

Introduction to Biomimicry
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Lecture - 08
Skills, Attitudes and Mindset for a Biomimic

You know, when you learn something, I know all of you have been tremendous up to now, right? How is it you know, it is not very easy to, first of all, it is not very easy to want to learn something new. After that, it is not very easy to continue to want that. And there are two things about a topic, right? There are two things.

One is what you learn, mathematics, physics, chemistry, commerce, law, or medicine. The other is the attitude for being a doctor. The attitude for being an engineer. If you are a civil engineer, you have to have the attitude of going under the raging sun, right? You cannot say, no it is too hot, I will not build that bridge. So, there are some attitudes, right? A doctor needs to have patience.

A doctor needs to have listening skills, a doctor needs to have certain attitudes, needs to do a lot of research, a doctor needs to take risks, right? Every profession, a chartered accountant, needs to be very thorough, and detailed right? Because I am giving my entire account to him. And if he makes a mistake, I am going to be in trouble. He does not want me to get in trouble.

For instance, my auditor is very thorough. I always ask myself. I would never have become an auditor, never, because you have to go through each and every payment, debit, credit, and all that. So, what are we learning? We are learning that in every profession, every time we do some work, there is a particular attitude that we bring to that work, right?

So, therefore, what we are learning is that all professions need an attitude, which is why sometimes we are misfits, or we do not like something, not because we do not like that work. But because we are not tuned to the attitude that work involves. For instance, I just still remember my first job was in the Taj Coromandel. I was a front office assistant.

And I just loved it, because my attitude to people is I love to meet people. But you put me behind a desk, and you have killed me. So, what I was thinking is that maybe it is an opportunity for me to share with you, what should be the attitudes for being a biomimic. So, we are going to have this every session for you. We are going to have skills and mindsets.

What are the skills, what are the mindsets, for every session so that there is a bonus section you know, all these movies have after the movie is over there is some more left, right? Everybody is waiting for that. So, therefore, yes, the learning basic learning is over. But we are saying no, we want to give you some more things to learn. It is actually not a learning but a sharing of views.

In all my lectures I do not start anything without talking about this particular book that I read. It is about this particular man whom I invoke before I do anything in my life. He is from India. He achieved greatness in his subject. He made the world notice mathematics. Unfortunately, he died very young. Born to very poor parents, struggled a lot with his academics.

But in spite of that, never lost his love for mathematics. Any guesses? I am sure most of you have guessed right. Most of you have guessed the name of this man. Should I call him man or should I call him a genius? Let us stick to genius. So, who am I talking about?

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The Man Who Knew Infinity



Srinivasa Ramanujan
(1887-1920)



I am talking about Ramanujan, talking about the greatest mathematician, India or the world has known, right? And I am going to talk to you about Ramanujan. And I am going to try and find out how Ramanujan can inspire us to become biomimics. What is it that we can learn from the life of Ramanujan that will make us big biomimics.

Not only biomimicry I am telling you, almost in every subject I have taught I have brought in the example of Ramanujan and people see the connection immediately. Okay, what is the story? First of all, let me acknowledge that the book that I have, lots of books I have is just one copy. It is called, The Man Who Knew Infinity by Robert Kanigel.

I have it with me in front of me, right? It is a book if ever you meet me and then I will probably give you a gift of this book. Because this is a brilliant book. I think every one of us must have it. Of course, it is fiction. Not fictional because it is a fictional biography, but Kanigel has done a brilliant job.

Okay, so what is, why, I am not going to tell you the story of Ramanujan because all of you know, that all of you know that Ramanujan was born to very poor parents. That he struggled through his academics. That he did not really do very well in school or college. By the way, he studied in Chennai at a college called Pachaiyappa's College. And I am not going to get into it, because they are all there.

You can always Google Ramanujan and find out. But what is it that I want to tell you?

I want to talk to you about this one.

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Letter from Srinivas Ramanujan to G.H. Hardy
January 16, 1913

Dear Sir,
I beg to introduce myself to you as a clerk in the Accounts Department of the Port Trust Office at Madras on a salary of only 20 per annum. I am now about 23 years of age. I have had no University education but I have undergone the ordinary school course. After leaving school I have been employing the spare time at my disposal to work in Mathematics. I have not read through the conventional regular course which is followed in a University course but I am striking out a new path for myself. I have made a special investigation of divergent series in general and the results I get are termed by the local mathematicians as "starting".

Just as in elementary mathematics you give a meaning to a^n when n is a negative and fractional by referring to the law which holds when n is a positive integer, similarly the whole of my investigations proceed on going a meaning to Euler's famous integral for all values of s . My friends, who have gone through the regular course of University education tell me that Eqn. (1) is true only when n is a positive. They say that this integral relation is not true when n is negative. Supposing this is true only for positive values of n and also supposing the definition Eqn. (2) to be universally true, I have given meanings to their integral and under the conditions I state the integral is true for all values of n negative and fractional. My some investigators are built upon this and I have been developing this to a remarkable extent so much so that the local mathematicians are not able to understand me in my higher flights.

Very recently I came across a tract published by you styled Orders of Infinity in page 36 of which I find a statement that no definite expression has been as yet found for the number of prime numbers less than any given number. I have found an expression which very nearly approximates to the real result, the error being negligible. I would request you to go through the enclosed papers.

Being poor, if you are convinced that there is anything of value I would like to have my theorems published. I have not given the actual investigations nor the expressions that I get but I have indicated the lines on which I proceed. Being unacquainted I would very highly value any advice you give me. Regarding it enclosed for the trouble I give you.

Yours truly,
S. Ramanujan

Excerpted from "The Man who knew infinity" by Robert Kanigel

NPTEL

What is this? This is a letter. Why am I talking about a letter, right? A letter is available for everyone to see. What was India at that time? Colonial, right? We were being ruled by the British. And why is this letter so important to me that I have to bring it to you? Because look at the contents of the letter. I am going to give you about two or three minutes to read that letter.

Let me just start the reading for you so that you continue, all right. So, dear sir, I beg to introduce myself to you as a clerk in the accounts department with the Port Trust Office at Madras on a salary of only 20 pounds per annum. 20 pounds per annum. I am now about 23 years of age. I have had no university education, but I have undergone an ordinary school course, right?

I am sure now you are reading it along with me. Now I read it, I come to, look at this one, right? Look at the second paragraph. Look at the second paragraph. Look at the confidence in the second paragraph, it is growing. He is talking about his work. Very recently, I came across a track published by you styled orders of infinity. Again, he is giving some more details.

And then he actually says that what he has found and he wants an opportunity to meet with or meet with Hardy. Now who is Hardy? A renowned British mathematician.

Who is Ramanujan? A young 21-, 22-year-old, not very popular, not very famous, very a clerk in the Madras Port Trust. And why I am showing you this letter is because for me this letter is about bravery, self-belief, and confidence.

A 22-year-old talking about his confidence in solving a problem, to writing a letter in British India, when there is no fax, no WhatsApp, no mail, writing a letter, and trusting and believing that what he is saying is right. And that is why I want to bring this letter to this topic of Ramanujan to you because when you start doing something, especially in biomimicry, the self-belief that what you are doing is right is very important.

Of course, you will, sometimes you will be right sometimes you will be wrong, you must believe that whatever I am doing, I am doing with a lot of passion. I am working very hard at it. And I have a lot of self-belief to say that this is this, this is the problem and this is the way I want the solution to be.

Many people come and give you advice saying no this and then you listen to their advice, you listen to their advice, but the most important thing when you are doing something very powerful when you are solving the world's problems is to completely believe in yourself convinced that what you are doing the solution that you are coming out with is right.

Or if it is going to have some sort of you know, if it has to have a correction you will but you will persist and you will be able to come back with a great solution. For me, that is the power of Ramanujan's letter. And of course, I would request you to please read that book. Because for instance there is one page, I wanted to read from so that you know.

Can you believe this, okay, 1913 Ramanujan writes to Hardy and on page 358, Hardy was asked about his greatest contribution to mathematics. So, there is this Paul Erdos who has recorded this. When Hardy was asked 'what is your greatest contribution to mathematics, you know what Hardy said?

Hardy said, the discovery of Ramanujan was Hardy's greatest contribution to mathematics. You know, I do not know how better to express the bravery and the self-belief of this man. So, for me, why I brought in Ramanujan's story now is to say that every one of you here is a, is master unto yourself, right?

You will have to believe that the work that you are doing is powerful enough, that the work that you are doing is important enough, that the work you are doing is right enough for you to continue in that work, whatever you do. So, therefore, yes, doubt is important, but not self-doubt. And self-doubt, therefore, is the problem with self-belief, right?

You must have a legitimate doubt. You must be able to clarify that doubt because it tells you that you are okay to correct yourself. So, the story of Ramanujan is to inspire us, is to inspire us to continue this journey and say that what we are learning now is the beginning of a new science and that with this science, we will be able to change the world.