Mitosis Karaoke: User's Guide

Introduction:
Mitosis, Karaoke? Why in the world would I bother to make such a thing? And why would I expect anyone to use it?

It's all about learning – deep, substantial, permanent learning –informed by insights emerging from cognitive science (explained in the book *Make it Stick*). My hypothesis is that

1. If you become familiar with my original *Mitosis Song,* and
2. Then try to sing it yourself following the fill-in-the-blanks lyrics on the screen of the *Mitosis, Karaoke* then
3. Your path to memorizing the material in the song will be much more efficient than just about anything else that you can do.

That's because interacting with the song in this way is *effortful*. This is not an easy task. But if you do the hard work of trying to memorize the lyrics in this guided way, you'll learn a lot about the Electron Transport Chain. Fill-in-the-blanks karaoke is going to help you to transfer the information to where you need it: into long term memory, where it will be available for that upcoming discussion session or test.

There are, of course, alternatives to remembering this material. Flashcards are another great way that forces you to recall what you know, and thereby encodes your learning in long-term memory. I have Mitosis quizzes and flashcards set up for you at my website.

Give it a try. It's going to be difficult. You won't get it right the first time. Keep on going back and forth between the fill-in-the-blank lyrics on the next page, and the original lyrics (with all the blanks filled in) that follow. Eventually, you'll be able to sing the Karaoke version fluently. And my hypothesis is that if you can do that, you'll have learned a lot about Mitosis in a fairly permanent way.

Please leave me a comment letting me know what you think.

Mitosis Karaoke!

View it at www.sciencemusicvideos.com

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_____ is cell division's longest part,
_____ membrane's intact as it starts,
The cell's _____, cytoplasm flowing,
Chromosomes get _____, _____ gets replicated

_____ are spread out so they can't be seen _____
But note the _____, the _____ factory
Outside the _____ are two _____,
They later make a _____ which will _____ _____
the chromosomes.

_____ follows, the chromosomes _____,
Each is made of two _____ _____, like an "X"
Each sister is a _____, the closest of kin,
And a connects them like Siamese twins,

The _____ disappears it melts away,
As the cell takes a _____ production holiday,
The _____ separate, start _____ formation
For separating _____ and cell _____.

CHORUS
_____**,** chromosomal ride
_____ -, pro-, _____ -, ana-, _____, divide
_____ go from one cell to _____,
Mitosis, how cells _____.

In late _____ (_____**)**,
The _____ _____ disintegrates,
The _____ migrate to the cell's opposing sides,
And between them the fibers of the _____ wend and wind,

The spindle's made of _____ fibers which attach
To chromosomes at _____, a protein patch
That serves like a _____ that the fibers can _____,
When they pull apart the _____, splitting them in _____,

The _____ moves the _____ with nudges so fine,
Into _____ formation on the _____ yard line
A location _____ defining _____,
Where the _____ are lined up on that _____ place

CHORUS
Mitosis, _____ ride
Inter-, _____ -, meta-, _____ -, telophase, _____
Eukaryotes go from _____ cell to _____,
_____, how cells _____.

The _____ fibers pull on the _____,
A cellular molecular mitotic _____ **-**_____ **-**_____**,**
The _____ snaps, sisters get _____,
Now these _____ are _____, they've been upgraded

This snapping _____ defines _____
The "A" for "_____", for moving different ways,
_____ spindle fibers separate the _____
See 'em waving _____, calling out "I'm gonna _____ ya,"

And the other _____ _____ _____ and grapple like felons
Makes the cell _____ like a watermelon,
In _____ membranes form 'round the _____
Which _____ _____ as the _____ come on home

CHORUS
_____, _____ ride
_____ -, _____ -, _____ -, _____ -, _____, divide
_____ go from _____ cell to _____,
_____, how cells _____.

In _____ cells there's a ring of _____
That form at the _____ and they _____ themselves in
Tighter, tighter, tighter, tighter 'til the cell is in ____ _____,
Yeah in animals, that's _____

But it's different in _____ in them the cell _____
By building a new _____ _____ from the inside
As the _____ sends _____ with _____ goo,
Which makes a _____, then a _____, divides the cell in _____

And instead of one _____ cell we now have _____ two
Identical _____, kind of _____ but kind of _____,
From your **single** celled beginning this is how you _____
And for single _____ eukaryotes it's _____ too!

CHORUS

Mitosis!

View it at www.sciencemusicvideos.com

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Interphase is cell division's longest part,
Nuclear membrane's intact as it starts,
The cell's **growing**, cytoplasm flowing,
Chromosomes get **duplicated**, **DNA** gets replicated

Chromosomes are spread out so they can't be seen **distinctly**
But note the **nucleolus**, the **ribosome** factory
Outside the **nucleus** are two **centrosomes**,
They later make a **spindle** which will **pull apart** the chromosomes.

Prophase follows, the chromosomes **condense**,
Each is made of two **sister chromatids**, like an "X"
Each sister is a **clone**, the closest of kin,
And a connects them like Siamese twins,

The **nucleolus** disappears it melts away,
As the cell takes a **ribosome** production holiday,
The **centrosomes** separate, start **spindle** formation
For separating **chromatids** and cell **elongation**.

CHORUS
Mitosis, chromosomal ride
Inter-, pro-, **meta**-, ana-, **telophase**, divide
Eukaryotes go from one cell to **two**,
Mitosis, how cells **renew**.

In late **prophase** (**prometaphase)**,
The **nuclear membrane** disintegrates,
The **centrosomes** migrate to the cell's opposing sides,
And between them the fibers of the **spindle** wend and wind,

The spindle's made of **microtubule** fibers which attach
To chromosomes at **kinetochores**, a protein patch
That serves like a **handle** that the fibers can **grasp**,
When they pull apart the **chromosomes**, splitting them in **half**,

The **spindle** moves the **chromosomes** with nudges so fine,
Into **linear** formation on the **50** yard line
A location **equatorial** defining **metaphase**,
Where the **chromosomes** are lined up on that **middle** place

CHORUS
Mitosis, **chromosomal** ride
Inter-, **pro**-, meta-, **ana**-, telophase, **divide**
Eukaryotes go from **one** cell to **two**,
Mitosis, how cells **renew**.

The **spindle** fibers pull on the **kinetochores**,
A cellular molecular mitotic **tug-of-war,**
The **centromere** snaps, sisters get **separated**,
Now these **chromatids** are **chromosomes**, they've been upgraded

This snapping **separation** defines **anaphase**
The "A" for "**apartness**", for moving different ways,
Kinetochore spindle fibers separate the **sisters**
See 'em waving **goodbye**, calling out "I'm gonna **miss** ya,"

And the other **spindle fibers push** and grapple like felons
Makes the cell **elliptical** like a watermelon,
In **telophase** membranes form 'round the **chromosomes**
Which **spread out** as the **nucleoli** come on home

CHORUS
Mitosis, **chromosomal** ride
Inter-, **pro**-, **meta**-, **ana**-, **telophase**, divide
Eukaryotes go from **one** cell to **two**,
Mitosis, how cells **renew**.

In **animal** cells there's a ring of **microfilaments**
That form at the **equator** and they **cinch** themselves in
Tighter, tighter, tighter, tighter 'til the cell is in **two pieces**,
Yeah in animals, that's **cytokinesis**

But it's different in **plants** in them the cell **divides**
By building a new **cell wall** from the inside
As the **Golgi** sends **vesicles** with **cellulosic** goo,
Which makes a **plate**, then a **wall**, divides the cell in **two**

And instead of one **mother** cell we now have **daughters** two
Identical **twins**, kind of **old** but kind of **new**,
From your **single** celled beginning this is how you **grew**
And for single **celled** eukaryotes it's **reproductive** too!

CHORUS