Hello everyone. This is a lecture for F.Y BSC

microbiology students. The paper is microbiology and biochemistry

one. I'm Rajani Prabhu, assistant professor from

government college of arts, science and Commerce Khandola This is modulle number 17 and the topic is

structure of endospore. This is basically outline of the topic.

We're going to study. Endospores -an introduction to it.

The characteristic and properties, examples of

Spore forming  bacteria, the structure of endospore and also
the classification of endospore..

After this topic, you're going to be able to define endospore
 and satte some important examples. State various

characteristics of it and explain how resistances shown by them

 also explain the significance of endospore in

food and medical industry.Describe the structure of Endospore

so as well as be able to classify the endospore based

on its  shape and position.

We know that microorganisms are very adaptive to the

surroundings, meaning they can change a lot depending on

whether the surrounding is normal or extreme, and they

employ various strategies under stress condition. One such

strategy employed by microorganism is production of

endospore. Usually this occurs in the nutrient deprived

situation. So when nutrient is very less, Organism tend to

produce something called endospores.
As the name suggest, endospores are our seed like structure which are present

inside the bacteria. OK, they are highly resistant. And are

designed to ensure survival strategy and they act basically

to preserve the genetic information under stress

condition.

So these are  like normal cell but of smaller structure

which is produced by cell under stress condition. They were

basically discovered by three people at the same time, almost

in 1876 by Cohn, koch and tyndall. This endospores  has been very fascinating to various

scientists from the time they were known till date. OK,

they're dominant cell present  within the so called

mother, said we're saying it “so called mother cell” because this

is not a reproductive structure.They're not the product of cell

division, they are just a survival mechanism. But they are

produced by 1 cell, small part of oneself. So like a baby of the

bigger cells. Hence we are calling it is.

Spore is a dormant structure produced by mother cell

this mother cell is actually called as sporangium. We

are going to discuss that later.

So we're going to just see now in detail why these cells

special cells are formed and why they are so much interesting. So there are various reasons to it.This is just the basic outline of what is a spore is a metabolically dormant structure and has a size of .2 Micron,which is of course very much smaller structure then  bacterial cell structure in size. The mother cell is called as sporangium. These are basically most prominently produced by gram positive.

A type of the cell both by Aerobic as well as anaerobic Archaea have not been reported as here to produce any type of endospores. OK, so as I said they were fascinating, so these are various reasons why they're so special.

Basically this structure, or Endospore are helping the cell to survive any type of extreme condition.OK doesn't allow the cell to get killed easily, they are. They Are very resistant to environmental stress such as high temperature, UV radiation, gamma, radiation. Action, even desicacation there says to be remaining viable for more than10,000 years. Some are even reported to be viable for 250million years. So that is like so many million years back, the endospore can still be viable if you put them in a proper nutrient condition. We have isolated this. There are reports of endospore being isolated from

the tombs of Egyptian Pharaohs,which was there, so this has

been of interest for scientists since a long time.

But these and us both, since they are so Hardy they can

actress Pathogens as well. One Example of that is Clostridium

perfringens, which causes gas gangrene since they're so, you

know, hard to destroy. It's very difficult to treat such

infections. These are also concerned for food industry, as

they are in. They show no.

Damage to heat condition. They Cannot be destroyed by the Heat

which is present produced by the which is employed in the food

industry so they cause food spoilage and also food

poisoning. But there was one case in 2001 this spores of

bacillus anthracis was used as bioterror. Some people, some bad

guy. You can see they had sent letters to other people which

were containing dispose of bacillus anthracis . So when the

receiver opened the letter they inhale the spore and got

attacked of anthracis and they died. This happened in 2001 so

suppose endospores can be used As a bioterror weapon, we should not be done. It's a very bad

thing to do, but it has. This is what point you have to know

about it, so can the thing destroy Endospore. It's not

like that or talk living that is heating them at 110 degrees C

for 15 minutes can deactivate them. Also this is there and there's another method which is called tyndallization that is heating after repeat interval of time, meaning heating now for 15 minutes allowing it to cool and then again heating the solution. This will.

Activate the endospore and then kill the activated Endospore easily, so this is this was done by the scientist tyndall and called tyndallization.

This can be viewed on the light microscope as well as electron microscope under light microscope. We can use malachite green staining to view endospores OK.

Though examples of spore forming bacterium, basically the most commonly studied bacillus andClostridium, these are rods.

One example of Coci is sporosarcina and all of them belong to Firmicutes phylum.This is just a picture showing you this malachites staining.The green colored entity which is present in the red cell is the Endospore, and those that stained green over here. Now let us discuss in detail the structure of the interest for the structure is very complex.

It has multiple layers. OK, so now you can see over here.

The innermost layer is called as the core. This is where the

ribosome and the nucleus of the cell is present. OK, so this is

just a nucleoid region. You Can say like a nucleus part, so

this is very just the difference between normal cell and endospore
that it had very low water content and has high amount of

soluble acid proteins and also calcium Dipicolinate in it which is

there in the core region. This Core is surrounded by inner

membrane. And then it is having a core wall,
. This core wall is basically made up of

peptidoglycan,
Over here after that Core Wall there is another layer which

is called as Cortex. Cortex is also having peptidoglycan but it

is less crosslinked as compared to this core wall

like Cortex occupies almost50% of the entire endomembrane

this image which I have drawn isn't showing the exact amount of

cortex it will be little Be going quantity. OK so it's covering almost 50% of the cell.

There is next layer which is nothing but a coat. Spore coat
which is there which is made up of 50 different types of

proteins. And the last final layer, which is a delicate layer

formed in many different phases called exosporium. This is

formed only in the later stage.We're going to see sporulation

later. So what confers resistance to this spore under

extreme conditions? Are all these layers which we just

talked about. OK, so different layers which we just described

now are all going to offer resistance to the endospore, the

main role of Endospore is to survive damage. So what it tries

to protect is the cells enzymes.Cells are very smart, it selects

the best thing to protect. OK,it knows that it has to protect

its beginning. It can survive longer time if whatever

Condition

. They can just use theDNA information in the DNA and

can form and you sell so it protects Dna and enzyme though

Spore coat protect the nucleus from chemicals an

although is impermeable to all the chemical.

The lining of the spore coat which is there which was called

as inner membrane is impermeable to chemicals. The core which is

there as I mentioned is low in.

Water content this low water content of the core makes all

the proteins inside the code immobile OK. So all the proteins

are in mobile so even if they are denature they will stay just

in that place. Only they will not move. So imagine the protein

nature. So the polypeptide chain has opened up but they

will stay in that area only.They will not get mixed up by

other protein. OK so when conditions are stable back

again, this opened polypeptide can again rebry form to its own

shape. And protein will get stabilized so low water

contained allows makes the whole endospore dormant and all

meaning metabolically lessactive. And also it allows the

immobilization of the proteins.OK, there's also high amounts of

Dipicolinate calcium ion,which makes the pH slightly

acidic inside the code as compared to the vegetative cell.

This also helps in stabilizingDNA. OK, so DNA.

stabilisation is actually offered by the complex which

are formed of calcium and is typical in IC acid.

This complex get integrated in the nucleic acid bases of the

DNA and stabilizes it there.Small solo, acid soluble, Dany

binding protein which further stabilizes the DNA. So the

structure of those four confers resistance or to the

score under extreme conditions.

Depending on the location and size of the spore, we can

simply classify this as terminals central and Sub

Terminal. This is very easy ais at one end of the bacteria

is called. This terminal is inthe middle it is called as

central if it is between Centraland the last end then it is

called a subdominant. That's All. Then, depending on the size

of it you can call it bulging and non bulging bulging meaning

it is giving the bacterial cell.

A swollen appearance. It will bulge out of the cell. OK, so it

will look like a swollen Bob over there whereas non bulging

will be small in size so it will not show any swollen appearance.

So depending on the shape you can just say that wait so it was

the classification of the

endospore. So that is all these are my references.

Thank you very much.