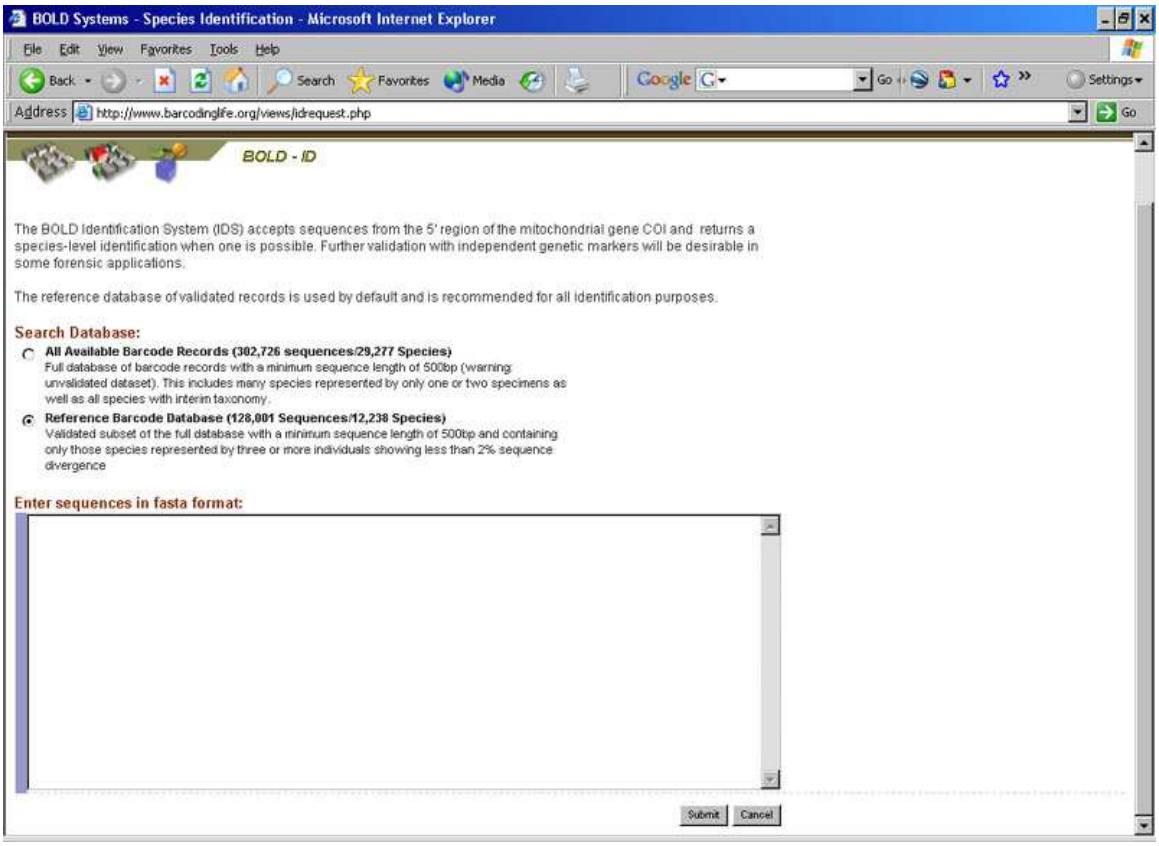
# DNA Barcodes

In this exercise we will use known DNA sequences to determine which species is represented by the sequence.

1. Open the following web page: http://www.barcodinglife.org/views/login.php
2. Click on the "Identify Specimen" link at the top of the page and you should see the following screen:



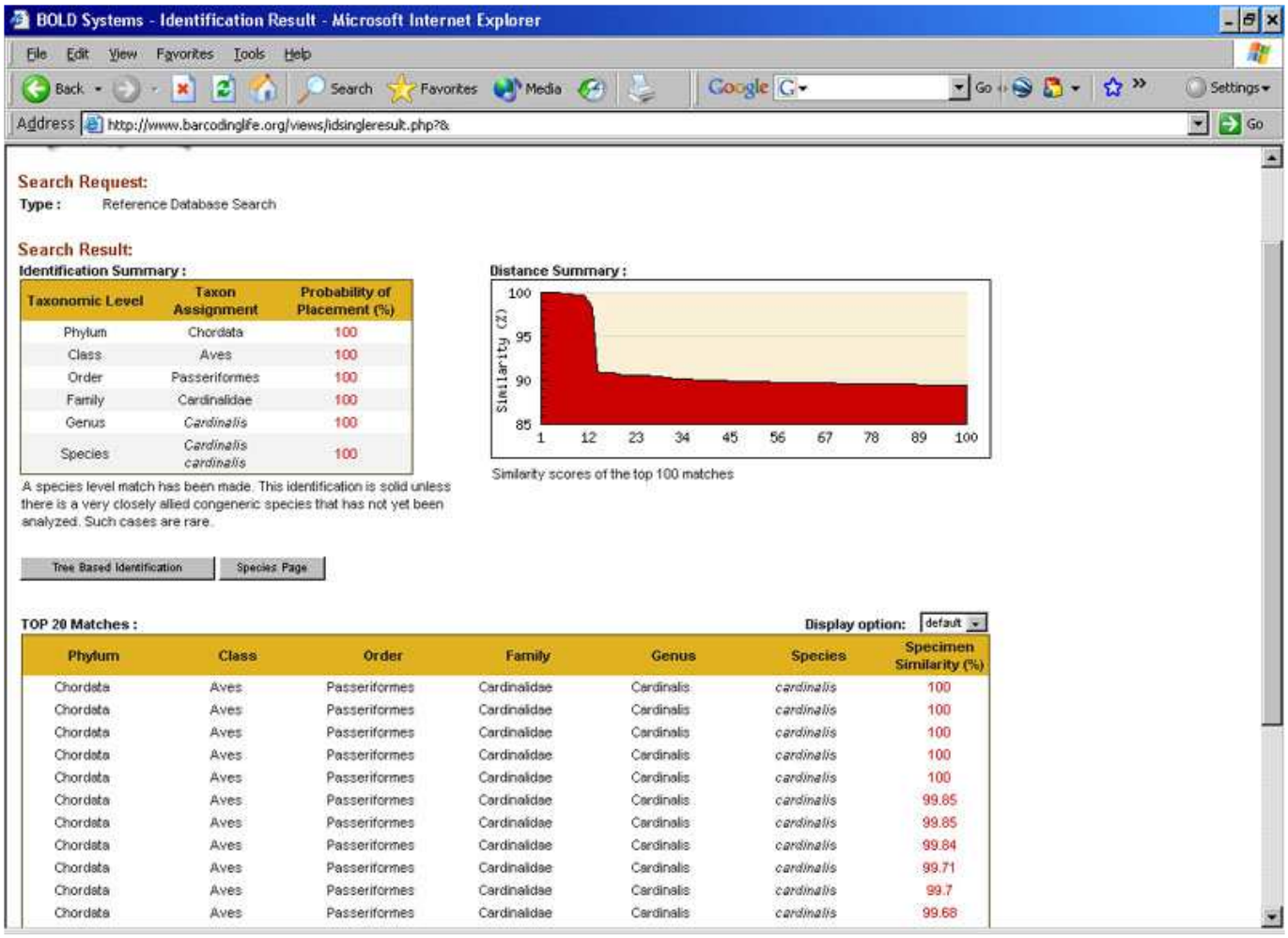

3. Use the text selection tool in Adobe Reader to copy the entire DNA sequence below for the Northern Cardinal. **Do not** copy the name of the Cardinal. Copy only the sequence beginning with ACTN…etc.

Cardinalis cardinalis - Northern Cardinal

ACTNTGTACTTANTCTTCGGCGCATGAGCCGGGATGGTAGGNACAGCCCTAAGCCTCCTCATTCGAGCAGAACT
AGGCCAACCTGGAGCTCTTCTAGGAGACGAC----------
CAAGTCTACAACGTAGTCGTCACAGCTCATGCTTTTGTAATAATTTTCTTCATAGTTATGCCAATTATAATCGGAG
GGTTTGGTAACTGACTAGTTCCCCTAATAATTGGAGCCCCAGACATAGCATTCCCACGAATAAACAACATA------
AGCTTTTGACTCCTACCTCCATCTTTCCTTCTCCTCCTAGCATCTTCTACAGTCGAAGCG------
GGTGTCGGCACAGGATGAACAGTATATCCCCCACTTGCTGGCAACTTAGCCCATGCTGGAGCT------
TCAGTCGACCTTGCTATCTTCTCCTTACACCTAGCTGGTATCTCCTCAATCCTAGGGGCTATCAACTTTATCACAA
CAGCAATCAATATAAAACCCCCTGCCCTCTCACAATACCANNNNCCACTATTCGTCTGATCCGTACTAATCACTG
CAGTCCTACTACTCCTATCTCTACCA----------
GTACTAGCTGCAGGAATTACAATGCTCCTTACAGACCGTAACCTCAATACTACATTCTTCGACCCT------
GCTGGAGGAGGAGACCCTATTCTATACCAACACCTCTTCTGATTCTTCGGCCACCCAGAAGTTTACNTCTTAATC
CTA

4. Paste the entire sequence into the "Enter Sequences" box and hit submit.

5. You should get a screen that looks like the following:




From the screen shot it is obvious that this DNA sequence matches, with 100% certainty, the other *Cardinalis cardinalis* sequences. In addition, it is easy to see how closely other species are related to this specimen.

Finally, use the scientific name of the Northern Cardinal (*Cardinalis cardinalis*) to find a picture of the bird on the internet.

Now, follow the same procedure for the DNA sequences below.

Thryothorous ludovicianus – Common Name_____?

ACCCTATACTTAATCTTTGGCGCATGAGCCGGGATAGTAGGCACTGCCCTAAGCCTTCTCATCCGAGCAGAGTTA
GGCCAACCTGGCGCCCTGCTGGGAGACGAC----------
CAGGTTTACAACGTGATCGTCACAGCCCATGCTTTCGTAATAATTTTCTTCATAGTTATGCCAATTATAATCGGAG
GGTTCGGAAACTGACTAGTCCCCCTAATAATCGGAGCCCCCGACATAGCATTCCCCCGAATAAACAACATG------
AGCTTCTGACTTCTCCCCCCATCCTTCCTGCTCCTACTAGCCTCCTCCACTGTCGAAGCA------
GGAGTAGGAACAGGCTGAACCGTCTACCCACCTCTAGCAGGCAACCTAGCTCACGCCGGAGCA------
TCAGTCGACCTGGCCATCTTCTCCCTCCACCTGGCGGGTATCTCATCCATTTTAGGCGCAATCAACTTCATCACAA
CAGCAATCAACATAAAACCTCCTGCCCTATCCCAATACCAAACACCCCTATTTGTCTGATCAGTCCTAATCACCG
CANTCCTACTTCTTCTCTCCCTCCCT----------
GTCCTCNNNGCGGGCATCACCATGCTGCTAANNNACCGAAACCTCAACACCACATTCTTTGACCCT------
GCNGNAGGAGGAGACCCAGTTCTTTANNANCATCTATTTTGATTCNTCGNCCACCCTGAAGNCTACATCNNGAT
CCTC

Toxostoma rufum – Common Name_____?

CTCTACCTAATNTTCGGCGCATGAGCCGGAATAGTCGGTACCGCCCTAAGCCTCCTTATTCGAGCAGAACTAGGN
CAACCTGGAGCCCTCCTAGGTGACGAC----------
CAAGTCTACAACGTAGTCGTCACAGCACATGCCTTCGTAATAATCTTCTTTATGGTTATGCCAATTATGATCGGA
GGATTTGGAAACTGACTAGTCCCCCTAATAATTGGAGCCCCAGACATAGCATTCCCACGAATAAACAACATG-----
--AGCTTCTGACTACTCCCACCATCCTTCCTACTACTACTAGCATCTTCCACAGTAGAGTCA------
GGAGTAGGAACAGGCTGAACTGTATACCCACCCCTAGCTGGTAACCTAGCCCACGCCGGAGCT------
TCAGTAGACCTAGCTATCTTCTCCCTACACCTAGCTGGTATCTCTTCCATCCTAGGAGCTATCAACTTCATTACAA
CAGCAATCAACATAAAACCACCCGCCCTCTCACAATACCAAACCCCACTATTTGTTTGATCAGTACTAATCACCG
CGGTATTACTCCTCCTATCCCTTCCT----------
GTACTCGCCGCAGGCATTACCATGCTCCTTACAGACCGCAATCTCAACACCACCTTCTTCGACCCA------
GCAGGAGGAGGAGACCCAGTACTATATCAACACCTTTTCTGATTCTTCGGCCATCCAGAAGTCTACATCCTAATC
CTC

Turdus migratorius – Common Name_____?

CTCTACCTAATCTTCGGCGCATGAGCCGGAATAGTGGGTACTGCCCTAAGTCTCCTCATCCGAGCAGAACTAGGC
CAACCAGGTGCTCTCCTAGGTGACGAC----------
CAAATCTACAACGTGGTTGTCACCGCCCATGCTTTCGTAATAATCTTCTTCATAGTTATACCAATTATGATCGGAG
GGTTCGGAAACTGACTAGTCCCCCTAATAATCGGAGCCCCAGACATAGCATTCCCCCGAATAAACAACATA------
AGCTTTTGACTCCTTCCCCCATCCTTCCTTCTCCTCCTAGCCTCCTCCACAGTAGAAGCT------
GGGGCAGGGACAGGTTGAACCGTCTACCCACCCCTCGCCGGCAACCTAGCACACGCAGGGGCT------
TCAGTAGACTTGGCCATTTTCTCCCTACACTTAGCAGGGATCTCCTCAATCCTAGGGGCCATCAACTTCATCACA
ACAGCAATCAACATAAAACCACCCGCCCTTTCACAATACCAGACCCCCCTATTCGTCTGATCAGTCCTAATCACC
GCAGTGCTACTCCTGCTATCCCTCCCC----------
GTTCTTGCCGCTGGAATCACCATGCTCCTCACCGACCGCAACCTAAACACAACCTTCTTTGACCCA------
GCAGGGGGAGGAGACCCAGTACTATACCAACACCTCTTTTGATTCTTTGGCCACCCCGAAGTCTACATTCTTATC
CTC