Goals: Understand how evolution works through gradual changes over time.
             Correlate DNA sequence conservation with evolution.

Activities: Play Vehicular Evolution game.
                   Align by hand rDNA sequences from mystery species.
                   Use NCBI to BLAST unknown rDNA sequences and ID organism of origin.

1) Vehicular Evolution
      You are the first people in the world to play the game of **Vehicular Evolution©** . I created it for 6th Graders at Woodlawn, so let me know what you think of it. If it is any good, we can share it with other schools. Maybe one of you will start a small business selling it to schools all over the country! Wouldn't your stock holders be pleased with that outcome?

Object of the Game
For the next few minutes, you get to simulate evolution. Evolution is a process where those individuals who are most <u>fit</u> are <u>selected</u> by nature to continue living and reproducing. For this game, each team of two students will create a series of vehicles to match ever-changing global conditions. You may use the pre-cut shapes or create new shapes using the limited resources provided to you (blank paper and one pair of scissors for the entire class). The goal is to create a new vehicle that works well in the current environmental conditions and to survive all three rounds of selection.

We will do one practice round of Vehicular Evolution. Then we will play three real rounds.

How to Play
1) Start with the paper shapes and blank paper in front of you. Keep the vehicle from your practice round.
2) When the timer starts, you must build a vehicle that works well under the conditions described by your instructor.
3) You will have 20 seconds to design and build your vehicle. Then you will have no more than 20 seconds to explain how you vehicle is adapted to the new environmental conditions.
4) If your new vehicle is judged to be complete and <u>adaptive</u>, you will be selected to continue playing. If your vehicle is incomplete or your explanation is unfit (took longer than 20 seconds to explain or does not match the new conditions), your vehicle will go extinct.
5) If your vehicle is allowed to continue, keep your vehicle in front of you until you are told a new condition and the 20 second timer will be started again.

2) Compare animals for conservation of body parts and niche selection.
Fish, amphibians, reptiles, mammals, birds.
1) What body parts are conserved and which ones are modified?
2) Are any parts created out of nothing, are all parts modified versions of something else?

3) Hand align 18 mystery DNA sequences. Work in groups of two.
What is DNA?
What does it do?
Is DNA conserved across species, or created from nothing?

Take the 18 DNA sequences and try to group them based on similarity of sequences. Put them in small clusters, but put similar clusters near each other.

For example, if you have these sequences:
```
AAAAAA
TTAATT
AAATAA
TAAATT
```

```
You might create these clusters:
AAAAAA
AAATAA

TTAATT
TAAATT
```

Go ahead and try to cluster these 18 the best you can.

Once you have completed your clustering, can you quantify their similarities and differences?

4) BLAST same sequences to ID animals and plant. Work in groups of two.
1) Go to http://www.ncbi.nih.gov/BLAST/
2) choose: Nucleotide-nucleotide BLAST (blastn)
3) Copy and paste a mystery sequence into the big box.
4) Click on the "BLAST!" button.
5) Click on the "Format!" button.
6) Scroll down to find the first matching sequence in the database. Record the species name and associate it to your mystery number.
7) Did you hand alignment match your understanding of evolution of species?

5) Genomics and Human Genome Project
What is a genome?
What is the human genome project?

<div align="center">

Mystery Sequences 1 — 18
</div>

#1   GCTTACGACCATATCACGTTGAATGCACGCCATCCCGTCCGATCTGGCAAGTTAAGCAAC

#2   GTCTACGGCCATACCACCCTGAACGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#3   GCCAACGACCATACCACGCTGAATACATCGGTTCTCGTCCGATCACCGAAATTAAGCAGC

#4   GTCTACGGCCATACCACCCTGAACGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#5   GGTTGCGGCCATATCTACCAGAAAGCACCGTTTCCCGTCCGATCAACTGTGTTAAGCTGG

```
#6   GATAGCGTCCATACCACACTGAAAACACCGGTTCTCGTCCGATCACCGCAGTTAAGCAGT

#7   GTCTACGGCCATACCACCCTGAACGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#8   GCCTACGGCCATACCACGTAGAATGCACCGGTTCTCGTCCGATCACCGAAGTTAAGCTGC

#9   GCTTACGGCCATACCACCCTGAGCACGCCCGATCTCGTCCGATCTCGGAAGCTAAGCAGG

#10  GCCTACGGCCACACCACCCTGAAAGCGCCCGATCTCGTCTGATCTCGGATGCTAAGCAGG

#11  GCCTACGGCCATACCACCCTGAAAGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#12  GCCTACGGCCATACCACCCTGAACACGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#13  GTCTACGGCCATACCACCCTGAACGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#14  GTCTACGGCCATACCACCCTGAACACGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#15  ACCAACGGCCATACCACGTTGAAAGTACCCAGTCTCGTCAGATCCTGGAAGTCACACAAC

#16  GCCTACGGCCATACCACCCTGGAAACGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#17  GTCTACGGCCATACCACCCTGAACGCGCCCGATCTCGTCTGATCTCGGAAGCTAAGCAGG

#18  GGATGCGATCATACCAGCACTAATGCACCGGATCCCATCAGAACTCCGCAGTTAAGCGTG
```

References

5S Ribosomal RNA Database. 2005 <http://www.man.poznan.pl/5SData/> (accessed 21 February, 2006).

Szymanksi, Maciej, et al. 2000. 5S Ribosomal RNA Database Y2K. Nucleic Acids Research. Vol. 28 (1): 166 – 167.