

# *Giants of Science 2016*

## LYRIC SHEETS

<b>SONG NAME (mostly alphabetical by the last name of the scientist)</b>	<b>SONG NUMBER</b>
1. <i>2015 Cambridge Public School Medley</i> by David Haines.....	SONG 01
2. <i>Eureka!</i> (Archimedes) by Lauren Mayer .....	SONG 02
3. <i>Annie Jump Cannon: Celestial Pioneer</i> by Bruce Lazarus .....	SONG 03
4. <i>Peanut Man</i> (George Washington Carver) by Ruth Hertzman-Miller .....	SONG 04
and Joanna Brown	
5. <i>Copernicus and Kepler</i> (Nicolaus Copernicus and Johannes Kepler).....	SONG 05
by Lauren Mayer	
6. <i>Madame Marie Curie</i> by Andrea Gaudette.....	SONG 06
7. <i>Mr. Darwin, Mr. Wallace, Mr. Matthew</i> (Charles Darwin) by David Haines .....	SONG 07
8. <i>It Would Have Been Enough</i> (Albert Einstein) by David Bass.....	SONG 08
9. <i>Galileo</i> (Galileo Galilei) by Haggerty Third Grade and Andrea Gaudette.....	SONG 09
10. <i>Jane with the Chimps</i> (Jane Goodall) by Bruce Lazarus .....	SONG 10
11. <i>Beauty and a Brain</i> (Hedy Lamarr) by Lauren Mayer.....	SONG 11
12. <i>Ada Lovelace</i> by Michael Ching and Jennifer L. Knox.....	SONG 12
13. <i>The Ballad of Michelson and Morley</i> (Albert Michelson .....	SONG 13
and Edward Morley) by Ruth Hertzman-Miller and Meg Muckenhoupt	
14. (Isaac Newton - placeholder).....	SONG 14
15. <i>In Praise of Emmy Noether</i> by Dan and Christine Kallman.....	SONG 15
16. <i>Schrödinger's Cat</i> (Erwin Schrödinger) by Dan and Christine Kallman.....	SONG 16
17. <i>Sparks Fly</i> (Nikola Tesla and Thomas Edison) by Dan Kohane.....	SONG 17
and Colin Killick	
18. <i>Down to Earth</i> (Neil deGrasse Tyson) by Tim Maurice .....	SONG 18

### **ACCESSING THE PRACTICE TRACKS:**

1. Go to [www.familyopera.org](http://www.familyopera.org)
2. On the left, under User Login, enter  
    Username: ncfo-chorus  
    Password: GOS-2016
3. Above left, under Content Menu, click on “2016 Giants of Science Performer Materials”
4. Click on “PRACTICE MP3s and LYRICS/SHEET MUSIC”

## **GIANTS OF SCIENCE PERFORMANCE ORDER**

- SONG 02. 287BC - 212BC Archimedes
- SONG 09. 1564 - 1642 Galileo
- SONG 05. 1473 - 1543 Nicolaus Copernicus  
and 1571 - 1630 Johannes Kepler
- SONG 07. 1809 - 1882 Charles Darwin  
and 1823 - 1913 Alfred Russell Wallace
- SONG 12. 1815 - 1852 Ada Lovelace
- SONG 13. 1852 - 1931 Albert Michelson  
and 1838 - 1923 Edward Morley
- SONG 17. 1856 - 1943 Nikola Tesla  
and 1847 - 1931 Thomas Edison
- SONG 03. 1863 - 1941 Annie Jump Cannon
- SONG 04. 1860 - 1943 George Washington Carver
- SONG 01. MEDLEY
- SONG 06. 1867 - 1934 Marie Curie
- SONG 08. 1879 - 1955 Albert Einstein
- SONG 15. 1882 - 1935 Emmy Noether
- SONG 16. 1887 - 1961 Erwin Schrödinger
- SONG 11. 1914 - 2000 Hedy Lamarr
- SONG 10. 1934 - still alive Jane Goodall
- SONG 18. 1958 - still alive Neil deGrasse Tyson

**SONG 1. 2015 Cambridge Public School Medley by  
Cambridge Public School Students, facilitated,  
tweaked, and arranged by David Haines**

**SONG 1: TO BE A SCIENTIST**

What is science? What is it for?  
We can all be scientists: search and explore,  
Think, ask a question, hypothesize,  
Prepare an experiment, do it, use your eyes,  
Record your information, see what  
    you can [see what you can] find,  
Reach your conclusion, use your mind [use your mind]!

**SONG 2: NEWTON'S LAWS**

I think Newton's Laws of Motion  
Are a great important notion  
To change an object's direction or speed,  
A push, punch, poke is all you need [all you need].

**SONG 3: THROUGH MY MAGNIFYING GLASS**

Through my magnifying glass, I examined  
Hair, and it looked like spaghetti or a stick.  
Then I inspected an insect, an ant,  
I could see hairs on its back! Fantastic!  
I tried to study a snowflake, but I never could catch one.  
I tried to study a snowflake, but I never could catch one.

**SONG 4: UNSUNG HERO**

I'm orbiting the Moon in Apollo eleven,  
Gazing through the porthole at the star-studded heavens,  
Checking dials, pushing buttons,  
    turning knobs all day [all day],  
Making sure that Neil and Buzz are on the Moon okay,  
Making sure that Neil and Buzz are on the Moon okay.

**SONG 5: STROBE**

Strobe photography, strobe photography,  
Strobe, strobe photography, strobe, strobe, strobe!

At Massachusetts Institute of Technology,  
Doc Egerton developed strobe photography,  
Made milk crown, applesauce, banana split,  
Stopped time with synchronized flash, that's how he did it!

Strobe photography, strobe photography,  
Strobe, strobe photography, that's how he did it!

**SONG 6: WHAT HAPPENED TO THE MARIGOLDS?**

What happened to the marigolds? [What happened?]  
What happened to the marigolds? [What happened?]

**SONG 6 (continued)**

We sowed grass and marigold seeds in yogurt pots  
    of dirt [of dirt].  
Grass grew fast, but the marigolds didn't, were the  
    marigold seeds hurt? [Were they hurt?]  
Was there too much water or [water or] sun?  
Not enough food to feed each one?  
Was the soil too patted [too patted] down  
For the seeds to grow from underground?  
    [Underground? Duh doo bee down]

What happened to the marigolds?  
    [What happened? Why?]  
Why did they die? [Why did they die?]  
What happened to the marigolds,  
And why did the grass thrive [alive]?  
And why did the grass thrive?  
What happened to the marigolds?  
    [What happened?]  
What happened to the marigolds?  
    [What happened?]

Would you say our experiment failed, 'cause the  
    marigold seeds didn't grow?  
    [What happened to them?]  
Would you say we learnt nothing from our  
    experiment? We'd say no...[no...]**NO!**  
We learnt some reasons [reasons] why  
Seeds may fail to flourish then die.  
Next time we can [we can] try  
To better the chances that they'll survive  
    [They'll survive, alive, alive]

What happened to the marigolds?  
Why did they die? [Why did they die?]  
What happened to the marigolds,  
And why did the grass thrive [alive]?  
And why did the grass thrive?  
What happened to the marigolds?  
    [What happened? What?]  
What happened to the marigolds?



## SONG 2. *Archimedes* by Lauren Mayer

Archimedes lived in Greece in the third century B.C.,  
And was one of the most brilliant minds in all of history.  
As a math'matician, engineer, and physicist, they say  
He discovered and invented things that we still use today,  
About how things worked and why, he did experiments to learn.  
He applied physics to math and math to physics in return,  
And he calculated pi with a precision so unique.  
Archimedes, the man who said "Eureka!"

Hydrostatics and mechanics he invented, also he  
Came up with the basic concept of the cent'r of gravity,  
Wrote of levers and of pulleys, and he figured what to do  
To move water up a hill using an Archimedean screw.  
He proved formulas to calculate the volume of a sphere,  
And showed how to use exponents when those huge numbers appear.  
Why, to list all his accomplishments, this song could take a week.  
Archimedes, the man who said "Eureka!"

Legend says the king asked him to figure if his crown was gold,  
And he took a bath and saw how much water the tub could hold,  
Then he shouted out "Eureka, a discovery I've got  
About weight and water, and why some things float and some do not."  
Is it true or just a legend, I couldn't really swear,  
'Cause there's no one we can talk to who actually was there.  
But when of Archimedes historians should speak, ah,  
They call him the man who said "Eureka!"  
Archimedes, the man who said "Eureka!"



**SONG 3. Annie Jump Cannon: Celestial Pioneer by Bruce Lazarus**

Little Annie learned to play piano,  
But it was clear she yearned to know the stars.  
Her mother led her to an upstairs window  
To witness constellations all aglow.

Someday she would know the stars  
As observed as narrow spectral bars.  
But on this Earthly sphere, aware of what is near,  
The wind through trees, the buzzing bees,  
She could not hear.

At Harvard she invented a new system  
Of classifying stars by letter names.  
They say she classified three stars a minute,  
About three hundred thousand stars in all.

“O B A F G K M” she ranked the stars  
She observed as narrow spectral bars.  
But on this Earthly sphere, aware of what is near,  
A baby’s cry, a lullaby,  
She could not hear.

Star by star, one by one,  
Through the years, resolutely.

**Sopranos/Altos:**

“O” stars are blue and hot, “B” stars are blue-white,  
“A” stars are white, “F” type stars are yellow-white.  
The Sun is a yellow “G” star, and it’s bright enough!  
“K” stars are orange, “M” type stars are red and colder.

“O” stars are blue and hot, “B” stars are blue-white,  
“A” stars are white, “F” type stars are yellow-white.  
The Sun is a yellow “G” star, and it’s bright enough!  
“K” stars are orange, “M” type stars are red and colder.

**All:**

Scarlet fever took her sense of hearing,  
But Annie Cannon’s sight was never dimmed.  
To distant stars you peer, celestial pioneer,  
With telescope and spectroscope,  
You need not hear.

**Tenors/Basses:**

This one’s an “O”, That one’s a “B”,  
This one’s an “A”, One more “B” star...  
Star by star, one by one,  
Through the years, persevering.

This one’s an “O”, That one’s a “B”,  
This one’s an “A”, One more “B” star...  
Star by star, one by one,  
Through the years, never-ending.

**Descant:**

Annie  
Jump Cannon,  
Annie  
Jump Cannon.





#### **SONG 4. *Peanut Man* by Ruth Hertzman-Miller and Joanna Brown**

VERSE 1: Round about the Civil War, the cotton farms down south  
Would plant the same crops ev'ry year till the nutrients leached out.  
George Washington Carver wanted to help his fellow man,  
Knew legumes could feed nitrogen back into the land.

CHORUS (Unison): You must learn all you can, George, you must learn all you can.  
Little did he know back then, he'd be the peanut man.

VERSE 2: In the southern town of Diamond, a boy named George is born.  
He starts his life in slavery upon the Carvers' farm.  
His brothers and his sisters mostly die when they are young.  
He's known throughout the neighborhood because of his green thumb.

CHORUS (4-part): You must learn all you can, George, you must learn all you can  
[learn all you can].  
[Little] did he know back then, he'd be the peanut man.

VERSE 3: To get himself through college, he finds he has to roam;  
Black students, even bright ones, aren't welcome close to home.  
He heads out to Neosho, and the school's closed for the night.  
He meets Mariah Watkins, her words will change his life.

CHORUS (4-part)

VERSE 4: In eighteen-ninety-six, he gets a call from Booker T.  
We need you in Tuskegee at our University.  
He preaches to the farmers on self-sufficiency  
And shows how crop rotation can improve efficiency.

SPOKEN SOLO: *Here's a list of some of his inventions...*

Shaving cream and antiseptics, printer's ink and axle grease,  
Insulation, rubbing oil, linoleum, bleach and cheese,  
Rubber tires from goldenrod, molasses, milk and glue,  
Wood stains, flour, cereal, silk and paper, too.

VERSE 5: Word of his inventions now travels far and wide;  
Presidents and bus'ness leaders ask him for advice.  
The scourge of the boll weevil damaged cotton in the South;  
Peanuts grew and flourished thanks to Doctor Carver's clout.

CHORUS (4-part)

CODA (sopranos/altos): You've journeyed through this land, George, you've got so many fans.  
Great scientist and hero, you've become the Peanut Man.

CODA (tenors/basses): You've journeyed through this land, George, you've got so many fans, so many fans.  
You're a hero, you've become the Peanut Man.



## SONG 5. *Copernicus and Kepler* by Lauren Mayer

### **Soprano/Melody:**

Around and round the sun we go,  
Oh we all agree today.  
But not that long ago, you know,  
We thought it was the other way.  
Yeah, we all learned how the planets turn  
From Copernicus and Kepler.

Copernicus was an astronomer  
In the sixteenth century.  
Put the sun at the center of the universe,  
And his work made history.  
But back then he didn't get a great response,  
He was the rebel of the Renaissance.

The views were diff'rent way back then,  
Their contemporaries dismissed 'em.  
But thanks to both these brilliant men,  
We understand our solar system.  
Yeah, we all learned how the planets turn  
From Copernicus and Kepler.

Eighty years later, Johannes Kepler  
Expanded on this notion  
Of astronomy and came up with three  
Laws of planetary motion.  
How orbits work he was computin',  
Inspiring guys like Isaac Newton.

Around and round the sun we go,  
Oh we all agree today.  
But not that long ago, you know,  
We thought it was the other way.  
Yeah, we all learned how the planets turn  
From Copernicus and Kepler.  
Yeah, we all learned how the planets turn  
From Copernicus and Kepler.  
Oh yeah!

### **Others:**

Ooo, ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo, ooo,  
From Copernicus and Kepler.

Ooo, shoo-wah, doo-wah,  
Ooo, ooo, shoo-wah, doo-wah,  
Ooo, shoo-wah, doo-wah,  
Ooo, ooo, shoo-wah, doo-wah,  
Ooo, wah, ooo, wah,  
**BASS:** The rebel of the Renaissance.

Ooo, ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo, ooo,  
From Copernicus and Kepler.

Ooo, shoo-wah, doo-wah,  
Ooo, ooo, shoo-wah, doo-wah,  
Ooo, shoo-wah, doo-wah,  
Ooo, ooo, shoo-wah, doo-wah,  
Ooo, wah, ooo, wah,  
**BASS:** Inspiring guys like Isaac Newton.

Ooo, ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo,  
Ooo, shoo-wah, doo-wah,  
Ooo, ooo,  
From Copernicus and Kepler.  
Yeah, ooo, wah, ooo, wah  
From Copernicus and Kepler.  
Oh yeah!



**SONG 6. Madame Marie Curie by Andrea Gaudette**

**SOPRANO:**

My name is Curie, Madame Marie Curie.  
I won the Nobel prize, with Pierre Curie,  
In nineteen hundred three,  
For our experiments with certain elements  
With luminosity.

**CHORUS:**

Nothing in life is to be feared.  
It is only to be understood.  
All throughout my life, the new sights of nature  
Have caused me to rejoice, rejoice like a child.

Uranium had certain properties.  
I coined this phenomenon radioactivity.  
I won the prize again in nineteen and eleven  
For my discoveries of two new elements  
With atomic properties of radioactivity,  
Thus opening the field of radiology.  
--CHORUS--

And in the war in France, I drove an ambulance  
With the new technology of radiology.  
By nineteen thirty-three, radiation poisoned me.  
I bore a great responsibility  
To dedicate my life to scientific beauty  
And make a better world for humanity.  
--CHORUS--

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**ALTO:**

My name is Madame Marie Curie.  
I won the Nobel prize, with Pierre Curie.  
Nineteen hundred three,  
For our experiments with certain elements  
With luminosity.

**CHORUS:**

Nothing in life is to be feared.  
It is only to be understood.  
Through my life, the new sights of nature  
Have caused me to rejoice.

Uranium had certain properties;  
I coined this phenomenon radioactivity.  
I won the Nobel prize again  
For my discoveries of two new elements  
With atomic properties of radioactivity,  
Thus opening the field of radiology.  
--CHORUS--

In the war in France, I drove an ambulance.  
I died of radiation poisoning.

I bore a great responsibility  
To dedicate my life to scientific beauty  
And make a better world for humanity.  
--CHORUS--

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**TENOR:**

Marie Curie won the Nobel prize,  
Nobel prize in Physics  
For our experiments with certain elements  
With luminosity.

**CHORUS:**

Nothing in life is to be feared,  
Only to be understood.  
Through my life, the new sights of nature  
Have caused me to rejoice.

Uranium had certain properties;  
I coined this phenomenon radioactivity.  
Marie Curie won the Nobel prize,  
Nobel prize in Chemistry  
For the discoveries of two new elements  
With luminosity.  
--CHORUS--

In the war in France, I drove an ambulance.  
I died, but I bore a great responsibility  
To dedicate my life to beauty  
And make a better world for humanity.  
--CHORUS--

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**BASS:**

Nobel prize, Nobel prize in Physics  
For our experiments with certain elements  
With luminosity.

**CHORUS:**

Only to be understood.  
Through my life, the new sights of nature  
Have caused me to rejoice.

Uranium had certain properties;  
I coined this phenomenon radioactivity.  
Nobel prize, Nobel prize in Chemistry  
For the discoveries of two new elements  
With luminosity.  
--CHORUS--

In the war in France, I drove an ambulance.  
I had a responsibility  
To dedicate my life to beauty  
And make a better world for humanity.  
--CHORUS--



**SONG 7. *Mister Darwin, Mister Wallace, Mister Matthew*  
by David Haines**

VERSE 1 (ALL):

Mister Darwin on the Beagle sailed the oceans and seas  
To South America and Tahiti and New Zealand, Maldives,  
To Australia and Tasmania, Keeling Island and Saint Helena,  
To Ascension and Mauritius and Brazil, de Verdes and Galapagos Islands,  
Mister Darwin on the Beagle sailed away for five years.

VERSE 2 (ALL):

Mister Darwin on his journey watched the plants, beasts, and birds.  
He drew pictures, gathered samples, kept a journal full of words.  
He saw beetles, iguanas, giant tortoises, flightless cormorants,  
He saw finches, frogs and lizards, duck-billed platypuses, albatrosses,  
Mister Darwin wondered where they came from, and he soon had ideas.

VERSE 3 (ALL):

Mister Darwin, when he got home, wrote these new ideas down,  
But he di'n't like to offend so didn't share them around.  
Twenty years passed, Mister Darwin got a letter from a Mister Wallace,  
Now this young man had discovered just the same thing Mister Darwin  
Found aboard the Beagle, Mister Wallace had the self-same ideas.

VERSE 4 (ALL):

Mister Darwin and Mister Wallace formed a team for some time,  
But Mister Darwin wrote his big book in eighteen hundred and fifty-nine,  
"On the Origin of Species by Natural Selection".  
Ev'rybody read the book, ev'rybody had an o-pin-i-on.  
Some people praised it, others damned it, Mister Darwin's big book.

VERSE 5 (ALL):

Mister Matthew was a gard'ner and when he read Darwin's book,  
He wrote a letter to the paper saying, "Just take a look  
At the book I wrote nearly thirty years ago, I had all the same ideas."  
No one listened and Mister Matthew and Mister Wallace were forgotten  
Over all the years, and now we just remember Mister Darwin's big book.

CODA (ALL, four parts):

Now when you think about natural selection,  
Just spare a thought for those forgotten two.  
Remember those names, just a brief recollection,  
Alfred Russell Wallace and Patrick Matthew.





**SONG 8. *It Would Have Been Enough* (Albert Einstein) by David Bass**

Now when we think of genius we think of Albert Einstein.  
Born to a humble bus'nessman in eighteen seventy-nine.  
The greatest mind in humankind, or so we all believe.  
But what exactly did this awesome physicist achieve?

In nineteen hundred five when he was only twenty-six,  
He explained Brownian motion, proved that molecules exist,  
Photoelectric effect, black body radiation,  
That light is both a wave and particle was his explanation.

That same year he developed special relativity,  
Explaining the experiment of Michelson-Morley.  
Velocity of light is "c" for ev'ry ref'rence frame,  
And "E" equals to "m" "c" squared rose to [to] the height of fame.

SOP/ALT/TEN:

Ooo, physics for this work,  
Time [while working] as a patent clerk.

BASS:

He later got the Nobel Prize in physics for this work,  
Which he did in his spare time while working as a patent clerk.

ALL:

By any test, [he was] the best, he [really] knew his stuff.  
[And] if that was all that Einstein did, it would have been enough!

Chorus:

Albert Einstein had a common touch,  
And in nineteen oh five he did so much.  
The problems that he solved that year were challenging and tough,  
And if that was all that he had done, it would have been enough. Hey!  
Albert Einstein, Albert Einstein.  
Yai dee dum bah dee dai dee da da dum!

He became an academic in his speciality,  
Then explained why things are opalescent near criticality,  
Why things appear redder as they veer further and further away.  
He prophesied how lasers could be engineered some day.

And then in nineteen fifteen general relativity  
Einstein gave a unified account of gravity,  
A paradigm of space and time, envisioning a curved  
Geometry of spacetime that has since become observed...

As rapidly decaying orbits of two neutron stars,  
Precession of the orbits of Mercury through Mars,  
As light that bends, as gravity lenses formed by galaxies,  
And as black holes when stars collapse in [sing] singularities.

**SONG 8. *It Would Have Been Enough* (Albert Einstein) by David Bass (continued)**

SOP/ALT/TEN:

Ooo, up in outer space,  
[What] [exactly has spurred] vigorous debates.

BASS:

It indicates there is dark matter up in outer space,  
Though what that is exactly has spurred vigorous debates.

ALL:

This would, you know, make [any] Joe an avid [Einstein] buff,  
[And] if that was all that Einstein did, it would have been enough!

Chorus:

Albert Einstein was able to replace  
How we define gravitation, time and space.  
Relativity can sometimes be as weird as Shia LaBeouf,  
And if that was all that he had done, it would have been enough. Hey!  
Albert Einstein, Albert Einstein.  
Yai dee dum bah dee dai dee da da dum!

Satyendra Bose predicted, working with our hero,  
Superfluid helium near absolute zero.  
Einstein foretold a space wormhole (or Einstein-Rosen bridge),  
And with a student patented a diff'rent kind of fridge.

Einstein predicted gravity waves and quantum entanglement too,  
And he explained how rivers erode their banks the way they do,  
Why in a cup, when they're stirred up, the tea leaves settle in the middle.  
And if that were not enough, he played a wicked awesome fiddle.

Einstein encouraged FDR to build atomic bombs,  
Then when the war was over said the arms race gave him qualms.  
He set his sights on civil rights before it was in fashion.  
A socialist, he fought against McCarthy [against McCarthy] [with a passion].

[But] one thing that he couldn't do no matter how he tried  
Was show how the fundamental forces all are [uni-] unified.  
Einstein, you clown, you let us down. You failed this final task.  
We only wanted one more thing. Was that too much to ask?

Chorus:

Albert Einstein failed for thirty years  
To cross this goal line, despite his sweat and tears.  
He wrote three hundred papers, but we say he wasn't done,  
'Cause we would not be happy till he wrote three hundred one.

Albert Einstein struggled till the end,  
But unifying fields was past his ken.  
And so we fear his whole career was just a bunch of fluff,  
Without a theory of everything, he didn't do enough.  
Poor Albert Einstein, Albert Einstein.  
Yai dee dum bah, he didn't do enough! Hey!

**SONG 9. *Galileo* by the Haggerty School Third Grade and Andrea Gaudette**

Galileo was a fellow and he liked to look at the stars.

He was born in fifteen sixty-four,  
Died when he was seventy-eight,  
Found out that ev'rything falls at the same speed  
Despite its weight.

Galileo was a fellow and he liked to look at the stars.

Then he built a telescope  
And made a compass,  
Found the four moons of Jupiter  
And made the first thermometer.

Galileo was a fellow and he liked to look at the stars.

He was a teacher, but the preachers  
Despised his ideas about how the Earth isn't  
The center of the universe.  
So he got thrown in jail,  
Then he got locked in his house.

Galileo was a fellow and he liked to look at the stars.



**SONG 10. *Jane and the Chimps* by Bruce Lazarus**

VERSE 1:

Jane Goodall went to Gombe  
To learn about chimps,  
Never realizing she would be there to stay.  
She was told, "Stay aloof",  
But she named them and waited.  
Oh Jane, never despair. We see, we know  
That aloofness makes one simply unaware, unaware,  
That aloofness makes one simply unaware.

VERSE 2:

David Greybeard, Goliath his friend,  
Took her in to their troop.  
Jane thought, "here is a bound'ry I can transcend."  
Then came Flo, and many more,  
And in time she was family.  
Jane, never despair. We see, we know  
To believe apes are brute beasts is quite unfair, quite unfair,  
To believe apes are brute beasts is quite unfair.

VERSE 3:

Chimpanzees are beings like us.  
They laugh, they sing,  
They hold hands and know life is precarious.  
Say "hello" and "good night",  
Getting mad, getting sad.  
Oh Jane, never despair. We see, we know  
To protect life in all its forms ev'rywhere, ev'rywhere,  
To protect life in all its forms ev'rywhere.



**SONG 11. *Beauty and a Brain* by Lauren Mayer**

**CHORUS:**

Hedy Lamarr, the famous movie star,  
Did more than entertain.  
Smart and scientific, her inventions were terrific,  
She had beauty and a brain.

ALL: Beauty and a brain.  
She had beauty and a brain.  
She had beauty and a brain.

**VERSE 1:**

Her life was more exciting than any movie plot.  
To start, she was smarter than anyone thought.  
Born in Vienna to a fam'ly of means,  
Became a famous actress while still in her teens.  
Wed a weapons magnate, a much older man.  
He made her come to meetings that were part of the Nazi plan.  
He watched her ev'ry movement, she grew more afraid,  
Till she finally escaped him, disguised as her maid.  
--CHORUS--

**VERSE 2:**

She made her way to London, and then to Hollywood.  
Became a major actress, her movies were quite good.  
But with Hitler in Europe, oh what could she do?  
No formal science training but she knew what she knew.  
Radio waves are intercepted with ease.  
But people, when they talk are always changing frequencies.  
So frequency hopping was the remedy,  
And she invented spread spectrum technology.  
--CHORUS--

**VERSE 3:**

Received a patent, [now] that's hard to get,  
But the army just wasn't ready yet.  
[So though] her idea was something sublime,  
She was twenty years ahead of her time.  
They told her selling war bonds was what she could do,  
But finally the industry caught up in sixty-two.  
Diff'rent systems developed from it, by and by.  
Without Hedy's invention, we might not have Wi-Fi!

**FINAL CHORUS:**

SOPRANO: Hedy Lamarr, famous movie star, Hedy Lamarr,  
ALTO (and kids): Hedy Lamarr, the famous movie star,  
Did more than entertain.  
Smart and scientific, her inventions were terrific, she had  
TENOR/BASS: Hedy Lamarr, famous movie star, Hedy Lamarr, terrific,





**SONG 12. Ada Lovelace by Michael Ching**

**SOPRANO:**

A A A A Da da da da da da da da  
A A A A Da da da da da da da da  
Ada Lovelace had a lovely brain,  
And it was quite keen or so they say.  
At math especially,  
She was exceptionally keen.

Ada Lovelace loved her twos and ones,  
And fives and nines, and somes and nones.  
She saw numbers in the air,  
Flying here and dancing there.

A A A A Da da da da da da da da  
Ada Lovelace loved to postulate  
And theorize on odds. She thought,  
“I can guess how things will move with math  
And then map it out!”

A A A A Da da da da da da da da  
A A A A Da da da da da da da da  
If A then D, then A again, on to infinity.  
If A then D, then A again, on to infinity.  
And she was right in thinking so,  
For this is how computers move:

If yes, then go. But stop if no.  
If yes, then go. But stop if no.  
{Repeat until cut.}  
Thank you, Ada Lovelace!  
If yes, then go. But stop if no.  
Thank you, Ada Lovelace!  
Thank you, Ada Lovelace!  
If yes, then go. But stop if no.

**ALTO:**

A A A A Da da da da da da da da  
A A A A Da da da da da da da da  
Ada Lovelace had a lovely brain,  
And it was quite keen or so they say.  
At math especially,  
She was exceptionally keen.

Ada Lovelace loved her twos and ones,  
And fives and nines, and somes and nones.  
She saw numbers in the air,  
Flying here and dancing there.

A A A A Da, A A A A  
Ada Lovelace loved to postulate  
And theorize on odds. She thought,

“I can guess how things will move with math  
And then map it out!”

Da da da da da da da da  
A A A A Da da da da da da da da  
A A A A  
If A then D, then A again, on to infinity.  
If A then D, then A again, on to infinity.  
And she was right in thinking so,  
For this is how computers move:

If yes, then go. But stop if no.  
If yes, then go. But stop if no.  
{Repeat until cut.}  
Thank you, Ada Lovelace!  
If yes, then go. But stop if no.  
{Repeat this line 5 more times.}

**MEN:**

Da da da da da da da da  
A A A A Da da da da da da da da  
A A A A  
Ada Lovelace had a lovely brain,  
And it was quite keen or so they say.  
At math especially,  
She was exceptionally keen.

Ada Lovelace loved her twos and ones,  
And fives and nines, and somes and nones.  
She saw numbers in the air,  
Flying here and dancing there.

Da da da da da da da da  
A A A A  
Ada Lovelace loved to postulate  
And theorize on odds. She thought,  
“I can guess how things will move with math  
And then map it out!”

Ada Lovelace thought, “If THIS then THAT”  
If YES then GO, if STOP then...NO  
If A then D, then A again, on to infinity.  
If A then D, then A again, on to infinity.  
And she was right in thinking so,  
For this is how computers move:

If yes, then go. But stop if no.  
If yes, then go. But stop if no.  
{Repeat until cut.}  
Thank you, Ada Lovelace!  
If yes, then go. But stop if no.  
{Repeat this line 5 more times.}



**SONG 13. *The Ballad of Michelson and Morley***  
**by Ruth Hertzman-Miller and Meg Muckenhoupt**

All scientists agree, a theory isn't true  
Unless you do a test and see if it can be disproved.  
And if your theory's wrong, you have to let it go,  
And try to make a new one up from all the facts you know.

You keep the best idea, the rest you throw away,  
And that is why we celebrate two scientists today.

CHORUS:

They were wrong! They were wrong!  
They were wrong about the ether they believed in so long,  
There was never any ether, so they never could be right,  
But Michelson and Morley helped us see the light.

The ether was a substance, so as the earth would spin  
The ether made a current where the light wave had to swim.  
They set up light and mirror to send light against the flow,  
And the scientists expected that the light wave would be slow.

The mirror was half-silvered so the light beam's other half  
Would flow across the ether and be fast, fast, fast.  
Two more mirrors would reflect the light beams, one and two,  
And from their speeds an interference pattern would ensue.  
--CHORUS--

In the end there was no pattern, and no matter where they'd go  
The light waves traveled just the same, there was no fast or slow.  
They repeated their experiment and rechecked ev'ry bit,  
But they always got the same result, and finally they quit.

Because of their experiment the ether age was through.  
They had to seek enlightenment and think of something new.  
They wrote three diff'rent papers so that ev'ryone would hear,  
And Michelson and Morley made it very, very clear:  
--CHORUS--

So remember, all you scientists, when ever you feel blue,  
It could be that your problem is a theory that's not true.  
The ether was a good idea, until it turned out wrong  
Because there was no evidence for ether all along.

While Michelson and Morley may have thought they failed the test,  
Their biggest failure was their most spectacular success!

They were right! They were right!  
And we'll be forever grateful that they found the speed of light,  
When they gave up on ether, they were right as right can be.  
They set the stage for Einstein and relativity.



**SONG 15. *In Praise of Emmy Noether* by Dan and Christine Kallman**

In the world of mathematics, there's a name we won't forget;  
Modern algebra and physics are most deeply in her debt.  
A genius, Einstein called her, as he justified the fame  
Of this gentle noble spirit: Emmy Noether is her name.

**CHORUS:**

Emmy Noether, Emmy Noether.  
Let us sing it all together, [together,]  
You shed great light on the puzzling world of matter,  
Painting large and small with elegance.  
Your theorems about symmetry explain the world so beautifully.  
Now we raise our song together in praise of Emmy Noether.

**VERSE 1:**

Born in Gottingen, Germany in eighteen eighty-two,  
A time and place where scientists were eager for the new.  
She studied dance and languages, but mostly she loved math,  
And soon she was determined: abstract algebra was meant to be her path.

**VERSE 2:**

She was gifted with intellect, but had to fight the throng  
Of men who thought that women being teachers was plain wrong.  
Though some despised her gender and tried to hold her down,  
Some others would defend her and the brave, impassioned Emmy rallied on.  
--CHORUS--

**VERSE 3:**

In the thirties in Germany, vile Hitler took command,  
And Emmy being Jewish had to flee her own homeland.  
She traveled to America and heard her praises sung,  
But then she suffered illness, and our brilliant Emmy perished far too young.  
--CHORUS--

Of Emmy Noether,  
We sing together  
Of Emmy Noether.  
Hmm...



**SONG 16. *Schrödinger's Cat* by Dan and Christine Kallman**

PART 1:

This is the knell for Schrödinger's cat.  
He wasn't too well. Have you heard about that?  
He died in a box, and also he didn't.  
Both dead and alive, but we cannot look in it.

PART 2:

The random reality of radioactivity  
Makes unknown the status of Cat's viability.  
This paradox persists unless it's observed  
For quantum mechanics is strangely absurd.

PART 3:

Dong! Dong! Dong! Dong!  
The cat is dead, or so I've heard.  
Meow! Meow! Meow-yow-yow-yow!  
And he's also alive!  
Strangely absurd!





**SONG 17. *Sparks Fly* by Dan Kohane  
and Colin Killick**

EDISON:

Perspiration over inspiration  
That was Thomas Edison's way  
Don't sit waiting for a dream to seize you  
Just put the work in every day.

Show him a genius and he'd tell you:  
Maybe that's somebody I'll pay.  
But give me trial, trial and error.  
Idle thinking leads you astray.

TESLA:

Currents floating in the air...  
Nicola felt them  
Set a task that can't be done,  
and watch it happen.  
No toil, right the first time  
As if by magic.  
Tesla moved the world  
without a string.

CHORUS:

At that time, the name Edison meant modern,  
The man who could bring marvels to your doors.  
Phonographs and telephones and light bulbs,  
He perfected them, and put them all in stores.  
In Menlo Park, his factory of science  
His hired minds invented 'round the clock.  
And in walks a young Serbian named Tesla,  
Who seemed like he could teach circuits to talk!  
He tells his boss:

TESLA:

Your generator's worthless!  
I can build it better! Cheaper, too!

CHORUS:

Edison laughs:

EDISON:

All right, all right son...  
There's fifty thousand in it if you do!

CHORUS:

But then when Tesla pulled it off,  
Edison chuckled.

EDISON:

Oh, Nick... you'll have to learn our  
Yankee jokes!  
But I'll be fair... here's ten bucks more per hour.

CHORUS:

And that was the last time they ever spoke!

Inventors of the world were after power.  
Bring it into people's homes and you'd be king.  
So Edison staked an empire on his answer:

EDISON:

Direct current--DC is just the thing!

CHORUS:

A single voltage pushing down a wire,  
Constant and dependable and sure.

EDISON:

Straight from the power plant to your Edison  
lightbulb,  
the way gas moves, but safe and clean and pure.

CHORUS:

Meanwhile... Tesla scraped his way on pennies.  
They paid him scraps to fix a clock or dig a ditch.  
But finally investors and a breakthrough  
Gave us the world where you can flip a switch.

TESLA:

With D.C. power, signals fade out quickly...  
You'd need a power plant every few blocks...  
The alternative, A.C., seems far too wild...  
But I can find a way to tame its shocks!

CHORUS:

A. C. is a wave within the wire,  
A roller-coaster current, high and low.  
Transformers build the peaks up ever higher,  
Till it can fly five hundred miles in just one go.

**SONG 17. *Sparks Fly* by Dan Kohane  
and Colin Killick (continued)**

CHORUS:

When it got somewhere you couldn't do much  
with it...

Just zap yourself...just zap yourself or cast a  
flick'ring light...

Till Tesla trapped its pow'r in rings of magnets,  
And his motors roared to life in all their might!

George Westinghouse gave Nicola a fortune:  
Two fifty for each horse-power he sold.  
His company surged out across the nation,  
Which made Edison's blood run ice cold.  
He tried to tell the world,

EDISON:

A.C. is deadly!

CHORUS:

While Tesla told the world of dreams in store.  
He lit the World's Fair's shining city safely,  
And in the end A. C. would win this war!

EDISON:

Seek perfection, build on others  
That was Thomas Edison's way  
The one who dreams is not the winner--  
It's the one who makes the dream pay.  
So Tesla beat him, he kept working  
Gave us marvels, told us to play.  
X-ray scanners, movie cameras,  
All his gadgets with us today...

TESLA:

Currents, fleeting, there and gone  
Nicola chased them...  
Tried things that could not be done  
And they would happen  
Though, not always in his time.  
Some seemed mere magic...  
Until the world caught up  
with Tesla's dreams.

**SONG 18. *Down to Earth* by Tim Maurice**

[SOPRANO] There he is, inside the  
Hayden Planetarium.  
A boy is thrilled by the vastness of space.  
At nine years old, the universe calls to him.

[ALTO] As a teen, he learns a lot about astronomy

[TEN/BASS] From teachers at Hayden  
Who are wonderf'ly inspiring.

[ALL] He wants to share their passion for  
science education.  
One day he will say:

Come with me, behold the cosmos!  
Let us see how a galaxy is formed.  
Look at all, all the beauty of the universe.  
[SOP/ALTO] If you seek to understand,  
[TEN/BASS] I will help to show the way.  
[ALL] Neil deGrasse Tyson,  
[SOP/TEN/BASS] Bringing the universe  
[ALL] Down to Earth.

[TEN/BASS] He studied hard, enrolled at Harvard University.  
[SOP] Then Columbia, where he earned his Ph.D.  
[ALTO/TEN/BASS] As an astrophysicist,  
He begins his research  
[SOP/ALTO] On stellar evolution  
[TEN/BASS] Type "One A" Supernovae,  
[ALL] And Galactic Astronomy.

Come with me, behold the cosmos!  
Let us see how a galaxy is formed.  
Look at all, all the beauty of the universe.  
[SOP/ALTO] If you seek to understand,  
[TEN/BASS] I will help to show the way.

[SOP] What's the most profound thing about the universe?  
[ALT/TEN/BASS] What's the most profound thing?  
[TEN/BASS] The most common elements in the human body  
[SOP/ALTO] Hydrogen, Oxygen, Carbon and Nitrogen.  
[TEN/BASS] Are among the most common in the universe.  
[ALTO] We are made from the stars.

[SOP] We come from the stars.

[ALTO] Now he serves as director of the  
Hayden Planetarium,

[SOP] And he's a host for many TV show  
on science.

[SOP/TEN/BASS] He's world-renowned, and  
he educates.

Look how far he's come!

[ALL] Now we hear him say:

Come with me, behold the cosmos!  
Let us see how a galaxy is formed.  
Look at all, all the beauty of the universe.  
[SOP/ALTO] If you seek to understand,  
[TEN/BASS] I will help to show the way.  
[ALL] Neil deGrasse Tyson,  
[SOP/TEN/BASS] Bringing the universe  
[TEN/BASS] Bringing the universe  
[SOP/ALTO] Down to Earth.  
[SOP] Bringing the universe  
[ALTO/TEN/BASS] Down to Earth.  
[ALL] Down to Earth.