

"The Wildly Popular Metabolic Melodies" 2007 CD Lyrics

En-er-gy © 2002 Kevin Ahern

(To the tune of *Let It Be*)

When I was walking through the forest grizzly bears came
after me. So I was badly needing En-er-gy

My body dumped some epinephrine out into the blood for
me, 'cause I was badly needing En-er-gy

En-er-gy / En-er-gy; En-er-gy / En-er-gy
I was badly needing En-er-gy

The epinephrine gave a kick to enzymes deep inside of me to
make a bunch of cyclic AMP

And when this hit my protein kinase: catalytic ecstasy
The C subunits started adding P's

Adding P's, adding P's; adding P's, adding P's
Phosphorylation city adding P's

The protein kinase put a phosphate
onto PBK for me using energy from ATP

And PBK in turn converted 'b's to 'a's and 'I's to 'D's *
So I released a ton of G1P

G1P / energy; G1P / energy
California needs some G1P

And when the chaos had subsided I consumed some Frito
Lays, which soon began reversing these pathways

The glucose halted epinephrine Insulin began the race to
turn on phosphoprotein phosphatase

Phosphatase - cleaves the P's;
Phosphatase - cleaves the P's
The dephosphorylation cleaves the P's

And so they were removed from action: cellular kinases.
Thanks to phosphoprotein phosphatase

I'll end my story here before I get depressed from one last
fact: that dephosphorylation favors fat

Favors fat, favors fat; favors fat, favors fat
Dephosphorylation favors fat.

Hemoglobin's Moving Around © 2006 Kevin Ahern

(To the tune of *Santa Claus is Coming to Town*)

Oh isn't it great what proteins can do?
Especially ones that bind to O₂
Hemoglobin's moving around

Inside of the lungs, it picks up the bait
And changes itself from T to R state
Hemoglobin's moving around

The proto-porphyrin system
Its iron makes such a scene
Arising when an O₂ binds
Pulling up on histidine

The binding occurs cooperatively
Thanks to changes qua-ter-nar-y
Hemoglobin's moving around

It exits the lungs engorged with O₂
In search of a working body tissue
Hemoglobin's moving around

The proton concentration
Is high and has a role
Between the alpha betas
It finds imidazole

To empty their loads the globins decree
"We need to bind 2,3BPG"
Hemoglobin's moving around

The stage is thus set for grabbing a few
Cellular dumps of CO₂
Hemoglobin's moving around

And then inside the lungs it
Discovers ox-y-gen
And dumps the CO₂ off
To start all o'er agin

So see how this works you better expect
To have to describe the Bohr effect
Hemoglobin's moving around

When Acids Get Oxidized © 2006 Kevin Ahern

(To the tune of *When Johnny Comes Marching Home*)

The fatty acids carried by CoA, CoA
Are oxidized inside the mi-to-chon-dri-ay
They get to there as you have seen
By hitching rides on carnitine
Then it goes away when acids get oxidized

Electrons move through membranes, yes. It's true, it's true
They jump from complex I onto Co-Q, Co-Q
The action can be quite intense
When building proton gradients
And it's good for you when acids get oxidized

The protons pass through complex V. You see, you see
They do this to make lots of A-TP, TP
The mechanism you should know
Goes through the stages L-T-O
So there's energy when acids get oxidized

When Acids Are Synthesized © 2007 Kevin Ahern
(To the tune of *When Johnny Comes Marching Home*)

The 16 carbon fatty acid, palmitate
Gets all the carbons that it needs from acetate
Which citric acid helps release from mitochondri - matrices
Oh a shuttle's great when acids are synthesized

Carboxylase takes substrate and it puts within
Dioxy carbon carried on a biotin
CoA's all gain a quick release replaced by larger ACPs
And it all begins when acids are synthesized

A malonate contributes to the growing chain
Two carbons seven times around again, again
For saturated acyl-ates there's lots of N-A-DPH
That you must obtain when acids are synthesized

Palmitic acid made this way all gets released
Desaturases act to make omega-threes
The finished products big and small form esters with a
glycerol. So you get obese when acids are synthesized

The Tao of Hormones © 2006 Kevin Ahern
(To the tune of *The Sound of Silence*)

Biochemistry my friend;
It's time to study you again
Mechanisms that I need to know
Are the things that really stress me so
"Get these pathways planted firmly in your head,"
Ahern said: Let's start with epinephrine

Membrane proteins are well known
Changed on binding this hormone
Rearranging selves without protest
Stimulating a G alpha S
To go open up and displace its GDP
With GTP because of epinephrine

Active G then moves a ways
Stimulating ad cyclase
So a bunch of cyclic AMP
Binds to kinase and then sets it free
All the active sites of the kinases await
Triphosphate because of epinephrine

Muscles are affected then
Breaking down their glycogen
So they get a wad of energy
In the form of lots of G-1-P
And the synthases that could make a glucose chain
All refrain because of epinephrine

Now I've reached the pathway end
Going from adrenalin
Here's a trick I learned to get it right
Linking memory to flight or fright
So the mechanism that's the source of anxious fears
Reappears when I make epinephrine

B-DNA ©2004 Kevin Ahern
(To the tune of "YMCA")

Phosphates are in nucleotides
I say phosphates cover bases inside
I say phosphates span the 5 and 3 primes
There's no need - to - be - real - mixed - up

Bases carry info you see
I say bases are all complement'ry
I say bases like A,T,G and C
They have got - to - be - all - paired - up

It's fun to play with some B-DNA
It's got a boatload of G-C-T-A
It's got everything a polymerase needs
When you melt all the A's and T's

It's fun to play with some B-DNA
It's got a boatload of G-C-T-A
You can make RNAs with a po-ly-mer-ase
Just by pairing up U's with A's

Proteins full of amino A's
I say proteins come from mRNAs
I say proteins require tRNAs
There is more - you - need - to - trans-late

Codons, like our friend U-A-C
I say codons come in clusters of three
I say codons have one base wobblee
Now you can - go - forth - and - trans-late

It's fun to play with some B-DNA
It's got a boatload of G-C-T-A
With those hydrogen Bs
And right-hand helices
Antiparallel fives and threes

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We All Need Just a Little ATP © 2003 Kevin Ahern
(To the tune of *Yellow Submarine*)

In the cells, inside of us, there's a sugar on adenine
Which is linked, to phosphate groups, and you know it as
ATP

If we build up a lot of ATP, we've too much energy,
metabolically (2x)

And the cellular decree, calls for storing up the energy
So we save, it chemically, building acids onto ACP

Making fat stores a lot of energy, creates NADP, and uses
ATP (2x)

When we need, some energy, we burn fats in fancy cell
machines
Acids all, get shuttled in, on the backs of little carnitines

We break acids every hour today, in mitochondri-ay, to
acetyl-CoA (2x)

One more thing, about this tune, should be remembered by,
all of you
Burning fat, converts a few, FADs to FADH₂s

NADH is a product too, that you can surely use, when NAD's
reduced (2x)

N-A-D © 2004 Kevin Ahern
(To the tune of *Penny Lane*)

In the catabolic pathways that our cells employ
Oxidations help create the ATP
While they lower Gibbs free energy
Thanks to enthalpy

If a substrate is converted from an alcohol
To an aldehyde or ketone it is clear
Those electrons do not disappear
They just rearrange – very strange

N-A-D is in my ears and in my eyes
Help-ing mol-e-cules get oxidized
Voila! N-A-D-H

And the latter is a problem anaerobically
'Cause accumulations of it muscles hate
They respond by using pyruvate
To produce lactate

Which the Cori cycle handles trans-hepatically
Synthesizing sugar's almost effortless
Using glu-co-ne-o-gen-e-sis
Anabolic'ly, Eagerly

N-A-D is in my ears and in my eyes
Help-ing mol-e-cules get oxidized
Voila! N-A-D-H

The Sound of Glucose © 2003 Kevin Ahern
(to the tune of *My Favorite Things*)

Aldehyde sugars are always aldoses and
If there's a ketone we call them ketoses
Some will form structures in circular rings
Saccharides do some incredible things

Onto a glucose we add a 'P' to it
ATP energy ought to renew it
Quick rearranging creates F6P
Without requiring input energy

At a high rate add a phosphate with PFK
F1,6BP is made up this way so we can run and play

Aldolase breaks it and then it releases
DHAP and a few G3Pieces
These both turn in to 1,3 BPG
Adding electrons onto NAD

Phosphate plus ADP makes ATP
While giving cells what they need - en-er-gy
Making triphosphate's a situa-shun
Of substrate level phosphoryla-shun

3-B-P-G; 2-B-P-G; Lose a water
PEP gets a high energy state just to make py-ru-vate

So all the glucose gets broken and bent
If there's no oxygen cells must ferment
Pyruvate / lactate our cells hit the wall
Some lucky yeast get to make ethanol

This is the end of your glucose's song
Unless you goof up and get it all wrong
Break it, don't make it to yield ATP
You'll save your cells from fu-til-i-ty

Brain Farts Just Happen In My Head © 2006 Kevin Ahern
(To the tune of *Raindrops Keep Fallin' On My Head*)

Brain farts just happen in my head.
I think it might be due to something Kevin said, Biochemistry
Gets brain farts a poppin' in my head and they're poppin'

So I just wiped out the teardrops from my eyes
And told my brain it had to do some mental exercise
Burn some ATP
So brain farts can stop inside my head they'll be stoppin'

'Cause there's one thing I've learned
When energy increases it sure pleases
My mental state - I'm doing great as tension eases

Now brain farts don't happen in my head
So I'm sure the final will be easier instead.
Cyclic AMP
Stops brain farts from poppin' in my head they're not poppin'
Thanks to caffeine ... Nothin's worryin' me

The Codon Song ©2007 Kevin Ahern and Indira Rajagopal
(To the tune of *When I'm Sixty Four*)

Building of proteins, you oughta know needs amino A's
Peptide bond catalysis in ribosomes
Triplet bases, three letter codes
Mixing and matching nucleotides who is keeping score?
Here is the low down if you count codons you'll get sixty-four.

Got - to - line - up - right
16-S R-N-A and Shine Dalgarno site.

You can make peptides, every size with the proper code
Start codons positioned in the P site place; Initiator t-RNAs
UGA stops and AUGs go who could ask for more?
You know the low down count up the codons
There are sixty-four

The Cell's Lament ©2003 Kevin Ahern
(To the tune of *Yesterday*)

Woe is me, my substrates are losing entropy
Causing gains in Gibbs free energy
Oh I can't lose no en - tro - py

Re-a-ly, I could use a source of enthalpy
To combat the rise in Delta G
Oh I believe in enthalpy

I crave en-er-gy, don't you see it's getting worse?
My re-actions all soon will stall and then rever-r-r-se

ATP, it's the metabolic currency
Guess I'll spend a bit judiciously
To help reduce the Delta G, help reduce the Delta G

God Rest Ye Merry Lipoproteins ©2002 Kevin Ahern
(To the tune of *God Rest Ye Merry Gentlemen*)

God rest ye merry dieters with high cholesterol
Your chylomicrons all contain triacylglycerols
And move from lymph to capillaries there their progress stalls
Tha-anks lipo protein li-pase, protein lipase
O-oh thank you lipo protein li-pase

And after their fat goodies have been hydrolyzed away
The chylomicron remnants go along their merry way
The liver grabs them from the blood and puts them all away
Just as we should do with Kenneth Lay, Kenneth Lay
O-oh just as we should do with Kenneth Lay

And when the liver gets a message from the body's cells
It makes up little packages we call VLDLs
They seem like chylomicrons, but turn in to something else

Please don't become the LDLs, LDLs
O-oh please don't become the LDLs

For LDLs cause chaos when their insides oxidize
The macrophages bind to them and foam cells can arise
You'd better watch your diet or your blood flow will downsize
And that would not be very wise, very wise
No-oh that would not be very wise

So if you take some lessons from this little comic bit
Your diet should be healthy and you should try to stay fit
Eat greens and drink red wine but try not to overdo it
And your heart will never ever quit, want to quit
No, no your heart will never ever quit

The Ribosome ©2007 Kevin Ahern
(To the tune of *America the Beautiful*)

O beautiful with R-N-A to make the peptide bonds
You hold t-RNA so it can pair up with co-dons
The Ribosome! The Ribosome! Translate mRNA
Initiate and translocate from start to UGA

Oh Little Protein Molecule ©2003 Kevin Ahern
(To the tune of *Oh Little Town of Bethlehem*)

Oh little protein molecule you're lovely and serene
With twenty zwitterions like cysteine and alanine

Your secondary structure has pitches and repeats
Arranged in alpha helices and beta pleated sheets

The Ramachandran plots are predictions made to try
To tell the structures you can have for angles phi and psi

And tertiary structure gives polypeptides zing
Because of magic that occurs in protein fol-ding

A folded enzyme's active and starts to catalyze
When activators bind into its allosteric sites

Some other mechanisms control the enzyme rates
By regulating synthesis and placement of phosphates

And all the regulation that's found inside of cells
Reminds the students learning it of pathways straight from
hell

So here's how to remember the phosphate strategies
They turn the Gpb's to a's and Gsa's to b's

Prostaglandins © 2007 Kevin Ahern
(To the tune of *Oklahoma!*)

Prossss-taglandins, the ei-co-sa-noids creating pain
Are the ones to blame – when you get inflamed
And ouch(!) – they hurt inside your brain

Prossss-taglandins, every throb and ache gets magnified
If you hope to win, cyclo-oxygen's
Generation's got to be denied

The Vioxx has all been recalled. So go get yourself Tylenoled
And if you aaaaaaaaaaaaaache, blame PGH synthaaaaaaaaase!
We must complain that you make the aches prostaglandins
Prostaglandin – D2, F1, G2, E2.
Prostaglandin, it's you!

The E. coli Song © 2004 Kevin Ahern
(To the tune of *Rudolph the Red-Nosed Reindeer*)

E. coli's very simple. That's the way the story goes
But if you worked around it you would probably hold your
nose

Most of the other cell types have a mitochondrion
They use to make triphosphates by phos-phor-y-la-she-un

When there is no oxygen, Coli's got it made
Glucose breakdown products all wind up making ethanol

Then all the cells around it shout E. coli's name with glee
"You make us feel light-headed when you act fermentally"

Glucagon is Coming Around ©2004 Kevin Ahern
(To the tune of *Santa Claus is Coming to Town*)

You've gotta admire what molecules do
Their cellular fire is ready on cue
Glucagon is coming around

If hormone should bind receptor outside
G proteins find G nucleotides
Glucagon is coming around

They activate cyclases that make amps
Which bind to Protein Kinase A
And pull the R's from C's

The glycogen shrinks in liver quite fast
The glucose into your bloodstream is passed
Thanks to this you have energy

And muscles uptake the glucose in turn
Obtaining a substrate all of them burn
Thanks to this you have energy

The pool of phosphatidyl inositides in you
Can send two separate signals when they get split in two

The muscles contract when calcium's free
Lowering levels of Creatine-P
Now you're gonna need energy

Those little calcium ions I hope you've learned them well
Are just like Martha Stewart all locked up in a cell

This story's complete. I know it's a load.
My hope is your head ain't gonna explode
You will need it in finals week

Translation © 2007 Kevin Ahern
(To the tune of *Maria* - from *West Side Story*)

Translation
The most intricate thing I ever saw
From five prime to three prime, translation, translation
The final step that we know about the central dog-ma
Amino, carboxyl, translation, translation. . . .
Translation, translation, translation . . .

Translation!
I just learned the steps of translation
And all the things they say about tRNA are true
Translation!

To form peptide bonds in translation
The ribosomal cleft must bind to an E-F-tee-you!
Translation!

A-U-G binds the f-met's cargo
16S lines up Shine and Dalgarno
Translation

I'll never stop needing translation

The most intricate thing I ever saw
Translationnnnnnnnnnnnnnnnnnnnn

Biochemistry Pie

(To the Tune of *American Pie*)

A long nine weeks ago,
I can still remember
How the lectures sometimes made me smile.
I pushed myself to study lots
So I could fill my head with thoughts
And then I'd find the effort all worthwhile

But mid-term one, it left me jaded
I worried as exams were graded
Sad news came from Kevin: the average - forty seven

It was so bad I went in shock I couldn't stand to hear the talk
Of Henderson and Hasselbalch, and bi-o-che-mis-try

So why, why, biochemistry why
Does percent misrepresent that my attention is high?
And all the students have a rallying cry
Singin' I will be a studious guy, I will be a studious guy

Did you draw an alanine?
And can you titrate a histidine?
If you know its p-K-a
Now do you believe you'll have it made
If you can pull a decent grade
And can recitation lead me to an 'A'?

Well we learned that protein structure is
A bunch of pleats and helixes
True beauty to behold
Man I dig how proteins fold!

There are seniors in pre-pharmacy
Learning all that chromatography
Gel filtration / HPLC
For bi-o-che-mis-try

I started Singin'
Why why biochemistry why
Must performance be enormous for my grade to be high?
And all the students have a rallying cry
Singin' I will be a studious guy, I will be a studious guy

Now for ten weeks we've been crammin' in
The fact that nuc-le-i have spin
But that's not all there is to see
There are six enzyme classes from EC
A cat-a-lytic triad three
And a voice that whispers Delta G

Oh, with enzymes there are lots of facts
Like low Kms and high Vmax
Some zymogens break down
If trypsin is around
And while Kevin lectured Milam Hall
His camera captured movies small
Sometimes they had no sound at all
In bi-o-che-mis-try

We were singing
Why why biochemistry why
Should I lament my last percent if my incentive was high?
And all the students have a rallying cry
Singin' I will be a studious guy, I will be a studious guy

R state, T state metabolic soul mates
Protein forms that we appreciate
ATCase binding siii---iiiites
They grab a C-T-P upright
The enzyme gets itself uptight
With aspartate on the sidelines out of sight

Then the stage was set for ex-am two
And some of us were feeling blue
I almost lost my nerve
Whoa, 'til I moved up on the curve
'cause my memory to me revealed
The answers that had been concealed
As if the key had been unsealed
For bi-o-che-mis-try

I'm always Singin'
Why why biochemistry why
Must a student be so prudent just to qua-a-lify?
And all the students have a rallying cry
Singin' I will be a studious guy, I will be a studious guy

(two stanzas skipped here)

We all pulled down the MP3s
And memorized the older keys
Then I just smiled and carried on
I went down to the class web site
To download ev-e-ry highlight
But the server said the pages were all gone

And in their rooms, the students stayed
The chemists crammed and the pre-meds prayed
There was no indecision
The end was in our vision
And the section that had made me fret
The questions for the problem set
I nailed them all without a sweat
In bi-o-che-mis-try

And I was Singin'
Bye bye biochemistry bye
You can debit all my credit 'cause my grade is so high
And all the students have a rallying cry
Singin' there'll be a party tonight, there'll be a party tonight