he spent a large part of his time in Trieste, and Salam lived up to the trust that was placed in him. He took pride in Imperial College and in the group he had established there, till the end of his days. Salam arranged for many from his department to visit the new institute in Trieste, and as his son Ahmad phrases it, always "took great pride in flying the college



colors.” The distance in no way affected Salam’s loyalty to his department in London, and actually, to British Science in general.

When, in the mid 1980s, the British Government was considering cutting particle physics funding for participation large international ventures - like CERN - Salam penned an impassioned protest. “Clearly, a country that has upheld fundamental science ... cannot lightly absolve itself and withdraw from supporting this most exciting adventure of ideas of our times,” he said, in a *New Scientist* article entitled “Particle Physics: Will Britain Kill its Own Creation.”

One of Salam’s greatest attributes was that he acknowledged and honored all aspects of his identity, subsuming them within himself without causing any conflict. Given his ability to compound loyalties, it should come as no surprise that when Abdus Salam moved to Trieste, he made the city his own. He did not merely live somewhere, he belonged. Italy was his country, as was England. Salam thought of the entire Muslim world as his, even after he was officially declared to lie outside its folds. The Government of Pakistan treated him in a deplorable fashion, but he never responded in kind. His son, Ahmad, quotes many touching examples of Salam’s devotion - from tuning in regularly to Radio Pakistan, eager for “any news he could on his beloved country”, to the Nobel laureate designing a tie with the logo BPP (Build a Better Pakistan). But perhaps the most heartbreaking gesture of loyalty was that Abdus Salam held on to his Pakistani nationality until the end of his life.

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## BE RESILIENT

Resilience is not an easy quality to cultivate, particularly for those of us who come from developing countries, where speaking up and asking questions is not always encouraged.

I don't know if Salam was born with this gift, but - reading between the lines - it seems to me that this quality was fortified (if not created) as a result of the two-component neutrino saga. When Salam first came up with that idea, he excitedly wrote about it to Pauli - the de facto 'referee' of the theoretical physics community. Pauli was critical, even dismissive, of the theory so Salam refrained from writing it up.

I am sure that in later years he must have regretted following Pauli's advice, but Salam's reaction to the incident is what elevates this story from a thousand others about missed opportunities. Rather than getting stuck on this one - admittedly consequential - miss, Salam incorporated the experience into his worldview, and decided that in order to avoid such a situation in the future, he would voice all his ideas, and let the rules of natural selection dictate their survival.

Salam might have resolved to not let the opinion of authority keep him from publishing something ever again, but he wasn't irresponsible about letting his ideas loose on the world. One way he managed the outflow was to use a group of peers at Imperial as his sounding board. Every day at the faculty restaurant, he would regale John Moffatt, P.T. Matthews and John Taylor with his latest theories, which they would then pick apart, sometimes dismissing them entirely, and - with no affront to his ego - Salam would simply come back the next day with fresh ideas for his posse to dismantle. One of the secrets of Salam's success was his adherence to the adage, "the best way to have a good idea is to have a lot of ideas."

We all face setbacks. What separates the successful people from the might-have-beens is the ability to bounce back. Salam not only rebounded himself, he also encouraged a similar resilience in others. In the words of Peter West, after talking to Salam, “one came away feeling failure is a temporary phenomenon.”

## BE RESOURCEFUL

The ability to find a way around obstacles always stands one in good stead. On the surface, it appears that opportunity favored Salam, and it might well have done, but often with a little nudge from the man himself.

There is no argument about the fact that Cambridge was a turning point in Salam's life and career, and one could argue that - since the particular scholarship he was awarded lasted only one year, and he was its only recipient - it was sheer luck that landed Abdus Salam in Cambridge. But that version of the story ignores one crucial component.

The scholarship was set up for the sons of farmers. Abdus Salam's father was a school inspector not a large landowner. However, when the family found out about the scholarship, Salam's father bought a small tract of land that qualified his son to apply. I do want to point out here that Salam was playing by the rules. Without ripping anyone else off, he gave himself a fighting chance. The scholarship was awarded through a competitive process and had Salam not been the best candidate, he wouldn't have won it. On the other hand, he not exhibited some creative problem solving, Abdus Salam might have followed the career path he was then pursuing, and spent his life as an officer in the Indian Civil Service.

As another case in point, there was the time when Salam came across a problem while working on renormalizing meson theories in Cambridge. He called up Freeman Dyson, who was then in Birmingham, to help resolve the puzzle but Dyson said he was leaving for Princeton the next day. Salam immediately hopped on to the next train to Birmingham, only to join Dyson on his journey to London. The two discussed physics - uninterrupted - on their way down.

Or there was the time when Salam, upon his return to Pakistan, needed to secure a scholarship. With characteristic gusto, he went out to obtain it. Salam met with the Director Education and many other officials of the Punjab Government and was eventually advised to go directly to the Governor, Francis Moody. Like Salam, Moody was also a St. John's man, and Salam thought it would do his case no harm if the alumni connection were to become known. Not wanting to be gauche about it, Salam merely ensured that he wore his college necktie to the meeting, and trusted Fate to take care of the rest.

Reading through his biography, one comes across many examples where destiny seems to favor Salam, but to merely dismiss it at that is to trivialize his own role in shaping his life. When faced with obstacles, Salam often came up with ingenious solutions, which he then enacted with aplomb.



## HAVE A SENSE OF FUN

Abdus Salam's ability to concentrate was legendary. Even as a five year old, he could become so engrossed in reading a book, he did not notice the cat running away with his dinner. That intense focus stayed with him throughout his life, as did his lively curiosity. Salam had an active, wondering mind, always brimming over with ideas. He kept track of these through notes scribbled on whatever he could find – from envelopes to scraps of paper, to the backs of posters. No 'writable' surface was safe. His son Ahmad tells an amusing story about the time Salam had lunch at the Buckingham Palace with the Queen and Prince Philip. After all the guests had left the table, Salam went back and asked if he could take his napkin – he had written some notes on it.

Salam was exceedingly hard working, and seemingly tireless. He was thorough, methodical, and disciplined. There was an order to all he did, and as a result, he never wasted time or effort looking for things - he always knew where every book, every pen, every piece of paper was.

Given these habits - or glancing at a list of his accomplishments - you might be tempted to think that the man never relaxed; you would be wrong.

Abdus Salam had a lively sense of fun. When his daughter Aziza's school held a fundraiser, Salam - having just read a book on the subject - volunteered to be a palmist. He dressed up in his sherwani and turban, threw himself into the role, and was a huge hit.

One of Salam's favorite ways to unwind was to read P.G.Wodehouse, and apparently he laughed out loud while doing so. When asked why he enjoyed these books so much, Salam replied that he liked them because they were "inconsequential". Wodehouse's stories could be enjoyed in the moment, but they left

no intellectual aftertaste. You didn't stay up nights worrying about the characters. As such, they provided the perfect break.

Salam did not watch much TV, but when he did indulge, it was usually in a comedy - Charlie Chaplin, Laurel and Hardy, or the Marx Brothers. His son Ahmad recalls him watching an old BBC sitcom called Dad's Army, and laughing so loud, he literally fell off his chair.

For me, this aspect of Salam's life, his ability to enjoy himself and unwind upon occasion, is as important as any other. For, while we must of course try to work hard and discharge our duties as best we can, it is also important to refrain from becoming impassive workhorses, particularly when we occupy positions of authority. The culture of every institution benefits from a degree of relaxation, informality, even straight out fun. These little breathers are what allow us to focus sharper and work harder.

## DO THAT WHICH, BUT FOR YOU, MIGHT NOT BE DONE.

When Abdus Salam was asked how it felt to straddle Physics and his administrative duties, he replied that he wished he had more time for Physics. What he left unsaid was that Physics, much as he loved it, was something he did for his own intellectual satisfaction and pleasure; in setting up the ICTP he was opening doors for others, and thereby discharging a responsibility placed upon him at birth. It is a testament to Salam's character that he never considered compromising the latter for the former.

The hours spent in administrative work obviously took away from research. Steven Weinberg, who shared the Nobel Prize with Salam, remarked at the amount of time he devoted to the ICTP "at the cost of physics." "I don't know that I would be able to do that," Weinberg said, but for Salam the matter went beyond choice.

Salam knew that he was uniquely positioned to do certain things; if he didn't do them, they wouldn't get done. Salam did not merely want to rest on his laurels as the first Muslim Nobel Laureate, he wanted to make sure that many came after him.

Growing up in a developing country, Salam was intimately acquainted with the perils and frustrations that come from a lack of access, and having crossed the oceans, he had also experienced the opportunities that the developed world enjoys. The sheer knowledge that such a huge chasm existed between his two worlds, was a call to action for Salam. Salam felt it incumbent upon him to bridge the gaping void, to try to give others born in circumstances similar to his own, the things he wished he had had - and the things he had not even known to wish for. And thus, the ICTP was born.

Salam knew from personal experience what it felt like for a gifted scientist who had been exposed to the best and brightest in his field, to return home to the

developing world and find himself completely alone. The dearth of colleagues, the lack of stimulation, the absence of constructive criticism, all these factors contributed to an inevitable decline in the quality of research. Isolation, Salam pointed out, “in theoretical physics - as in most fields of intellectual work - is death.”

In establishing the centre, Salam reflected upon the time he had spent in Lahore and, in hindsight, tried to work out the conditions that would have made it palatable for him, and by extension, for the countless other scientists who face the same challenges. He arrived at the conclusion that “If at that time someone had said to me, we shall give you the opportunity every year to travel to an active centre in Europe or the United States for three months of your vacation to work with your peers; would you then be happy to stay the remaining nine months at Lahore? I would have said yes. No one made the offer. I felt then and I feel now that this is one way of halting the brain drain, of keeping active men happy and contented within their own countries. They must be kept there to build for the future, but their scientific integrity must also be preserved. By providing them with this guaranteed opportunity for remaining in contact with their peers, we believe we are making a contribution to solving the problem of isolation.”

Yet another burning concern for Salam was “how easily Einstein might have been lost, ... if he had been born in a developing country.” Salam wanted to do his part to ensure that no one’s potential go unfulfilled just because they were not born into plenty, and any time spent in this endeavor he did not consider wasted.

All of us occasionally come across tasks that we - with our particular knowledge and expertise - might be uniquely positioned to accomplish. This is especially true in developing countries, where there is so much progress still to be made. Such tasks often seem mundane, administrative, and not at all exciting on a personal level, but they have a value for the society into which we are born. The world would be a far better place if we were to accept these charges with good grace, and plunge into them as whole heartedly as Salam did with the ICTP.

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## RESIST BITTERNESS

I am convinced that Salam was able to accomplish so much partly because he didn't waste energy being bitter, but instead channeled his resources into more positive endeavors.

As a case in point, Salam could have fretted endlessly - and unproductively - about missing out on publishing the theory of the two-component neutrino, but instead he learnt from the episode and diverted his thoughts to a far more constructive direction.

Similarly, when the Government of Pakistan declared Salam's (Ahmaddiya) sect to be non-Muslim, much as that hurt him personally, he did not let it sour his relationship with the country. Salam was able to mentally divorce the people and the Government, realizing that regardless of what the State said, the people loved him, and it was for their benefit that he worked.

Salam's faith in his compatriots was vindicated. When he died and his body arrived in Pakistan for the burial, it was greeted by throngs of people, lining the streets. Thousands upon thousands had turned out to pay their last respects to this illustrious son of the soil. The outpouring of love and pride was unfortunately not reflected in the attitude of the government, but Salam knew the sentiment existed and throughout his life he acted with the confidence and affection that came from this belief.

Perhaps the seed for his confidence was planted decades earlier, when Abdus Salam stood first in the Matriculation Exam. The result was declared on a hot summer afternoon, and as Salam biked back home after receiving the news, he saw the entire village out on the streets to greet him. This was particularly significant because most of the shopkeepers in the village were Hindus, and traditionally a boy



from the (more educated) Hindu community stood first in this exam. But in Jhang that day, everyone, regardless of caste or creed, stood in the blazing sun to pay a tribute to this Muslim son of their village.

In Salam's own words: "I remember returning home around 2 p.m. in the afternoon on my bicycle from Maghiana to Jhang city. The news of my standing first in the exam had already reached Jhang city.

I had to pass through Police Gate district of Jhang city to reach my home in Buland Darwaza. I distinctly recall that those Hindu merchants who normally would have closed their shops due to afternoon heat, were standing outside their shops to pay homage to me. Their respect for me and their patronage of education has left an indelible impression on my mind."

I like to think that incident nurtured Salam's subsequent outlook, that he was strengthened by the memory of a time when there was unity across religious and ethnic divides, and he carried that feeling within him.

Regardless of what fueled it, Salam believed that his people loved him, and he reciprocated their emotion; he simply did not allow the Government any place in that relationship. While I am sure he would have appreciated some official acknowledgement and acceptance from his country, Salam did not let the lack thereof embitter him.

## DEVELOP TOLERANCE FOR A MULTIPLICITY OF VIEWPOINTS

Science is remarkable not only as a body of knowledge, but also as a system of thought. The logical process, the emphasis on reproducibility, the international scrutiny, the exacting standard for proof: these are the reasons we trust scientific knowledge. Equally crucial is the iconoclastic nature of the discipline. In science, no authority is absolute, and no one's word is taken on reputation. There is no culture of bowing to precedence, or deferring to the Classics; every result is evaluated afresh and is subject to the same critical analysis.

All these attributes can be interpreted as virtues of science, but they are equally conditions that must be met in order for science to grow and thrive.

Salam knew just how a crucial role science plays in the growth of nations, and he considered - deeply, and with characteristic care - the problem of how best to strengthen science in developing countries. He wrote many, very well researched, policy papers on the subject, full of data, and from all his observations, he culled a few 'laws': basic ingredients that seemed to be common to almost all cases of social progress.

“The last hundred years have seen nation after nation start with something like our conditions and crush through the poverty barrier. The laws governing this type of transformation are now well understood,” Salam said, at a talk he delivered in Pakistan.

He outlined many ways of engendering such a transformation. Here is one I find particularly poignant.

“Excellence in science is dependent on the freedom and openness within the scientific community, and not necessarily upon the society at large. In science, if

there is a considerable body of persons who appreciate what one is engaged on, if there is a body of persons who are permitted to discuss freely and openly their doubts, express their reservations of each other's work as well as speak out their own visions, if there is a body of persons who can discard the beliefs they cherished, if empirical evidence goes against them, then science at the highest level will continue to be created," Salam said.

Scientists, in other words, could create their own mini-Utopia, regardless of any dissonance that existed around them. Within this little intellectual oasis, the rules of the discipline would reign rather than the rules of the country, thus ensuring scientific progress. Once a nation made solid advances in science, Salam felt, it was firmly on the road to development: technological advances would help solve many of the problems that beset society, and theoretical advances would raise the intellectual stature - and confidence - of the people.

It is important to point out that by suggesting that scientists focus first on their own little community, and on producing work of true merit, Salam was not advocating that academics seal themselves up in ivory towers, divorced from the problems around them; quite the contrary. He was, in fact, rousing the (often most highly) educated people to bring about - peaceful - social revolutions.

The idea, or at least the hope, was that the logical, problem solving, free-thinking, critical, thought process cultivated by scientists would eventually become strong enough to spread out into the wider community and take root in the culture at large.

Should this scenario play out, a society could undergo an incredible amount of progress, without incurring any of the casualties revolutions bring in their wake. It would be almost an ideal solution, and the seed for this incredible social change is planted by tolerance. The practice of science is an excellent way to cultivate the capacity to engage with multiple viewpoints, and develop tolerance for a vast range of ideas and opinions.

Salam had this ability in spades. He was able to see many different perspectives, and even hold what some might consider opposing views without being conflicted. Perhaps the most well known example is his religiosity. Salam was a devout Believer. He quoted verses from the Holy Quran in many of his speeches including, most

notably, the Nobel acceptance speech. Salam never apologized for, or hid, his beliefs. He listened to recitations of the Quran while working technical calculations, balancing both the religious and scientific parts of himself in perfect harmony.

Scientists in general are not very religious, and Salam numbered among his dear friends many avowed, and sometimes quite vocal, atheists. Even in a matter like religion where arguments often become heated, Salam was able to maintain and honor his own beliefs, while being completely tolerant of the beliefs - or lack thereof - of others around him.

We have already spoken about Salam's simultaneous loyalty to many different institutions. That, too, would not have been possible had Salam not been able to hold multiple viewpoints.

In fact, Salam's prolific idea generation - which we discussed earlier - bears testimony to the fact that he was able to consider many different options. His resilience speaks volumes about his willingness to put his ideas out there, solicit the opinions of others, accept their criticism, and be ready to discard ideas that did not make the cut, without feeling personally affronted.

Salam's open-mindedness and intellectual tolerance played an essential role in his career, and he argued that it could play a parallel part in the growth of nations.

## CARRY YOURSELF WITH DIGNITY

Salam may have been, as he repeatedly claimed, “a humble man”, but he was never servile. He competed, in every arena of his life, as an equal. He treated people with respect and consideration, but was not subservient or sycophantic. Maintaining his dignity was very important to Salam. He knew that in order to be taken seriously by the best, he had carry himself with confidence and grace, and of course excel at what he did.

The same logic holds for societies as well, Salam argued. It was a perpetual thorn in his side that developing countries kept importing ready-made technology, rather than investing in fundamental science. One can never hope to be respected if one is always seen with a begging bowl in hand. Salam wanted developing countries to take charge of their destiny through a cultivation of scientific knowledge.

Salam completely agreed with C.P. Snow that “there is no evidence that any country or race is better than any other in scientific teachability; there is a good deal of evidence that all are much alike. Tradition and technical background count for surprisingly little. There is no getting away from it; It is possible to carry out the scientific revolution [across the world] in fifty years. There is no excuse [...] not to know this.”

Invest in science, Salam pleaded developing nations: take your place on the world stage as contributors, not just consumers. He advocated passionately for developing countries to engage “in the enterprise of creating scientific knowledge not just because Allah has endowed us with the urge to know, this is not just because in the conditions of today this knowledge is power and science in application the major instrument of material progress, it is also that as members of the international community, one feels that lash of contempt for us - unspoken, but still there - of



those who create this knowledge. Why should others have an obligation to aid feed and keep alive nations who do not contribute to man's stock of knowledge?"

In order to enforce this crucial message, Salam came at it from another angle. Importing technology is a temporary tide-over, he said, not a proper solution; an understanding of the underlying science is crucial in order to manipulate and modify existing technology to meet your individual needs. The creation and mastery of science will fill you with a pride and joy that is not to be found in the utilization of technology, Salam reiterated over and over again.

Salam's belief in science as a tool for social betterment comes across loud and clear in the many speeches he delivered on the subject, and he makes excellent arguments to support his case. But there is at least one more reason behind his desire to see developing countries pursue lofty scientific goals.

Salam thought of science as "the joint heritage of all mankind." When we work for the advancement of our common pool of knowledge, differences of race, caste, creed, religion and politics become irrelevant. All the external labels we use to differentiate ourselves from others, simply fall away. We come to know each other on a level that surpasses these superficialities, simply as human beings, held together by the essential curiosity of our race, and our shared excitement in any progress that is made towards our common goal.

This might sound overly idealistic, but if you consider the demographics of at any substantial scientific endeavor today - be it CERN or LIGO or FermiLab - you will see a huge cross-section of nationalities, races and religions working together collegially, sparing no thought to the political or religious differences that supposedly divide them.



## 4. SALAM'S OTHER MASTERPIECE

## CHAPTER 4

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# SALAM'S OTHER MASTERPIECE

Abdus Salam held that “the joint endeavour in science [could become] one of the unifying forces among the diverse people on the planet.” And as every good scientist does, Salam constructed a toy model to demonstrate the features of his theory: he called it the International Center for Theoretical Physics.

Rexhep Meidani, who later became the President of Albania, was first a physicist, who personally benefitted from his association with the ICTP. Meidani recognized exactly what Salam had set out to accomplish. Salam’s “target was not only to create a scientific center,” said Meidani, “but also to capture, through his human and spiritual imagination, the most advanced model of a community, and a new building of collaboration, independent from race, religion, nationality or political affiliation, and moreover to light the path of an integrated peaceful world of free people with an open heart and original mind.”

For half a century now, people from all over the globe have flocked to Trieste, to meet there as equals. The ICTP truly is a little haven where people make it a point to help each other, where bureaucratic hurdles are minimized, where you meet people who face problems similar to your own, and have negotiated them in ways that perhaps did not occur to you. Scientists who feel isolated in their own countries, discover a network of peers. Connections made in Trieste often deepen into collaborations.

The ICTP is as much Salam's masterpiece as the electroweak theory, and there are some remarkable parallels between these vastly different endeavors. Electroweak theory uncovered a deep, hidden, symmetry between two apparently very different forces of nature; by looking back to a time when electromagnetism and the weak nuclear force had not yet adopted their current guises, Weinberg and Salam were able to show that these forces we now perceive as being fundamentally different, in fact stem from the same root. In its own way, the ICTP accomplishes the same. By looking beyond our apparent differences and focusing on what we have in common, the ICTP unifies people just as electroweak theory unified two forces.

There is an argument that comes up every now and again, about the scientist's role in discovering laws of Nature. Does the individual really have any 'creative freedom' in formulating a theory? If Einstein had not discovered relativity - so the canonical example goes - someone else would have eventually arrived at the same truths, but no one other than Beethoven could have written the 9th Symphony. While I personally believe that every great scientist leaves an 'artistic signature' on their work, I know that is a statement about style, not content. The strength of a scientific theory lies, after all, in its universality and reproducibility! And in fact it has often happened that scientists working completely independently - and in total ignorance - of each other, have stumbled upon the same scientific truth.

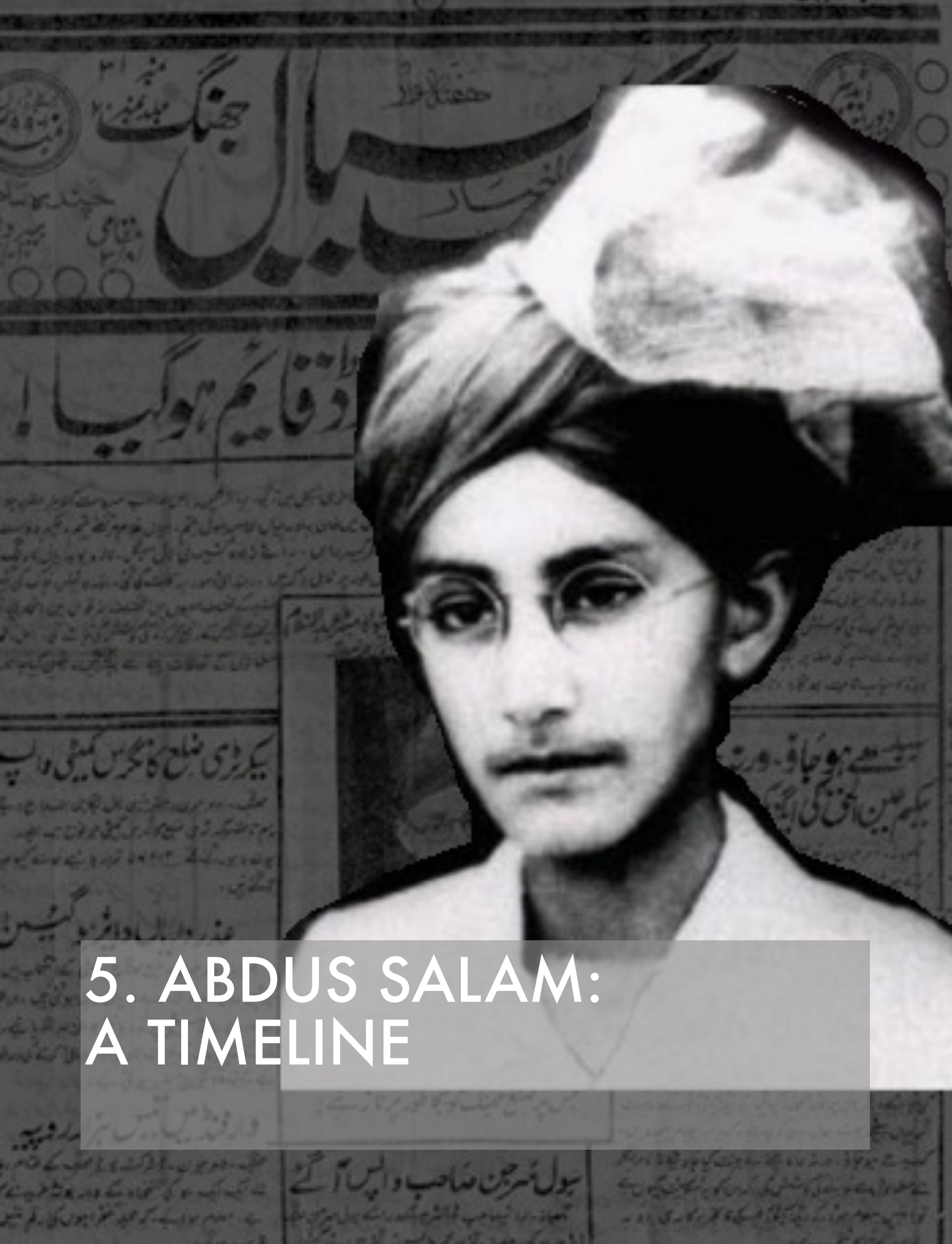
Salam was once asked what he thought of the electroweak theory. With characteristic humility, he replied "It is a good piece of work. Allah was very gracious in letting me get involved with something which, InshaAllah, will live."

One could perhaps concede Salam's point, and say that yes, there was an element of luck, or grace, in that he focused on just the right problem, at just the right time.

Had he not done so, the 1979 Nobel Prize in Physics would probably still have been awarded, at the same time, for the same piece of work, but to Glashow and Weinberg only.

But there was something else Salam was involved in. Something great, that only he could do. Something in which there was much ‘creative freedom’ in the accomplishment of the task, and a deliberate choice in taking it on in the first place. If the electroweak theory came Salam’s way, the ICTP is something he went out on a limb to create. The center would not have existed, had it not been for Salam. And this too, is a “good piece of work,” and one that “Inshallah, will live.”





# 5. ABDUS SALAM: A TIMELINE

حضرت علامہ اقبال

چند سالہ

مقامی

وقایع ہمہ گیر

پیکر برقی ضلع کا گریجویٹ کمیٹی واپس

سیکریٹری ہو گیا اور

یکم سن اپنی کی ایک

پول سرجن صاحب واپس آئے

# ABDUS SALAM: A TIMELINE

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## ADAPTED FROM THE MARIE CURIE LIBRARY'S SALAM ARCHIVES

- 1926 A baby boy is born on 29 January in Jhang, in British India's Western Punjab. He is to be the eldest of seven brothers and two sisters born to Muhammad Hussain, a teacher and official in the Department of Education, and Hajira Hussain, a housewife. Before the child was born, Muhammad Hussain had a dream that this unborn son would go on to do great things and serve God. In gratitude, the first-time father names his baby Abdus Salam – the servant of peace. All his life, Salam wears this name like a mantle.
- 1940 At 14, Abdus Salam scores the highest marks ever recorded in the University of the Punjab's Matriculation Examination. When Salam cycles back home after the results are announced, the entire village is standing outside to greet him. Based on this outstanding performance, Abdus Salam wins a scholarship to Government College, Lahore.
- 1943 At the age of only 17, Abdus Salam publishes his first research paper, entitled: "A Problem of Ramanujam".
- 1946 At the age of 20, Abdus Salam graduates from Government College, Lahore, with a Master's degree in Mathematics. He is awarded a scholarship to St. John's College, Cambridge.
- 1949 At Cambridge, after just two years of study, Abdus Salam obtains a Bachelor of Arts degree with double first-class honours in Mathematics and Physics.
- 1950 Publishes his first article in the influential peer-reviewed journal



Physical Review.

Awarded Smith's Prize, St. John's College, Cambridge for the most outstanding pre-doctoral contribution to physics.

Completes work for his Ph.D thesis in theoretical physics. The quality of his research wins Salam an international reputation, and he is invited to spend a year at the Institute for Advanced Study in Princeton, where Einstein works.

Instead, he elects to return to Pakistan as a Professor of Mathematics at his alma mater, Government College, Lahore.

- 1952 After completion of formalities, Abdus Salam is awarded his Ph.D. He returns to the University of Punjab as the head of the Mathematics Department, but soon realizes that isolation, and the complete lack of administrative support in Pakistan makes a research career impossible.
- 1954 Returns to Cambridge as a lecturer in mathematics and Fellow of St. John's College.  
Visits Pakistan occasionally as adviser on science policy to the Government.
- 1955 Attends the first Atoms for Peace Conference convened by the United Nations in Geneva, as Scientific Secretary.  
Helps establish the United Nations Advisory Committee for Science and Technology.
- 1956 Salam develops the groundbreaking idea of neutrino parity violation, but, heeding critical commentary by colleagues he respects, postpones publication, thereby losing first claim rights.  
  
Joins Imperial College, London.
- 1957 Becomes Professor of Applied Mathematics at Imperial College.
- 1959 Becomes the youngest Fellow of the Royal Society of London, at the age of 33.

- 1960 Becomes Professor of Theoretical Physics at Imperial College where, together with Paul Matthews, he creates a world class research group. As delegate from Pakistan, proposes the creation of the International Centre for Theoretical Physics to the International Atomic Energy Agency (IAEA).
- 1961 Becomes Chief Scientific Adviser to the President of Pakistan. For the following decade, Salam exerts a strong influence on domestic scientific policy, being a leading figure in the Pakistan Atomic Energy Commission (PAEC), a member of the Scientific Commission of Pakistan and the founder of Pakistan's space research agency SUPARCO.
- 1964 After years of planning, discussion and negotiations, the International Center for Theoretical Physics is founded, with the collaboration of the IAEA, the Italian Government and the city of Trieste.
- 1968 Presents the theory which shows how the electromagnetic and weak forces may be considered manifestations of a single more fundamental force, the electroweak force.
- 1973 With Jogesh Pati, puts forward the idea of quark-lepton unification, which later develops into the widely investigated branch known as Grand Unified Theory (GUT).
- 1974 With Pati, Salam publishes his most cited paper, proposing leptons as the fourth quantum number.  
Proposes the formalism of superspace, with John Strathdee.
- Pakistani Parliament declares Ahmadis non-Muslims. In protest thereof, Abdus Salam resigns as Chief Scientific Adviser to the President, grows a beard and adopts the prename Muhammad, to assert his Muslim identity.
- 1979 Shares the Nobel Prize for Physics with Steven Weinberg and Sheldon Glashow, Harvard University (USA), "for their contribution to the

theory of the unified weak and electromagnetic interaction between elementary particles, including, inter alia, the prediction of the weak neutral current"

Salam uses the authority conferred him by the award, and the funds connected to it, to foster various projects for the advancement of basic science in developing countries, with the aim of filling the gap between the North and the South, reducing conflicts and promoting peace.

1983 Salam creates the Third World Academy of Sciences (TWAS) to recognize, support and promote excellence in scientific research and encourage the pursuit of the same in developing countries. Salam serves as the first President of the TWAS.

1984 Publishes the first edition of his collected essays "Ideals and Realities". It will subsequently be translated into ten different languages.

1988 Salam establishes the Third World Network of Scientific Organizations (TWNSO), to improve the status of science and technology in the South.

Conceives the setting-up of an International Centre for Science and High Technology (ICS), with the intention to extend the charter of ICTP from fundamental science to high technology and its industrial applications, for the benefit of developing countries.

1990-1994 Develops a project to set up a network on 20 international centres of excellence in various fields of applied science, technology and environment modelled on ICTP, to be located in the South.

Advised by the World Bank, Salam mobilizes political leadership in developing countries under "a commission of heads of state or government in the South" to support the project. The Commission (COMSATS) is formed and 19 leaders agree to join.

Invited by the Prime Minister of Pakistan to chair and organize its first meeting, he is unable to attend as too ill to travel. His project of 20

centres is endorsed and it is agreed to establish the Commission's secretariat in Islamabad.

- 1994 Retires as Director and becomes President of ICTP.
- 1996 Professor Abdus Salam dies in Oxford on 21 November 1996 after a painful and protracted illness. His body is flown to Pakistan, to be buried next to his parents, in the Ahadiyya graveyard at Rabwah. Despite the lack of official acknowledgement, thousands of mourners line the streets to greet this son of the soil.
- 1997 The ICTP is renamed "the Abdus Salam International Centre for Theoretical Physics" in honor of its visionary founder.
- 1998 The Government of Pakistan issues a commemorative stamp carrying Abdus Salam's portrait. An accompanying statement, declares him to be "one of the most outstanding scientists of Pakistan".





# ACKNOWLEDGEMENTS

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My deep gratitude to Ahmad Ali, Elizabeth and Robert Delbourgo, Michael Duff, Chris Hull, Peter Jenni, Ahmad Salam, Kelley Stelle, Monika and Qaiser Shafi, Spenta Wadia and Peter West for many wonderful and enlightening discussions. Abdus Salam is even more alive to me now that I have seen him through their eyes.

# PHOTOGRAPHS

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- Page 4. Abdus Salam, lecturing on the Grand Unified Theory at the University of Chicago's Oriental Institute. Wikipedia
- Page 7. Talk at ABDS90, Nanyang Technical University, Singapore. Author's personal collection
- Page 10. Abdus Salam at the ICTP. Courtesy Ahmad Salam.
- Page 14. Courtesy Ahmad Salam.
- Page 40. The International Centre for Theoretical Physics. Author's personal collection.
- Page 44. Newspaper announcing Abdus Salam's record breaking score in the Matriculation examination. 1940.
- Page 50. Commemorative Stamp issued by Pakistan Government.
- Page 51. Abdus Salam at the Blue Hall, Stockholm, delivering the speech at the Nobel Banquet. Courtesy Ahmad Salam.



## FURTHER READING

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[Ideals and Realities: Selected Essays of Abdus Salam](#), ed. Z. Hassan, C. H. Lai.

[Salam +50: Proceedings Of The Conference](#), ed. M. Duff

[Cosmic Anger: Abdus Salam, the First Muslim Nobel Scientist](#) by Gordon Fraser

[Abdus Salam](#), by Jagjit Singh

[The Inspiring Life of Abdus Salam](#) by Mujahid Kamran



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