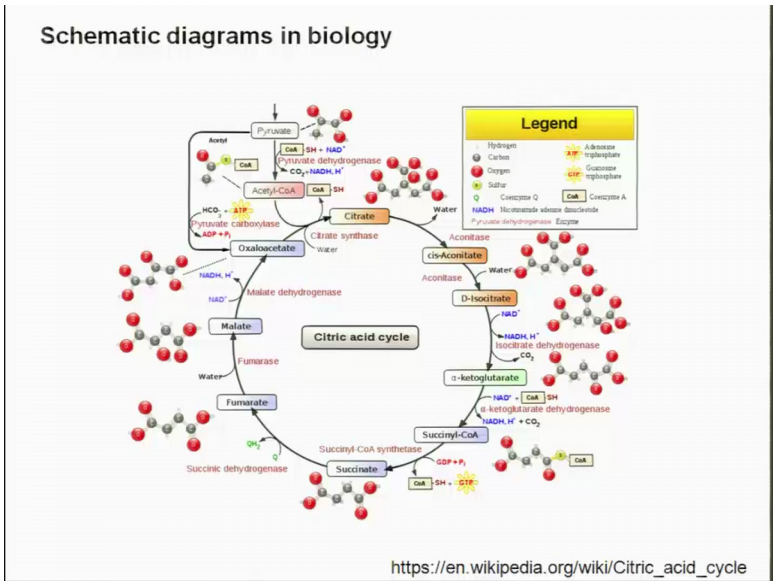
Introduction to Professional Scientific Communication
Prof. S. Ganesh
Department of Biological Sciences & Bioengineering
Indian Institute of Technology, Kanpur

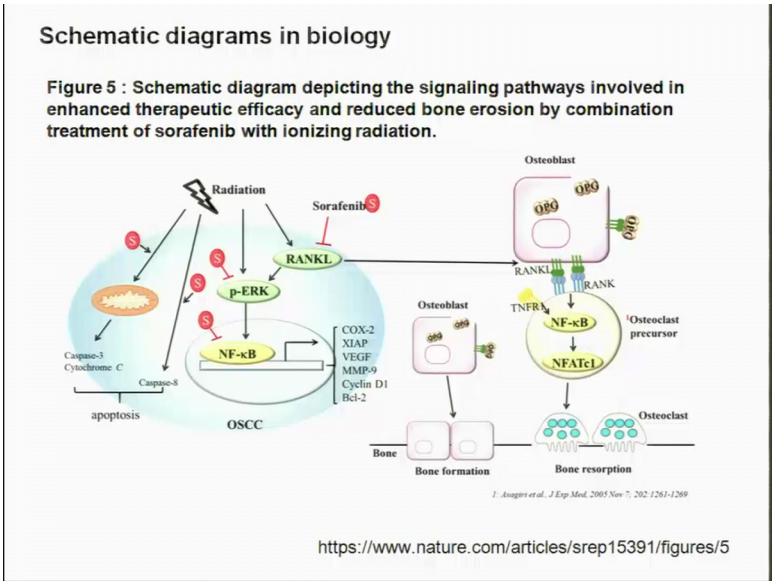
Lecture - 16
How to Prepare Schematics

(Refer Slide Time: 00:21)



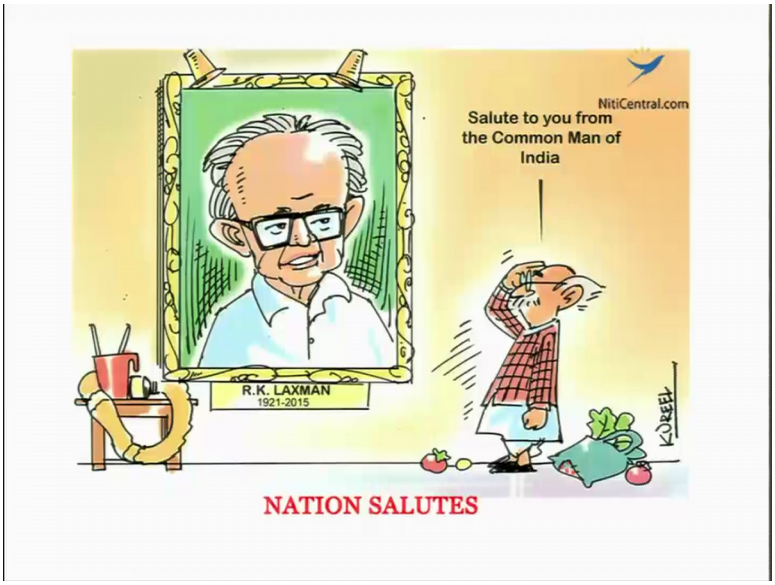
Welcome back to this week for lecture, and the course Introduction to Professional Scientific Communication. Now, we are going to come and discuss about the schematics. Again the schematics something that we have discussed in the results section that even when you are doing an experiment to explain how you have done the experiments there are schematics and you have to draw them. So, how do you really draw? Like this is one of the common schematic all who have done some bit of chemistry, biochemistry either in your B.Sc or class twelve would have known this. This is citric acid cycle this is one of the metabolic pathways in your cell, and which clearly tells you that how for example, the succinate is converted to fumarate and so on so forth you know it is a kind of a flowchart that is given. It is a complicated diagram, but easy for you to understand you know otherwise if you have to write everything in a word in the textual form in a it will take about you know three or four pages, no one will make out any meaning out of it, it is extremely difficult to explain.

(Refer Slide Time: 01:24)



So, often the schematics helps us to understand things in much better way and that is shown in so many you know different ways if you have studied research papers or textbooks if you look into there are you know such kind of schematic shown which explains a pathway. For example, a given signaling pathway or you know how for example, what is shown here is a radiation can affect different signaling mechanism in the cell and how whole thing is changed and so on. So, these are all always present and we will use it you know to explain.

(Refer Slide Time: 01:53)



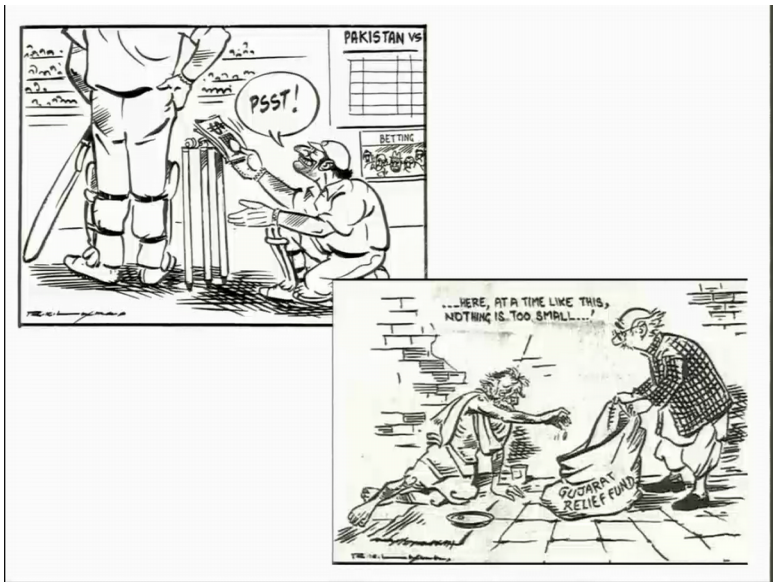
The reason being that schematic helps us to convey things in much better way and that is you know you can easily understand if you open a newspaper I do not know how many of you have the habit of reading newspaper. If you have read newspaper you know 10 years back or 5 years back there used to be a famous person called R. K Laxman, he used to draw these cartoons in the times of India newspaper, even now very similar kind of cartoons you know continue in many newspapers.

And used to make one caricature called as common man as a common man is somebody who retired who is struggling for the survival, who finds it very difficult day-to-day life what is shown on the right side in a person with bald head and gray hair and mustache with the specs. And this guy you know pretty much is part of every cartoon that he made you know you can identify yourself with the common man. And he is normally these are about the political message that it is done. And this particular cartoon is just to honor that person when he passed away you know in 2015 he passed away and it says the nation salutes R. K. Laxman.

(Refer Slide Time: 03:07)

These are some of these his caricature. This is the common man. And his one on the right side is R. K. Laxman with the common man with himself drew, so that is what the common man is.

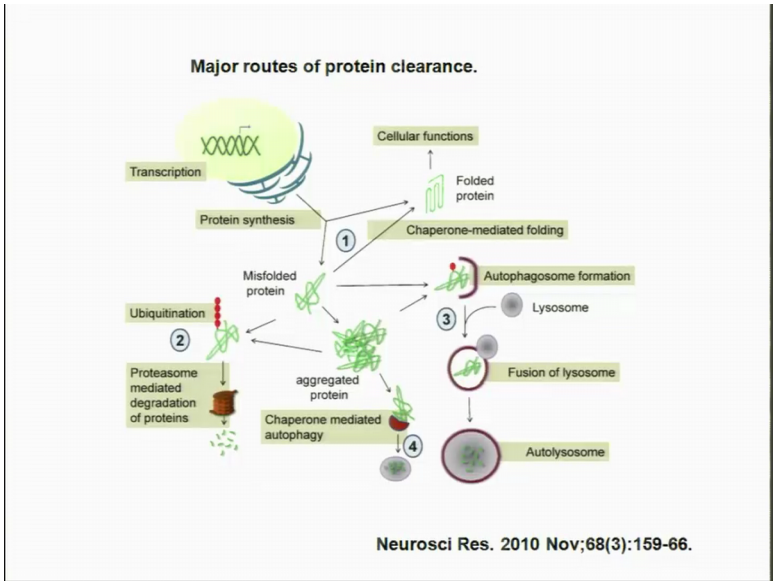
(Refer Slide Time: 03:17)



So, there are a number of cartoons that really explain what happens in the country. The one on the top came when there was a match fixing allegations going on in the cricket. It really says that the wicket keeper now telling the batsman take money and get out right things like that you know this is not a sporting way, but that explain as to how rampant the match fixing was. Or, for example, sometimes it can be not very sarcastic, but appreciates how people contributed to some national building.

For example, what you is shown here is that when there was a Gujarat earthquake right and there even a beggar could contribute he says here at a time like this nothing is too small even he gives 1 rupee, 2 rupee whatever little he had, and this common man is collecting. What it means is that you guys whoever reads this right, looks at this cartoon please contribute; even if it is two rupee does not matter contribute to the relief fund it is a you know huge impact it had on the nation. So, the cartoons convey everything you know.

(Refer Slide Time: 04:25)



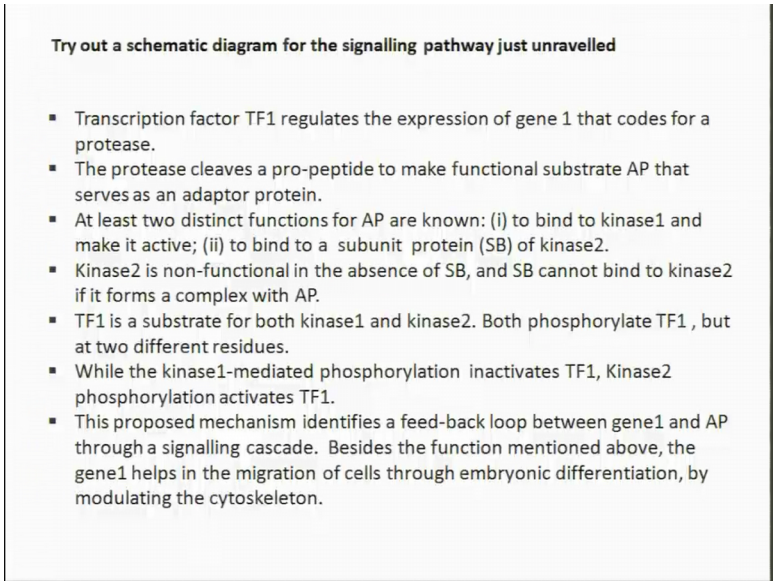
So, for example, many of the journals you know how this kind of you know schematic what you call in research you know articles is pathways, it was you know. Again it conveys important message which talks about some of the in a cascade that happens some other important event that happens in this cell or how the organisms grow, how the tissue differentiates, there are many complex information that are conveyed using the schematics.

So, what is shown here again this is from one of the research article is that how protein that is not folded properly is removed from the cell right. It talks about the various pathways through which the protein can be degraded. There is a proteasome, whether it is lysosome and so on, so that is some of the ways by which you can explain. We have looked at how the schematic serves us to explain some of the concepts in your research paper much better than writing them out. We spoke about pathways; we spoke about some other complex events that happens in the cell which can be beautifully you know explained using schematic. This very similar way R. K. Laxman used his cartoon to explain some of the political events.

So, we are going to use one hypothetical signaling pathway, this is not something existing, but just you know something that I will made up just to explain how to make schematic. And I am going to narrate that hypothetical pathway, signaling pathway and then we will see how that can be converted what I have written in the text, how that can

be converted into a schematic which explains everything that we otherwise you know find it very difficult to explain using words. And that will help you to understand how do you make schematics.

(Refer Slide Time: 06:09)



So, let us see what is written here. So, this is let us read out. And you will find it difficult to comprehend everything and connect everything and that is extremely important for you to realize that despite reading many times it is difficult to connect each point with other because although it is given here as a bullets, each one is connected to the other one or the other way. But that cannot be conveyed in the textual form that is why we need connect schematic.

So, let me read out. The transcription factor TF 1 regulate the expression of the gene 1 that is the name gene 1 and this particular gene codes for a protease, so a protein that whose function is to cleave other protein substrates. The protease cleaves the pro-peptide to make functional substrates. So, the pro-peptide is cleared by the protease, therefore it you know the cleaved form is active which is called as AP that serves as an adaptor protein meaning it goes and binds to some other protein and makes it active or inactive depending on the context.

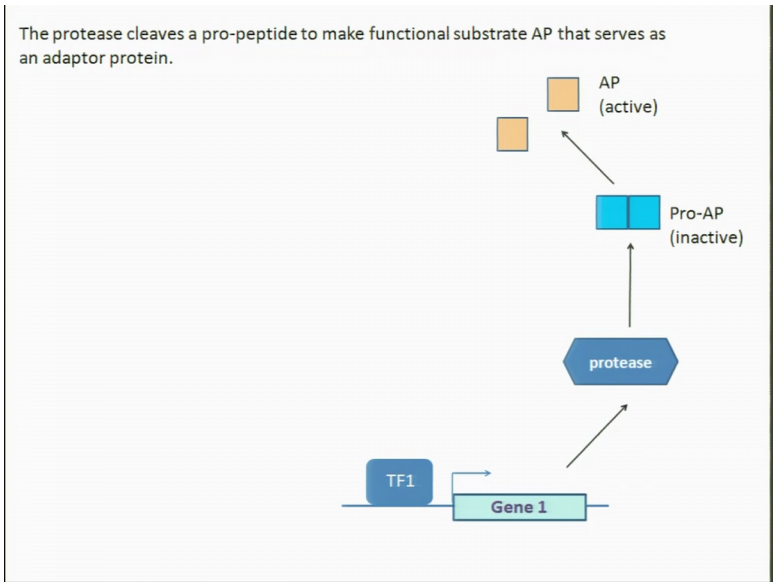
At least two distinct functions for the AP are known the adaptor protein which is a product after cleaving by the protease you know processed product, one to bind to kinase 1 an enzyme which adds a phosphate group to substrate that is what kinase and make it

active. So, it binds to the kinase 1 it makes it active. This another function is to bind to a subunit protein called SB of kinase 2; the another kinase which also adds is phosphate group to some other protein and that kinase 2 requires a subunit and this AP now goes and binds to that subunit. Now, already it is difficult for you to connect everything and that is exactly the story, but that is exactly the message. Kinase 2 is a nonfunctional in the absence of SB. So, it requires SB to be active and SB cannot bind to Kinase in it if it forms a complex with the AP. Now, you can see that how it becoming more complicated.

So, the TF 1, the transcription factor is a substrate for both kinase 1 and kinase 2. Now, you have to connect this particular bullet with the first bullet right, both phosphorylates TF 1, but are two different residues while kinase 1 mediated phosphorylation in activates TF 1 kinase to phosphorylation activates to F 1. So, it is a very different kind of a regulation. This proposed mechanism identifies a feedback loop between gene one and AP through a signaling cascade, besides the function mentioned above gene one helps in migration of cells through embryonic differentiation by modulating the cytoskeleton.

Now, this is what narrated each one would have understood some points, some points very difficult to connect, because is everything written in a textual way you know you cannot connect all them together. Now, that is what we are going to convert the entire thing that is mentioned here into a schematic. Let us do one after the other right. What is shown on the top always invariable in every slide is that particular bullet right, we are going to add to the schematic that we are drawing. The first sentence is transcription factor TF 1 regulates the expression of a gene one that codes for a protease. Now, you have three different elements in this sentence, one is transcriptional factor, second is a gene the third one is a protease. Now, all three have to be you know shown in a schematic. So, how do you do that?

(Refer Slide Time: 09:39)

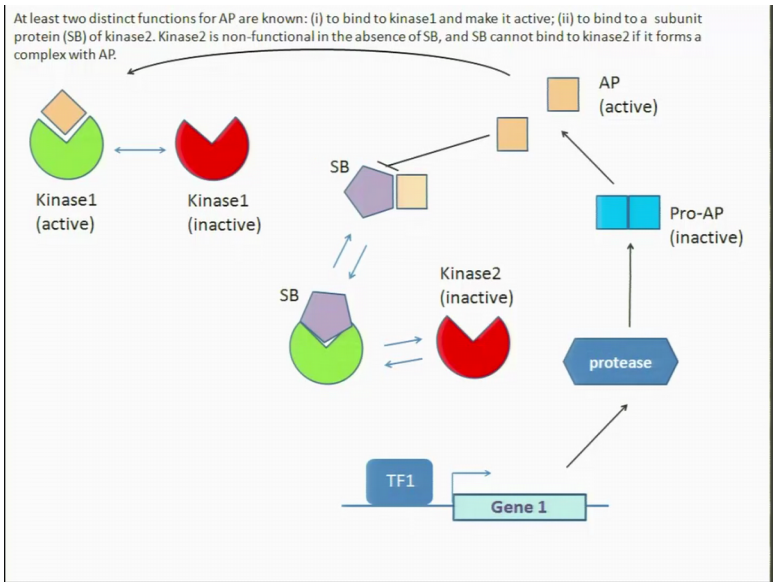


So, this is how we can show. So, you draw a gene by drawing a line and a box and then put as a gene one that says this segment of the DNA, which is represented by the line is a gene. And you put an arrow on the top because the direction of the transcription. Therefore, you would expect the transcription factor to bind upstream of it that is what is shown here TF 1 binds and then the gene is possibly on it may transcribe; and then that makes the protein called protease which you have identified by an arrow all right. So, now, the arrow as part of the gene color is very different from the arrow that identifies the protease as a product of the gene. So, even the colors are very very important. And you have use a different shapes to identify the transcription factor is different from protease that is the protease.

Now, second bullet let us see the protease cleaves your pro-peptide to make functional substrate AP there serves an adapter protein. So, the proteases and substrate and the substrate is cleaved. Now, after cleaving the pro peptide now becomes a functional peptide with the name AP all right. So, how do you show that this is what is. So, you show a double box with a different color, you call as a pro-AP which is inactive. The protease you are linking it with narrow saying that protease identifies that to be something that acts upon the protein that is cleaved now you have AP which is active. It is a pro-peptide now that is active.

Now, you are talking about the function of the AP which is the active AP component and we are going to talk about the two distinct function at least two distinct functions for AP are known one to bind to kinase 1 and make it active. So, it binds to kinase 1 and makes it active. Second one to bind to a subunit protein SB of kinase 2, and kinase 2 is a nonfunctional in the absence of SB, and the SB cannot bind the kinase 2 if it forms a complex with AP, it is a complex you know statement, we are to show them beautifully.

(Refer Slide Time: 11:41)

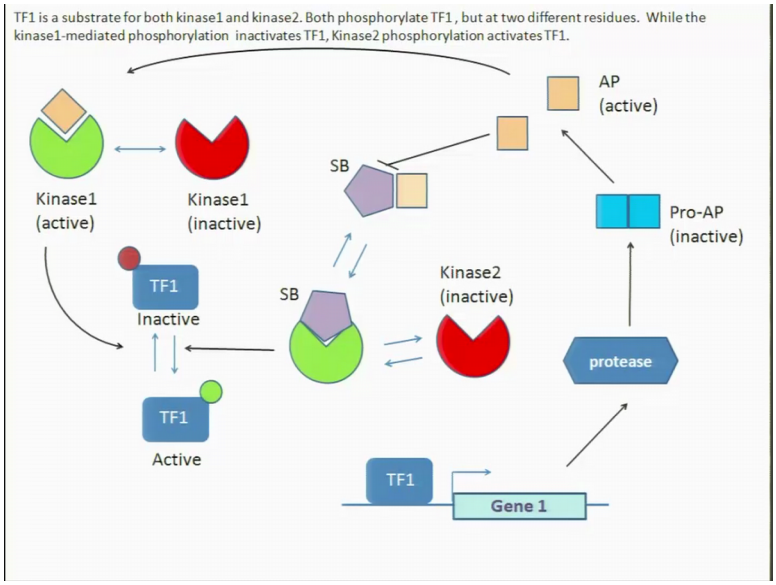


Let us look at the first part much easier that the AP binds to kinase 1 make it active. So, what is shown here is that you know the kinase 1 is shown, the AP goes and binds and you show it something like you know socket that goes and bind that means, that it is a you know the interaction is very very specific. And then you bring in some color code for example, AP with kinase 1 is active you show it as a green. The kinase 1 without AP is inactive, now we shown is in a red form. And you connect these two with a double line with double arrow, arrow head saying that this is dynamic, it can be inactive or active depending on whether the AP binds to it right.

Now, let us look into how to connect the second function that is to bind to a subunit protein SB of kinase 2. And kinase 2 is nonfunctional, in the absence of SB, SB cannot bind to kinase to you the forms complexity AP, this is what we are showing here. Now, AP binds to SB right and then even it binds right, it is inhibitory. In the sense, you can see there is a line at the end of the line there is another small line which indicates it

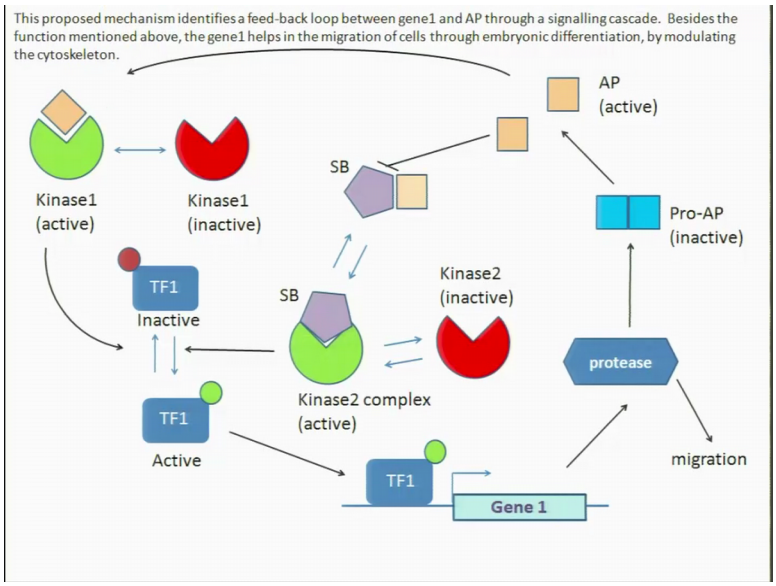
inhibits that particular function, the function is SB binding to kinase 2, so that SB cannot bind if it is in complex with AP right. Now, if you remove SB, then the kinase 2 is inactive; if the kinase 2 is bound to SB, then it is active. In other words, the AP if it binds to SB, it can make the kinase 2 inactive in one it makes active kinase 1; in another it makes inactive right that is what we are able to convey.

(Refer Slide Time: 13:29)



Now, the TF 1 that we are talking about transcription factor is a substrate for both kinases, and both phosphor it TF 1, but at least in two different you know residuals therefore, the outcome could be different while the kinase 1 mediated phosphorylation inactivates TF 1 kinase 2 phosphorylation activates TF1. So, how do you show this? We can show here like this. So, you have TF 1 you have already drawn TF 1 on the DNA. So, you show it as you know small circles on the top of the TF 1, you know the rectangle one in two different residues different place and you are showed it with colored because that shows also whether it becomes active or inactive. So, if kinase 1 phosphorylates you know the active one becomes inactive likewise if kinase 2 phosphorylates the inactive becomes active and so on.

(Refer Slide Time: 14:24)



So, now you can go and say finally, that this proposed mechanism identifies a feedback loop between gene 1 and AP through a signaling cascade. So, you can see here that how a gene one which is shown here and AP which is a product resulting from the action of the protease called by gene one as a feedback loop which regulates the gene one expression itself you know, so that is pretty obvious from this diagram that is shown. And then, you say that what is the net result? Why should you have this feedback? It says that you know gene one helps in the migration of cells through embryonic differentiation because the protease may have other substrate and that substrate may have some other function, and one of the function is the embryonic differentiation by modulating the cytoskeleton. Now, you know the embryonic differentiation is regulated. And this is a signaling mechanism which regulates that particular process.

Now, whole thing what you are narrated we are able to put together in a you know in a schematic which explains beautifully as to how we are able to convey you know this you know you remove everything. There is no legend nothing you just put a title saying that this explains you know a schematic pathway to explain the proposed mechanism by which gene one regulates the embryonic process which is regulated by say the pro-peptide or AP you know a signaling mechanism right.

So, you can say this and this explains you know otherwise you would have taken two pages to write this, but everything can be beautifully explained using this kind of

diagram, so that is one of the ways by which you can you know explain. So, you may want to practice such a kind of a thing is read about some mechanism that is narrated in the text, do not look at the pathway, you try to draw it yourself and see now go back to the journal and see how people have drawn it and how we can improve. So, it is really, really explains you. It is not only in your writing research paper, but if you are a master student or whatever if you are writing even exams you want to explain something you may not how much time to explain everything, you can draw a schematic in your answer book that would convey to the teacher or instructor that you are able to explain what happens without really jotting down everything by word by word, so that is a way to convey the thing it is helpful. So, you should be able to practice more and improve your skill set.