Introduction to Professional Scientific Communication
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Lecture – 14
Writing Results Section (Contd.)

So welcome back to this lecture week 4 lecture on introduction to professional scientific communication, this week we have been discussing about how to write the results section. So, in the previous section we have seen how do you write the results section.

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Tips on effective use of tables and figures in research papers

- First, check out what your target journal has to say on the issue. Some journals limit the number of tables and figures and also have specific guidelines on the design aspects of these display items.
- Next, decide whether to use tables and figures or text to put across key information.
- After you have decided to use a display item, choose the display item that best fits your purpose based on what you wish readers to focus on and what you want to present.

https://www.editage.com/insights/tips-on-effective-use-of-tables-and-figures-in-research-papers

So, now we are going to discuss something about the non textual elements, how do you make tables, how do you make figures that are very effective, which can convey your observation the best way to present your data.

So, let us look into some of these issues. So, these are the tips on effective use of you know tables and figures in research papers that are sort of listed in this slide here, and these are all you know from a particular website I reason I have used these website is, that this website also gives you more you know a detailed discussion on each one of the bullet that I have put in. So, therefore, it would help you because you can go read this particular you know link the entire description therefore, you can better understand.

So, the first thing is first check out what your target journal has to say on this issue its very important you know when you write the research paper before you put together on your results you should know which journal I am writing, whether the journal what is the guidelines as to the limit the length of the paper, some journals are very very you know nice they will say that they do not put any restriction on the number of pages that you have, but it cannot be 100 pages; obviously.

So, is easily can printed pages could be 15, 16 they are fine with that they do not put, but some journal extremely stringent they will say that your entire manuscript should not exceed for example, you know 12000 words right, which includes figures and everything they will say that if it is this size then these many words you calculate and so on. So, the number of printed pages would not exceed for example, 5 pages therefore, now you have to think about as to how you are going to present everything that you found in 5 pages. So, challenging aspect.

So, you need to really decide as to what is the best way to communicate your observations right to group the results to present in different ways therefore, you want to do that homework and before you really you know arrive it has to how many tables figures and so on. So, some of the journals limit the number of tables and figures also have specific guidelines and design aspects of this display and say that, one column, two column, one page is not accepted and so on.

So, they will have given for example, what is the letter that you font you would use in the figure right even they will give you this kind of an important tips, because that makes the figures and schematics that you make more effective eventually when it gets accepted and published therefore, you need to look at that. Next decide whether the use of table's figures or text you know put across key information right. So, which one I should use whether I should use the text to convey my results tables or figures which way I should be able to put across the information better that you decide.

And after you have decided to use you know on which way you are going to do choose the display item and best fits your purpose based on what you wish readers to focus on and what you want to present. So, you have to always think that what; is the most significant observation. So, how do highlight that. So, really to have one and other way to implement that, even when you are making certain figures right.

So, let us look into some of these aspects in this lecture, first let us look into the tables, so, what are tables right.

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Tips on effective use of tables and figures in research papers

Tables:

- To show many and precise numerical values and other specific data in a small space.
- To compare and contrast data values or characteristics among related items or items with several shared characteristic or variables.
- To show presence or absence of specific characteristics

The best way to decide on the format of the table is to review a number of papers and see which format is most useful to you as a reader! Often that is the best format that you might want use for your data to be presented! After all the data being presented is for the benefit of the reader!

https://www.editage.com/insights/tips-on-effective-use-of-tables-and-figures-in-research-papers

The tables these are to show many and precise numerical values and other specific data in a small space. So, you may have for example, the talking about how the temperature fluctuates for example, in a week right 7 days in a particular hilly town let us say. So, what you will you do? So, you will have the date or date and then you will have the time point and the you have the exact temperatures you can have three columns and clearly show will mark a small table, which convey everything that you want to say..

So, this is a basically the precise numerical value that you applying for the seven days right this is one example right that you do not need to narrate everything in the text you stand alone it can convey or to compare and contrast data values or characteristics among related items or items of several shared characteristic variables.

So, you may compare in a one town with another town for example, the same day you know same time point, how the weather was here as compared to the other city. So, now, you have two columns city a city b or town a town b. So, you can you know show exactly how does it fluctuate right.

To show presence or absence of specific characteristic you can you can talk about for example, a remote village and heart of the city right you have done the time point, you

have measure the temperature what you are showing is that, temperature did not vary between the city and say the rural area, but the particulate matter the pollution level is very high in the city. So, you can bring in a column and show that is very high the level of that particulate matter on the air is very high in the city as compared to a rural area.

So, that highlights the difference. So, you have a table which can really help you to convey, what you wish to display as the major finding of your study. So, the best way to decide on the format of the table is to review a number of papers this is the best thing you want to do.

So, before you when you arrive at a decision you may have certain ideas, but best thing is, you go and read several papers as a reader and you find which one explains you better because now you are looking at the data as a reader, you do not know the exact data, but you are trying to understand what others have done the one that you can understand beautifully is the format that is so, helpful to the reader right.

So, as a reader you are able to judge it data better than as the person who sort of generated the data and when you go and look at it probably will be able to get the best data format that you know, could be the best way we can represents after all already the data being presented is for the benefit of the reader therefore, whatever you find beneficial is the best method or approach you can display your data as well. So, therefore, you want to do some homework as to which type of table format that you would like to present.

Tips on effective use of tables and figures in research papers

Tables:

- To show many and precise numerical values and other specific data in a small space.
- To compare and contrast data values or characteristics among related items or items with several shared characteristic or variables.
- To show presence or absence of specific characteristics

Figures:

- To show trend, patterns and relationship across and between data sets when the general pattern is more important than exact data values (graphs and data plots).
- To summarise research results (graph, data plots and pie chart).
- To present a visual explanation of a sequence of events, procedures, geographic features or physical characteristics (schematic diagram, images, photographs and maps)

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Now, we are coming to the figures, figures are there to sort of a again a give a summary of the data that you are presented. You may have looked at for example, you know I gave you an example of you have looked at the temperature at this certain definite point like in a Monday to say Sunday and twice in a day you measure the temperature in two different cities easily can put in a table, but you are done the same thing for one year. So, you cannot have a data table which represent you know every day in a year and two data points for every day now that would be ridiculous because nobody can go through that. So, what you can do?

So, you can have a summary of the data. So, how do you arrive at the summary of the data? This is where you really make kind of a line diagram, bar diagrams, flowcharts you know many other such things that would you know likely to represent the pattern that you have got the trend that you have got. So, to show the trend patterns relationship across and between data sets and the general pattern is more important than exact value there may be a deviation day to day, but certainly there is a trend right.

So, you would expect that in an around noon the temperature will be much hotter than early morning and you know for example, late evening, that is going to be true weather its winter or weather is summer. So, you want to prove that then this is the best way to do that you know give a trend a pattern using a line diagram and so on. So, that is how you arrive at to summarize research you know research results for example, again you can

present graph data points pie chart and so, on to present visual explanation of a sequence of events, procedure, geographical feature of physical characteristics then you present what is called as schematic diagram. So, for example, you are done an experiment, I say that I have injected this drug for 10 days then I have done a surgery, then I followed it for 15 days now then various measurements.

So, now when you are narrating it becomes very complicated to relate right, but the whole thing can be the procedure the protocol as to when did you do the surgery, when was the drug administered, how many days you have allowed that to recover if this can be presented as a schematic, that makes easier for the reader to understand how you are done.

So, that is one schematic diagram or it could be images like for example, one example I had given was the western blot or photographs you know, you can even have photographs when you talk about say for example, a deformity you know I have a genetic disorder as a result my facial features changes.

So, there is no better way than show in a photograph of the face has to for example, distance between the two eyes right distance between the nose and mouth. So, there are differences in certain developmental anomalies. So, you have to show the figure therefore, the reader can understand better.

So, you can show the images or you can show maps, I gave you an example of how for example, if you study butterfly you know from different localities different you know towns and states of the country, where are the places I have you know isolated the species I have looked at the species what is the pattern, if I put a map and show it you know it makes easy for the reader to understand.

So, these are the ways we can add the figures, we are going to look into some of those data as to how effectively you can present.

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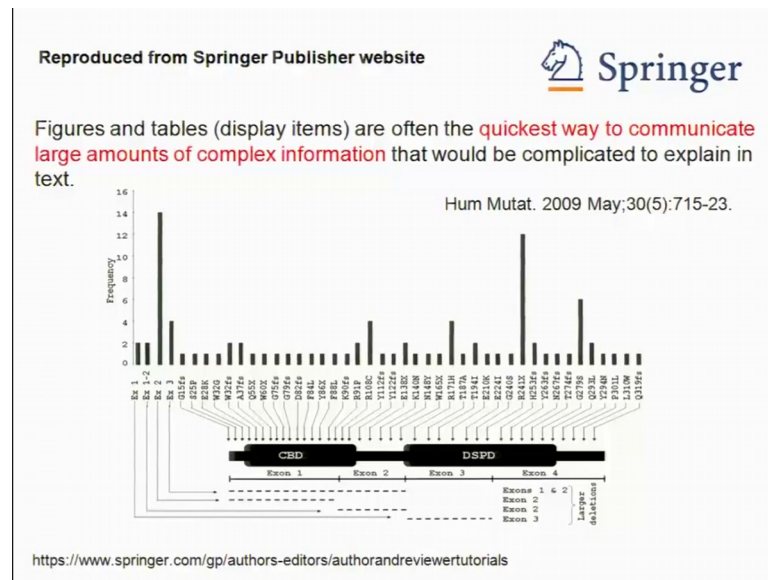
So, it again it is from the Springer website figures and tables what do you call as display items are often the quickest way to communicate large amount of complex information right that would be complicated to explain the text it is very difficult to explain the text. So, you better sort of put the data in one other form and sort of you know summarize as to what that particular figure means, what that particular table means that much easier.

I am showing one you know figure from a research paper, this is a complicated data here, but if I tell you it will help you to you know understand quickly, even those values that I need not go on the tell you.

So, what is shown here is the one that is shown as x on 1 2 3 4 the line at the bottom the chromosomal segment of a particular gene. So, now, you can understand what you mean by x on 1 2 3 4 if you are a biology student you know these are different section of a gene, and then the above there is one CBD DSPD this is the nothing, but a protein which has two domains this is a protein that is quoted by this particular gene, and these are the two domains. What is shown on the top are the mutations the individual mutations that are known to be present in many of the patients suffering from a given disease.

So, these are the different mutations right the mutations a because of the mutation a particular amino acid residues change to something else or the frame shifter. So, each mutation affects the way the protein functions and the bar above talks about the frequency of the mutation how many if independent families had the same mutation.

Now with this information if you look into you will find there are what is called as a deletion large deletions in x on two the occurrence is very high you can see frequency fourteen the bar is like almost like skyscraper, then you have another mutation which is r 2 4 1 x towards the right side again you find a tall bar which against suggest that these are the mutations that are more frequent in the families as compared to the other mutations.

It really you know summarize the I need not go and say that every mutation what is the frequency you know in about five sentences I can complete, you know the whole thing that you know what is the highlight of the figure.

So, if I what detail, I can go to the figure and I you know get the information. So, such kind of figures really helps the reader to understand the complex data. So, for one to develop this figure who take you know large amount of time because you know you have to go through the literature, every paper identify which are the families that have the mutation make a huge table you know convert them into you know a frequency table and then make the figure it takes time, but that is the effective way of communicating.

So, you may want to consider such kind of you know ways to present your data. So, this is another data from again another paper which talks about again a complexity in the experiment right.

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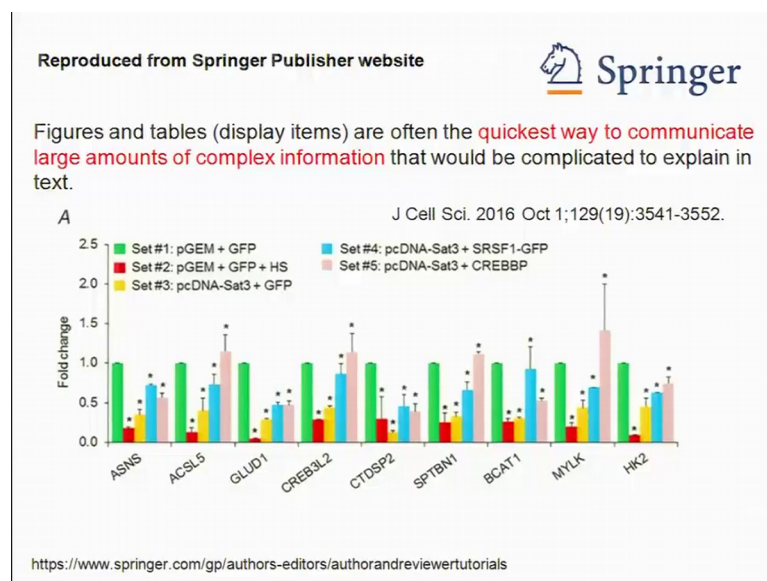
So, there are three is there are five sets here you know identified different color set 1 2 3 4 5 and so on and each one in is given a given color the bar represent each one and you can see that you know set one has got two combination pGEM GFP, the other one have various combination.

So, basically you know here there is an assay that was done, to look at the expression of certain genes which are listed at the bottom ASNS and so on details in our bother. So, basically are looking at this fold change the difference in the expression levels of the gene under various conditions right what are the conditions? The conditions are set one set two set three set four set five there are various conditions. Now there is not get into that exact specifics of this what conditions are, but these are six different conditions are five different condition by giving a you know a color code teach one of them and presenting in nice way.

Now, I can easily compare every set with other set and I can understand as to how each one of a gene expression level varies in various conditions. Now this if I how to narrate and the text is going to take you know three pages, but it can be said in a small bar diagram like you know thing that is shown. In addition this bar diagram also talks about you know the values the value is that each bar represent there is you know standard deviation on the mean right.
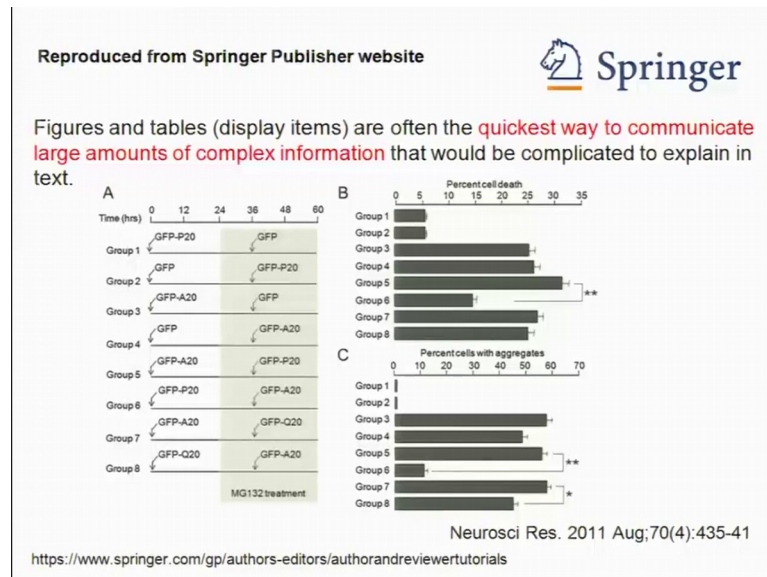
So, you have biological replicates you have expert replicates and this is a summary of all these things and there are stars that are put in there these stars talk about the significance you know you are done a statistical test to see whether the difference that you see is statistically significant right.

So, that denotes that is indeed it is a significantly different and so on. So, this is what it explains when you present the data, therefore, it is important that you make very good figures to that would best explain your data. So, you cannot simply you know one fine morning you get up and then make it. So, you need to think about what is the best way you have to look at large number of papers as to how people present and come up with the best way that you can present your data.

Unless you make your data presentable easily followed by others now this will not be accepted by the community, because if it does not convey what you wish to convey your read is not going to get. If he is not going to get the significant we were finding the

largely appreciated therefore, it will not be accepted for publication. Therefore, it is important that you communicate your results the best way and you find the best method to you know show your results.

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https://www.springer.com/gp/authors-editors/authorandreviewertutorials

Now, I am going to show you another schematic diagram, which talks about even the experiment. So, what is shown on the left side the figure A is a exponential condition right. So, what is shown on the top is time in hours that is from 0 hour to 60 hours. So, that is 60 hours experiment right then you had 8 different groups right group 1, group 2, group 3, group 4, group 5 and so on until group 8. And each group had different type of combinations you can see GFP P 20 followed with GFP let us not get into this in a details, but what it says is GFP P 20 was introduced at zero hour, and the following when GFP was introduced at 36 hours.

Now, you have various combination right and then you also say that at 24 hours after introducing the first set that is GFP P 20 in group 1, you have added a chemical which is called as mg 1 3 2 for next you know from 24 to 60 hours this cells basically were maintain in a given chemical. So, that is what it explains now. Now this is your experimental setup right your approach there are different groups.

Now, you are going to talk about the outcome of each experiment with reference to for example, whether this cell survived or not for example, percent cell that that is what shown in D and then in C talks about percent cells with aggregate certain you know

aggregate that are present in the cell this is a two different data point for the each one of the eight groups that are shown here.

So, now, we can easily relate each bar which is group 1 group 2 group 3 whatever it is in each of the experiment whether the percent cell death that is figure B or percent cells with aggregate that is figure C, you can easily compare with A and then appreciate which combination is able to protect the cell or which combination is unable to protect the cell and whether the aggregate that are forming in the cell have any correlation with the cell death you know you can compare all these things in a universal can compare.

So, you can in the textual form you highlight couple of points and leave it, the reader can go and look into that. So, it makes the reader it makes it very easy for the reader to understand what kind of combination that you are done in terms of experimental setup and how the observations are and what really they mean possibly the correlations and so on. So, it explains right. So, these are all you know schematic these are all data points converted into bar diagram, these are all you know statistical analysis everything come in one place to explain what you are done.
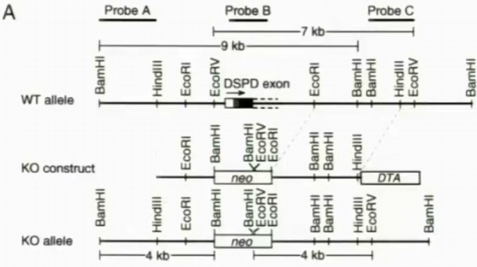
So, that should be the approach you should take when you want to explain your complex data with the help of schematics bar diagrams and so on.

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I will give you one more example of how a complex data can be presented as a figure. So, again whatever that you see is from a research paper, which talks about small segments of a gene and the gene is the plan is to delete the gene are build a part of the gene in the cell. Now I then you want to understand as to what happens to cell if that part of the gene is deleted this is what is called as knockout you know animal and you talk about you know gene knockout, you basically delete a part of a gene and then look at the effect as to what happens to the cell.

So, to delete part of the gene you need to you know have understood as to what are the restriction sites and enzymes that goes and cuts there, you know where are they and which other sites that you can use to repeal the gene with something else, and if you have introduce that particular constructing to the cell how the gene would be rearrange inside the chromosome, and how it can be you know detected.

So, these are the things that are shown here one on the right side is identified as WT allele is the wild type allele which has got all the enzyme sites which are identified as a bamhl hind three the relative position is identified, it identifies that is the particular exon called as DSPD exon and the orientation is identified by an arrow and then you talk about how you are generated a construct you know. So, you have replaced the DSPD exon with neomycin cassette the rest are all flanking sequences, and then once it goes into the cell and replaces that particular exon now how that would allele the knockout allele would look like.

So, this is how you generate in a schematics which explains you know what you are done. Sometimes this is required for you to even understand and design experiments its not only for the reader at time is required for you to come up with ways to manipulate the gene. So, this annotation and making representation of how the genome sequence you know the different elements are represented you know it is very very important for you to understand as well as convey to others.

So, this is in one more example as to how we can use schematics to better explain, I am going to give you one more example because you know there are different ways by which people do.
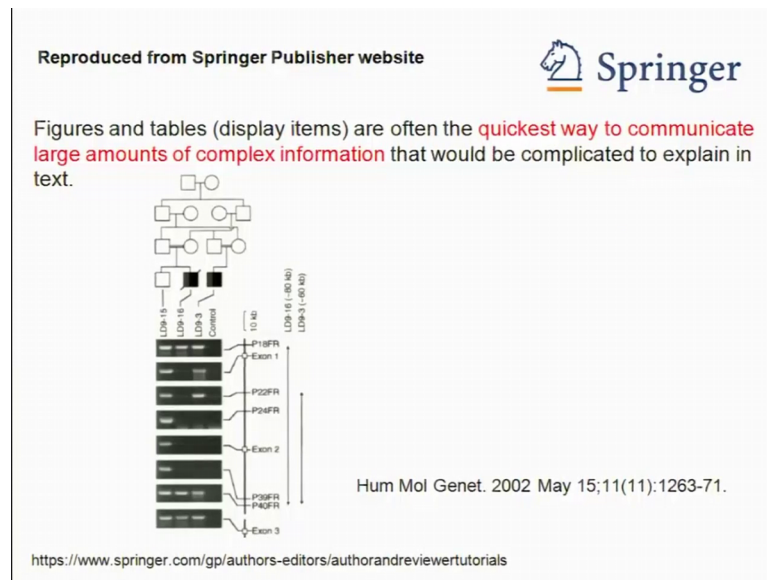
So, you need to appreciate that you know you have to keep that in mind, there is no one rule for everything right. What is shown here is on the top is a pedigree basically it is the family it is a four generation family that is represented, here the squire the male and circle is a female, a line that is connecting the two directly is called as the marriage..

And then you can see that parents had two sons and they are married and they had kids and then and finally, in the fourth generation you have two individuals that are you know filled with you know called you know the black color these are individuals that are affected with the given disease right.

So, it explained everything as to what is the relation, whether it is a male or female, how was the marriage whether is affected unaffected and whether in fact, the one square which is LD 9 16 with a line crossed across represent that he is no longer he is dead by the time and you do this experiment right so; that means, that you know he is no longer alive..

So, the even that is you know explained everything, then basically what you are done is you looked at the genes by doing an approach called as PCR, to look at whether in different segments of the genes are present on art, and this particular experiment suggest that there are segments that are absent in the in this two gene individual that are having the disease suggesting that the loss of that particular segment of the gene resulted in the disease right that is what I explained in this figure.

So, its very complex you know data, but presented in a very simple way therefore, reader can quickly understand the relationship between where is individual that are there, and then to appreciate the results has to that deletion correlated with you know the phenotype or the busy status in the individual that I have been a said here.

So, again you know these are the ways by which you are able to convey complex information; there is no one single rule that applies to everything. So, you have to be innovative even when you create figures as to how best you can explain your data to the reader.

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Many readers will only look at your display items, your understanding that right.

So, for example, I am working in exactly the same kind of field that you are working in and you have written in such paper, I do not need to bother about the introduction because I know exactly what does being down. So, what I am interested in? I am interested in what is that something new that you form.

So, what I do? I do not even wait for reading you a result section because I know the background, I look at your figures right I strike go to the figures and try to understand myself what the results mean or if I am an editor right you submit a paper to the journal that I am handling as editor, it comes to me then I have to evaluate.

So, you may have claimed something your title may say something you are abstract myself in a fantastic idea, but I want to see whether whatever you are saying is substantiated strengthened by the observations and how good your observations are. So, what I do? So, I go and look at your figures, whether they convey exactly the same thing or does it support your observation or whatever you are claiming that it to be. So, the figures would tell me.

Now you had a remember that if you are not made your figures in a professional way they do not look professional, then I would doubt even how good you would have been in carrying out the experiments, but if you have made your figures in a professional way they look good they combined well.

Now, then is going to give me a confidence as to you would have done even your research in a professional way therefore; I would have faith in your research right so, this extremely important. So, you often you see that you know when you go to any party you dress up yourself quite well the reason is you want to present yourself quite well right. Otherwise you would have been just like that you would not have comb your hair you would not have would best possible dress material that you have and so on, but that day you go in a better way.

So, figures are like that because you want to present yourself so, well on that particular day. Figures are like that they have to be the best you know you may have a data, but unless you process and present the best way is not going to convince the authors, the readers or even the editors. So, it is important right.

So, therefore, insurer display items can stand alone from the text and communicated clearly the most significant results, it is extremely important because they have to be stand alone and I look at the figure I should be able to understand even without reading the result section. So, that should communicate on your own its extremely important. Display items are also important for attracting reader to your work.

So, as I mentioned right now well designed and attractive display items will hold the interest of the reader because they like it. So, therefore, they would like to see more and understand what are the different elements that are there, compel them to take time to understand a figure and can even entice them to read your full manuscript right it is like a trailer of a movie again right.

So, they will show some snippets of the movie and it will make you curious as to what the movie is about. So, that is that is something like that you need to make the figures very very attractive and finally, high quality display items give your work a professional appearance, this is what I was trying to tell you. Readers will assume that a professional looking manuscript contains good quality science thus readers may be more likely to trust your results and your integration of the results right.

So, if you go and buy a textbook from a market if the cover page does not look good does not look attractive. If the paper quality that they have used is not really good the printing quality is not good though the text may be very good now you may not buy that book because it does not look good.

So, you are not gone through the text it may be fantastic, it is just that they are unable to print in a good quality material there unable to design it properly, but the text is beautiful, but again the look is you know it is something that you looked at and you are not convinced they you may not buy it. Exactly the same way your figures you need to be extremely careful as to that they look like a professionally drawn figure therefore, you have to know how to you know develop figures.