Iwelcome you to this session on

microbial Physiology MID 102.

This unit for deals withchemoheterotrophic protein

metabolism. And the module thatwe will be doing.

Deals with the aspects ofcatabolism including transamination,

deamination and decarboxylation.

What we will be tackling in thisunit are the catabolic pathway

reactions of amino acids andvarious anabolic aspects of

these catabolic reactions.

At the end of this module.

You will be able todifferentiate between types of

biochemical reactions forremoving the Alpha amino group

from amino acids.

You will understand anabolicaspect of catabolic reactions,

and you will be able to giveexamples of different

reactions involved in thecatabolism of amino acids.

Protein turnover refers toproteins being synthesized from

proteins which are degraded.

Degradation of proteins happens in the intestine.

But unlike fatty acids and

glucose. The surplus amino acidscannot be stored or excreted.

They have to be further oxidizedto provide energy.

Now this oxidation has twomajor aspects. One is the

removal of the amino groupAlpha Amino Group and two is

that the carbon skeleton getsconverted into a metabolic

intermediate.

It could go into the Krebs cycleand you could have a variety of

products like fatty acids,ketone bodies, and glucose being

formed from the degradationproducts of amino acids.

So while some amount of aminoacid degradation does happen in

the skeletal muscle, the majorsite for amino acid degradation

is the liver.

One key reaction in theremoval of the Alpha Amino

group is transamination.

So we look at an aminoacid, an L amino acid.

Which reacts withan Alpha ketoacid.

So what happens is simplythat the amino group gets

transferred to the Alphaketoacid at the Alpha

position.

Forming an amino acid from the

keto acid. And a keto acidfrom the amino acid.

In other words, there is nonet removal of amino acids

there is there is no netremoval of the amino group.

That is simply a transfer ofamino groups. So there is no

net deamination in thisreaction.

This reaction is catalyzed by agroup of enzymes called

aminotransferases. Which have aprosthetic group pyridoxal

phosphate. So the actualmechanism of trans

amination is that the aminogroup gets transferred to

pyridoxal phosphate to formpyridoxamine phosphate, and

from pyridoxamine phosphatethe amino group is getting

transferred to Alphaketoglutarate to form the

knew amino acid.

These transaminases are found inthe cytoplasm an in the

mitochondria, and there are twoamino acids, amino transferases

which are extremely relevant inclinical medicine. These are a

Lt or aminotransferase, an AST

aspartate aminotransferase. Butif we look at the general

reaction. Oftenaminotransferase, we look at the

reaction of altf. We look at thereaction of AST in all three

cases you may have different.

Ketoacids being formed, but itis the same.

Amino acid being formed.

In other words, the purpose oftransamination is to pull,

create a pool of glutamate tochannel the amino groups into

glutamate, and this glutamatehas one of two options. Once

it enters the mitochondrialmatrix, it can either trans

emanate and form a desiredamino acid, or it can be

oxidatively deaminated by anenzyme glutamate

dehydrogenase.

The oxidative deamination.

Results in the removal of theamino group as in ammonium iron.

The glutamate dehydrogenase,which is mediating this

reaction, is allostericallyregulated and we can see clearly

here that GTP is a negativemodulator, while ADP is a

positive modulator. So in otherwords, this reaction proceeds

when there is a need for energy.

And when this reaction proceeds,you have any DP becoming any

DPH, so any DPH can enter theETC and produce ATP.

In general. When the amino

acids. The major side of thecatabolism is happening in the

liver, but you have amino acidscoming in from the skeletal

muscle also into the liver.

And the emphasis is on theremoval of the amino group. The

amino group is removed asammonia, which goes into the formation of urea or uric acid.

Now we can see clearly here thatthere is trans amination, resulting in creating a pool ofglutamate, but you have glutamate also being formed fromthe amino acid glutamine.

Coming to the glucose alaninecycle, which is extremely significant, becausw theskeletal muscle while it can carry out. I mean or acidoxidation. It does not have the enzymes of the urea cycle.

So hence the ammonium has to betaken or nitrogen is to be taken in a particular form to theliver for the excretion of nitrogen. So we can see veryclearly here that the crucial reaction of transamination iscreating the amino acid alanine in the skeletal muscle. This is being transported through the blood to the liverand again by the process of transamination. You havethe creation of glutamate.

Glutamate releases ammoniumto go into the urea cycle.

Also, there is pyruvate beingformed which can form glucose by glucose noogenesis happening inthe liver. So in this way the liver does not have to bear thefull metabolic brunt, some amount of oxidation can happenin the skeletal muscle, but the

brunt of glycogenesis is
is doneby the liver.

So if an amino transfer is inthe glutamate dehydrogenase

in conjunction, then it isreferred to as trans

deamination, but there are someamino acids which do not undergo

transamination, so they willbypass trans D ammination and

undergo direct oxidativedeamination. So these direct

oxidative damnation can be doneby amino acid oxidises. Now

these are flavoproteins, whichmeans they are cofactors, will

be flavin mononucleotide and.
are found in the liver,

kidney, and peroxisomes.

So we can see clearly here thatan amino acid oxidase.
When it actually an amino acid

you have. Flavinmononucleotide becoming

getting accepting thehydrogen ions and then when

it goes through E TC itwill provide ATP.

The amination can also be.

Nonoxidative by an enzyme. Sofor order for amino acid

accident reuning they can beacted upon by a dehydratase.

Now this enzyme is called sobecause it carries out

dehydration prior to theamination. It has the same

cofactor pyridoxal phosphate,and produces the respective

keto acid, like in the case ofserene, the keto acid is

pyruvate. In the case of treonin the keto acid is Alpha

Ketoglutarate.

Non oxidative daamination of anamino acid like cysteine.

By the enzyme. This sulfydrase would result in removal

of the sulfhydryl group andcreation of the Alpha keto

acid, pyruvate.

No oxidative deamination can alsobe catalyzed by group of.

Enzyme is called amino acid,ammonia lies is. And what is

interesting about this reactionis that it is a reversible

reaction which means, along withglutamate dehydrogenase, this S

parties this enzyme involved inthis reaction can also provide a

means for channeling ammoniainto the amino position of an

amino acid. So this is the firstanabolic aspect we're seeing.

Actually, the second because wehave already explored glutamic

dehydrogenase. So along with

glutamic dehydrogenase. This isalso becoming an.

Anabolic reaction?

And we have deamidation by glue.

Tell my glutamin is which can.

Give you a sufficient pool, orrather, this reaction

functions to give you improvethe pool of glutamic acid.

Another means of.

Breakdown of amino acids wouldbe by removal of the.

Carboxyl group has carbondioxide, so the carboxyl

group is being removed ascarbon dioxide.

And Interestingly, unlike

deamination and transamination.

This reaction of decarboxylationhas an anabolic aspect.

Because you can see a histidinedecarboxylase enzyme is

producing this compound calledhistamine which has great

physiological effects. Now thiscompound stimulates gastric

secretions. We have otherexamples as well, so you have a

nonprotein. Amino acid if it is acted upon

by a specific decarboxylase.

If we have a non proteinamino acid called 5

hydroxytryptophan acted upon bya specific decarboxylase, it

produces serotonin which isaccessible vasoconstrictor or

are neurohormonal agent.

Then we have another non proteinamino acid called DOPA which

acted upon by a decarboxylasewill produce dopamine.

This is in the brain. Ifdopamine is an intermediate

which produces adrenaline, whichis an important vasoconstrictor

So in other words, of theproducts of decarboxylation, all

are anabolic in nature.

To summarize, most amino acids use transamination prior to

denomination to concentratenitrogen,
special rule intransporting ammonia from the

skeletal muscle to the cytosolof liver hepatocyte and the

reactions catalyzed by ammonia,lies, and glutamate

dehydrogenase. For incorporation of

ammonia in the Alpha aminoposition, decarboxylation also

has anabolic potential.

These are my references,thank you.