

# The Lighter Side

## Songs About Cancer, Gene Expression, and the Biochemistry of Photosynthesis

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### Abstract

These three biology songs can be used for educational purposes to teach about biochemical concepts. They touch on three different topics: (1) cancer progression and germ cells, (2) gene expression, promoters, and repressors, and

(3) electronegativity and the biochemical basis of photosynthesis. © 2017 by The International Union of Biochemistry and Molecular Biology, 00:000–000, 2017.

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This set of three songs approaches biochemistry and molecular biology from some novel perspectives. Music has been found to increase student learning and motivation [1–4]. All songs have been field tested for student familiarity with the originals, and “Hello, I’ve Metastasized” has even been used to recruit prospective students! PowerPoint slides are provided in the Supporting Information Material, with annotations that expand and explain for educational purposes, for those who wish to lecture using these songs as a review following covering the material. The rationale and best practices for doing so are described elsewhere [5]. I also include links to movies with audio to help instructors fit the words to the tune.

Cancer, like the song “Hello,” is about a failure of communication, and a betrayal that cannot be repaired (<https://youtu.be/bJ-xh2iFk94>).

#### Hello, I’ve Metastasized (To the tune of “Hello” by Adele)


Hello, I can’t hear you  
We were once the same before mutations when we split in two  
Before I learned to be free  
And now I’ve just about forgotten everything I used to be.  
Each small difference builds between us

As I change lifestyles...  
Hello from the other side  
I’ve divided a thousand times  
But when you call and say that I’ve gotta slow down  
I don’t listen ‘cause my genes have had a breakdown.  
Hello, I’ve metastasized  
Now I refuse to suicide  
I’m immortal and I grow in other tissue  
I bring in new blood and I’ll happily grow over you, I don’t care...  
...Hello, how are you?  
Seems this body that we share is somehow failing now, I’m sorry  
Even all my oncogenes  
Won’t allow me to keep growing once the nutrients stop flowing.  
It’s no secret that each body  
Is running out of time.  
But something lasts though we have died  
Through germ cells we are purified  
As we age, our cells maximize their own fitness  
But each new birth keeps our variation suppressed, for a while.

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The next song is about bacterial gene expression, and the repressors that prevent it. Like in the song “All the Single Ladies,” if a significant other is unfaithful, they have no right to complain about their partner expressing themselves. ([https://youtu.be/LR\\_EYU0ljY](https://youtu.be/LR_EYU0ljY))

### All the Structural Genes (To the tune of “Single Ladies” by Beyoncé)

All the structural genes (All the structural genes)  
All the structural genes. Open your strands up!

You blocked RNAP, I’ve been trapped, but now I’m finally free  
You wanna repress so I can’t express my protein’s beauty.  
The shape you took was like a hook you bound the operator.  
And your embrace, it blocked some space stopped promoter  
from promoting me.

Now you’re gone I finally get to put RNAP on it.  
Now you’re gone I finally get to put RNAP on it.  
‘Cause you’ve bound to an inducer guess you can’t stop it.  
When you’re gone I finally get to put RNAP on it.  
Promoter, promoter, promoter, promoter, promoter, pro-  
moter, promoter, promoter.

So you’re allosteric, that’s so generic, inducer made you change  
Well that’s your loss, you’re an albatross, ‘cause my activa-  
tor binding site’s filled.

Got no time for haters, got my activator, let me be your  
educator.

‘Cause with activator bound, and repressor not bound  
It’s time to express me.

[CHORUS]

Inducible means signals turn me on  
They bind, repressor’s gone  
Or they make activators bind to me.  
If repressible, signals halt me, assault me, like I’m faulty,  
makes me salty, stop me and turn me off  
They make repressors bind  
Keep activators confined  
It makes it tough to make my stuff; the cell has got enough.

All the structural genes (All the structural genes)  
All the structural genes. Open your strands up!

The next song is about an electron’s non-cyclic flow through photosynthesis. Like in the song, “House of the Rising Sun,” once someone (an electron) has been set on an unstable path, many troubles will follow. (<https://youtu.be/FxsF3VCz3JY>)

### House of the Light Reactions (To the tune of “House of the Rising Sun” as performed by The Animals)

There are two photosystems, that catch light from the sun  
And they’ve been the ruin of many electrons, for energy,  
undone.

Oh I had been safe in water, till I tore that home apart,  
To bind reaction center stably, but I broke those pigments’  
hearts.

‘Cause the photons lift electrons, their excitement passed to  
me,  
I left the one who loved me stably; an acceptor, accepted me.

Oh atoms, tell electrons, not to do what I have done  
If they must reduce a molecule, choose...an electronegative  
one.

Well I soon left that acceptor, as my energy was drained.  
Passed from carrier to carrier molecule, down electron  
transport chain.

Well the second photosystem, they call Photosystem One.  
It’s so briefly the home of this poor electron, till the rising  
of the sun.

### References

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