

**Sociology of Science**  
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**Lecture – 11**  
**Matthew Effect in Science: R. K. Merton -Part III**

Dear friends, this is the part 3 of the lecture that I have began. I have begun on Matthew effect in science. So, this is a concluding lecture the third installment. In this lecture, I will discuss the Matthew effect in operation at the ins level of institutes at the institutional level at a macro level, then I will move on to the concept of precocity and late bloomers in relation to Matthew effect, then I will finally, talk about the symbolism of intellectual property as discussed by Robert Merton. Now, we have already discussed how Matthew effect can be dysfunctional for individual scientists the particular the newcomers and not so eminent ones.

We have already discussed further that though it is dysfunctional for individual scientist, but it can be functional for the very nature of science itself because it helps and the diffusion of scientific knowledge when I; when we pick up the writings of famous person in the process by reading them though those ideas get communicated to the wider scientific community and that is ultimate aim goal of science that is diffusion of spread of scientific knowledge and so, it is functional for science itself at a broader label.

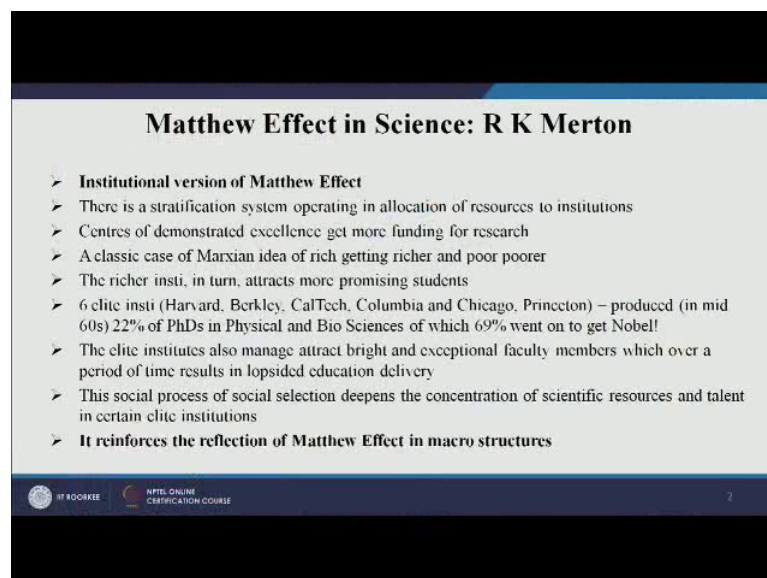
Then we discussed the social and psychological basis of Matthew effect what makes a reputed person reputed they have certain social character exceptional ego strength they have that training which they received an evocative stimulating environment in their younger days which they pass on to their immediate successors juniors in the labs the normative guidelines of how to go about research their ability to pick important problems all these things makes them unique separate from the lot.

Now finally, we said that though the uniqueness of the scientist make them more visible at the same time if we look at the fact that they do not become eminent overnight they became eminent over a period of time and they took time to establish themselves. Similarly it is a case with the younger scientists there we must give them time to an to mature because we if you do not, then they will get ignored and many of the new things

that they may come up with will miss out on them. Now, we come to the, another dimension of Matthew effect that Matthew effect can also operate at institutional level. Now there is a stratification system within the scientific community the not so, well known ones are at the bottom well known ones the reputed ones at the top.

So, this is a class structure those were at the top get more facilities though are those who are at the bottom get relatively less facilities. Similarly Matthew effect can also be operational at the institutional level.

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**Matthew Effect in Science: R K Merton**

- **Institutional version of Matthew Effect**
- There is a stratification system operating in allocation of resources to institutions
- Centres of demonstrated excellence get more funding for research
- A classic case of Marxian idea of rich getting richer and poor poorer
- The richer insti, in turn, attracts more promising students
- 6 elite insti (Harvard, Berkley, CalTech, Columbia and Chicago, Princeton) – produced (in mid 60s) 22% of PhDs in Physical and Bio Sciences of which 69% went on to get Nobel!
- The elite institutes also manage attract bright and exceptional faculty members which over a period of time results in lopsided education delivery
- This social process of social selection deepens the concentration of scientific resources and talent in certain elite institutions
- **It reinforces the reflection of Matthew Effect in macro structures**

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The centers of demonstrated excellence top universities elite institutions are the equivalent of well known scientists and relatively unknown obscure universities research centers are the junior scientist who are at the bottom level in the class structure, but it is at the institutional level the centers of demonstrated excellence the top universities for instance in America.

You think of Harvard you think of Columbia you think of MIT you think of Chicago, these institutes get more funding from the industry these institutes attract the brightest faculty members from all over the world these institutes receive the finest of talents who enroll themselves in these institutes as students know that is about us it can be UK. It can

be Cambridge University, it can be Oxford University or it can be in India. It can be in the engineering and technical education, it can be the IITs for social science, it can be Delhi University, it can be Jawaharlal Nehru University, it can be institute of economic growth, it can mean Delhi school of economics for social science.

These are the top elite institutes they get the finest of faculty the best of students they find it easier to attract more funding hence it further reinforces their excellence it further in. So, reinforces their strength they go from strength to strength.

They become better the contributions by those scientists, academicians, working in these institutes a far superior then those who were working in mediocre institutes for instance, in India we have Bundelkhand university we have merit university we have Kuvempu University, there is so many universities who are not in that top bracket, but they may also have bright faculty members they may have bright students who have potential, but that potential does not get tapped because all the attention is focused on those top elite universities or institutes they walk away with all the credit they walk away with all the advantages.

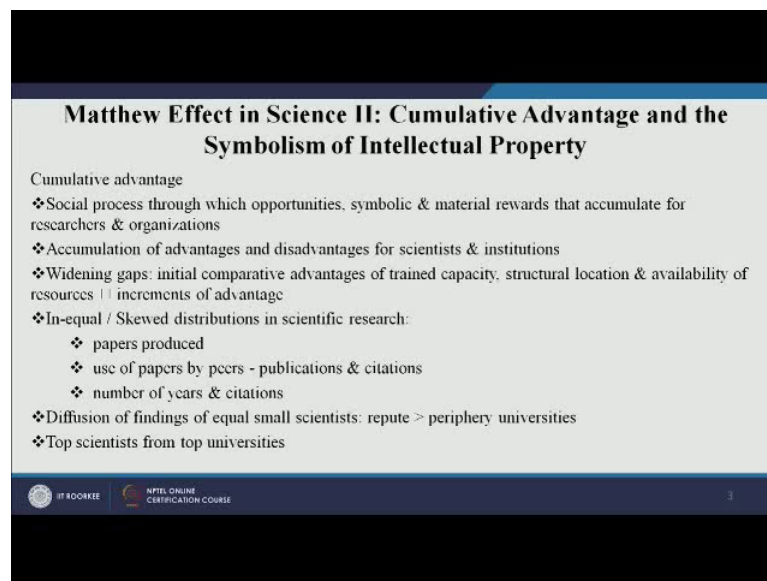
So, this is the operation of working of Matthew effect at an institutional level it is a classic case of ma of Marxian idea of rich getting richer poor becoming poorer like one example that is given by a Matt Robert Martin from US is that he says 6 elite institutes of US Harvard, Berkeley, California, institute of technology, Columbia and Chicago and Princeton; all the six institutes produced in mid 60s; in mid 1960s, 22 percent of PhDs in physical and biosciences of which they just produced 22 percent of PhDs, but of this 22 percent, 69 percent went on to get Nobel Prize.

So, this shows the extra advantages that this top universities get which results in top prizes going to people who belong to these institutes to go into scientist to faculty members who are working in this top institutes. So, they always attract bright and exceptional faculty members which over a period of time results in lopsided education delivery if you have the best in one place and mediocre in another place definitely the education delivery the quality of education delivery would be much superior.

In those institutes because there is a concentration of scientific resources and talent in

those elite institutes and people take advantage of that the faculty members, the scientists, the students who work there, they take very good advantage of that and the able they are able to realize their potential and they make it big. So, it anyway reinforces the reflection of Matthew effect in the macro structure now this is a first part of my discussion in this concluding lecture were lied where I discussed the Matthew effect in operation at a macro level at the institution level of institutes.

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**Matthew Effect in Science II: Cumulative Advantage and the Symbolism of Intellectual Property**

Cumulative advantage

- ❖ Social process through which opportunities, symbolic & material rewards that accumulate for researchers & organizations
- ❖ Accumulation of advantages and disadvantages for scientists & institutions
- ❖ Widening gaps: initial comparative advantages of trained capacity, structural location & availability of resources | | increments of advantage
- ❖ In-equal / Skewed distributions in scientific research:
  - ❖ papers produced
  - ❖ use of papers by peers - publications & citations
  - ❖ number of years & citations
- ❖ Diffusion of findings of equal small scientists: repute > periphery universities
- ❖ Top scientists from top universities

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Now I come to second aspect that is the cumulative advantage and disadvantage of scientific resources at disposal to scientists. Now this part of Matthew effect is taken from the second article that he wrote in 1998 the first article, he wrote in 1968 on Matthew effect that is where he introduced this topic second article on Matthew where he wrote exactly 20 years after words in 1988 and he further reviews what has happened in those 20 years the original thesis that he proposed does it still stand true or is there a change is there some addition he finds that it still holds true and there is further evidence given by other scientists of Matthew effect in operation in the scientific community and that is and all the scientists all the scholars who have worked in the field of sociology of science.

They have come to the conclusion that there is a widening gap in the initial comparative advantages of trained capacity their structural location and the availability of resources between those who have who are located in good places those who have initial ability

those who showed signs of talent in the only part of the career they get more advantages they get cumulative advantage additional advantage and that widens the gap between those who have already made a mark and those who are yet to make a mark in this regard a couple of examples.

He quotes; he says that the two scientists one of the most popular geneticists another was bio geneticist these two scientists collaborated on a joint project which culminated in publication of their result and this result was published in the same journal in the same issue back to back in both of them where their joint authors and both the papers in the same issue of the journal the co authors in the first paper the senior scientist well known scientists Leontyne was the main author and the second paper JL Hobby, the junior scientist was the main author, but if one looked at those papers one would one would one could tell that in terms of conceptualization in terms of execution in terms of writing in terms of contribution to method both had made similar contributions their contributions were not divisible.

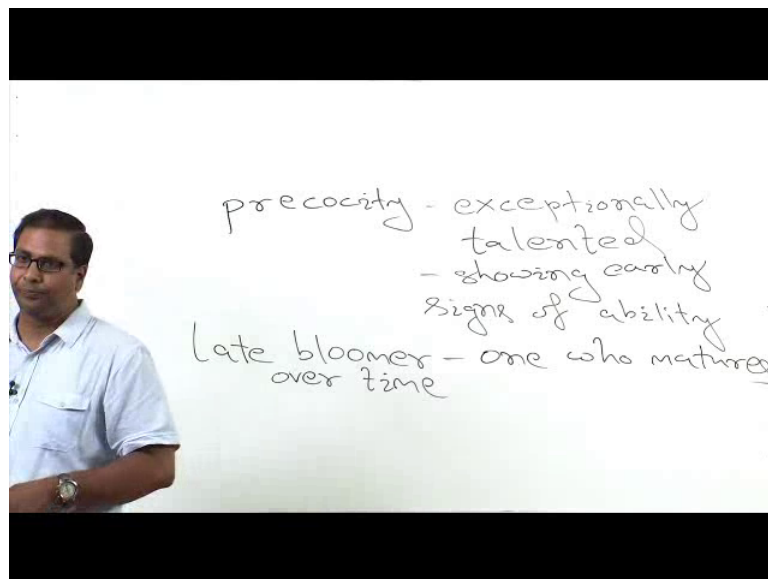
So, the point is both the papers were written by two scientists where both of them made similar contribution, but in the first paper the senior scientist is the main author first author in a second the junior scientist is the main author, but when it came to citation it was found that the one which had senior scientist as the first author got more citation than the second one, but the junior scientist the main author every time the junior scientist article written by the junior scientist as the main author got cited.

It always invariably included the other article where the senior scientist is the main author, but it was the reverse was not true does it the article where the senior scientist is the main author was cited, but need not necessarily include the citation of the other one it proves Matthew effect in operation another example that he gave is that he quoted JBS Haldane famous biologist by a scientist. Now JBS Haldane said that when he worked at ISI Calcutta, he worked with an exceptional talented Indian scientist, S K Roy and because of his tremendous research.

Jbs Haldane could produce and come up with a very significant finding regarding rice research and rice, but when it came to the time of publication he could not keep him as a first author, but he knew that if he puts SK Roy as a first author people will not give him

any credit because he was not at all a PhD, he was not a first class masters also people would anyway give credit to JBS Haldane though JBS Haldane himself acknowledged that the entire work was the brainchild of SK Roy, but in this scientific community because of Matthew effect operation and the working and the psychology of Matthew effect the person who has done more work because a person is unknown would not get any credit. Now Matthew effect is also related to the concept of precocity.

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And late bloomers there is Robert Martin says there is a institutional bias for precocity. So, we have these 2 words precocity and late bloomers those who are precautious those who are pre cautiously talented or those who are exceptionally talented from a very early age of their life they show initial ability early genius, they are exceptionally bright for their age are precausive precautious people.

Now say if you look at the society at a broader level and then will come to the scientific community he says in the society precautious child precautious students they always walk away with all the scholarships fellowships residences in kind of in case of medical sciences top prizes because of their initial superlative ability capabilities they may or may not sustain their brilliance over a period of time they may slow down over a period of time contrast them with the late bloomers late bloomers take time to mature nature gives us with tremendous ability to pick up over a period of time different individuals have

different ability different potentials some people pick up early some people pick up late.

So, the late bloomers may pick up things late may succeed late than the precocious people, but they may continue to shine throughout their life they make they may make late contribution, but their contribution may continue for a longer period of time compared to the precocious people now what happens in a society in a wider society those who are precocious talent they get all the advantages and let us look at the class structure there is a person who belongs to a or belongs to a upper class.

There is a person who belongs to lower class the lower state of society the person who is precocious will not have any problem getting scholarship fellowship getting admission in top universities top institutions in medicine, in law, in engineering compare them with the late bloomers from a upper class; the person may not show early sign of ability, but the person may get backed up by his or her family background by parental support by economic support from the family the person who is a late bloomer.

But belongs to a upper class family can always make a strong comeback at a latter point of his or her career the parents may put him or her in a private engineering college in a private law school or in a private medical school the person may pick up things and can do fabulously well afterwards contrast this person with a led bloomer from a lower class from a un from a not.

So, privileged strata of society the person may drop out early because a person is not showing only signs of ability the person may struggle if you struggle and if you happen to have come from a lower class from a poor family then there are chances that you drop out altogether you drop school you drop college you change your stream you do not get a second chance even if you have the ability to make a comeback to bloom latter.

Now this is a basic concept which is found in wider society bring that idea into academics to the scientific community the certain people who are late bloomers within the scientific community the certain departments where faculty members are late bloomers for instance Robert Martin says people from social sciences and humanities are invariably late bloomers they always take time to mature, but once they mature they may keep making meaningful contribution in their field compared to the biological sciences or mathematics

or physical sciences or chemistry, but those late bloomers always find it difficult to cope up with absence of resources available at their end absence of resources.

We discussed about funding or lack of funding we discussed about getting a chance to get published in international journals reputed journals we talked about your book getting published by a top publisher you getting a chance to buy a scientific equipment for your for your laboratory for instance psychology lab in humanities and social sciences. So, late bloomers always struggle whether in the wider society on the academics because they find it difficult to get that second chance.

Even if they have ability they can keep pick up, they can always make a strong comeback and they can sustain their effort over a longer period of time compared to the precautions people. Now I come to the another aspect if Matthew fact is an operation at an institutional level at the institution level then how is that this is counteracted how is that it is neutralized Robert Martin says you see if we simply look at the growth of science and if we extrapolate in the 20th century, if you look at the growth of science and if we extrapolate the figures from 1930s and 50s to 80s-90s and well into 21st century simply based on statistical extrapolation.

Now every human being on earth would have become scientist even there cats and dogs would have become scientist by now.

If you simply go by statistical extrapolation looking at the growth of science in the early part of 20th century, but that has not happened. Similarly if Matthew; Matthew effect is in operation at the individual level as well as at the level of institutions then all these big universities all over the world would have produced all the best academicians all the best faculty members all the best scientists.

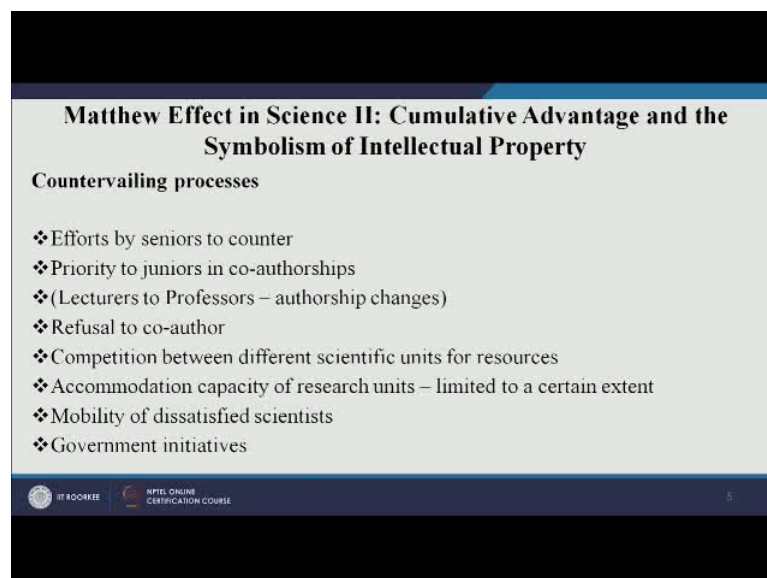
But does not happen; what are the countervailing processes what are the processes that neutralize; this thing there are 3 or 4 Robert Martin has identified first in many cases established scientists they refuse to put their name into the joint collaboration into the papers books articles that is one way another way in which it is neutralized is that many young capable scientists faculty members do not join a department or an institute where a plenty of famous ones they know that if they go there.



They will not be able to succeed; they will always be overshadowed, they will not get a chance to make a mark on their own conversely already known reputed scientist would not like to have junior scientists who are extremely capable or more capable of than themselves they may not like them to be part of the same department same institutes issue can be social or psychological, but whatever the issue may be, but it neutralizes. So, the faculty member moves to other universities other institutes.

So, there is a gradual spreading of talent across the institutes within a country.

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**Matthew Effect in Science II: Cumulative Advantage and the Symbolism of Intellectual Property**

**Countervailing processes**

- ❖ Efforts by seniors to counter
- ❖ Priority to juniors in co-authorships
- ❖ (Lecturers to Professors – authorship changes)
- ❖ Refusal to co-author
- ❖ Competition between different scientific units for resources
- ❖ Accommodation capacity of research units – limited to a certain extent
- ❖ Mobility of dissatisfied scientists
- ❖ Government initiatives

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Then there is this when an institute gets some funding it is equally divided among all the departments. So, certain departments who are lagging behind other departments they also get a boost financial boost it also works at a macro level where government provides equal amount to different universities as funding industry provides equal amount to different universities for their growth for their development. So, such because of such government initiative the departments or the institutes which are mediocre they also get a chance to come up. So, these are the ways in which this process is counteracted.

Now I come to the final part on this discussion that is a symbolic symbolism of intellectual property now a part of it was discussed when we were discussing communism as a one of

the of science where Robert Martin says that science is social it is collaborative it is shared enterprise where a scientist takes or draws material from his or her predecessor works on it and presents it to the future scientist to take from it in this context Robert Martin makes a very important statement very significant statement that in science once private property is established by giving its substance away only.

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**Matthew Effect in Science II: Cumulative Advantage and the Symbolism of Intellectual Property**

Symbolism of Intellectual property in Science

- ❖ In science, one's private property is established by giving its substance away
- ❖ Only after communicating/ publishing work – scientists can legitimately own it/ secure it as their contribution
- ❖ Positive recognition by peers – basic form of reward – all other (monetary or career advance or material scientific capital) derive from it
- ❖ References & citations - not nuisance but incentive to scientists
- ❖ Normative guidelines of reciprocity ( or else amounts to Plagiarism)
- ❖ Serves two functions
  1. Instrumental: Directs the readers to the original source - leads to further source of knowledge
  2. Symbolic: Peer recognition, registers the intellectual property of the author, maintains intellectual tradition

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When you give you a substance away only when you communicate your scientific findings then your ownership of that finding ownership of that article is truly established there is a very interesting statement to make this basically talks about the symbolism of intellectual property, it talks about the fact that the positive recognition by peers is a basic form of reward all other rewards such as monetary or carrier advanced or material scientific benefits are derived from it.

In fact, through the communication system by giving your substance away that is communicating your work to the greater scientific community to the wider scientific community you establish your ownership of that house how does that happen it happens through references and citations references and citations or bibliography are not missions are not just ornamental things.

In a book or an article they are not footnotes does not serve a ornamental function superficial function it serves a very important function it. In fact, serves two very important functions the references the bibliography that you find in books or in articles in academic works, it serves two important functions one is instrumental and the other one is symbolic an instrumental function he says when you have reference or bibliography the instrumental function says that it directs the reader to the original source it leads to further source of knowledge when you look at a reference or bibliography we look at that this is this work has been cited.

We get to know about the work that has been cited the publisher the author the year of publication then we can always locate that book and we can read that we can further validate our knowledge we look at a reference in that book and from there on we can go on finding more books more knowledge claims more authors, I will get to know more about them. So, it serves an instrumental function where it directs the readers to the original source from the original source.

We can go to further original source it leads to for the source of knowledge then we have a symbolic function that is pure recognition when I cite something I give acknowledgment to that person I acknowledge the authorship of that person and that is a normative reciprocity it is reciprocal if I write something, I communicate the person who cites it puts it in his or her article or book acknowledges my contribution by putting it in citation otherwise it constitutes plagiarism intellectual academic larceny.

So, through the such acknowledgement of the person who has written the book by putting it in our citation or bibliography we basically give we acknowledge and we recognize rise recognize write recognize the persons contribution the recognition is automatically given through citation on bibliography that is symbolic function that establishes the norm of reciprocity give and take.

So, hence when Morton says that assigned in science once private property is established by giving its substance away this what he means only when it is communicated and the communicated finding is cited the person who cites it quotes it acknowledges the original author and that is how through that recognition the norm of reciprocity in the scientific community is established it maintains a scientific tradition it leads to further scientific

knowledge diffusion this brings us to an end of discussion of Matthew effect in science in the next class I will take up a new topic that is the structure of scientific revolution, I will move on to the history of science in the next lecture.

Thank you.