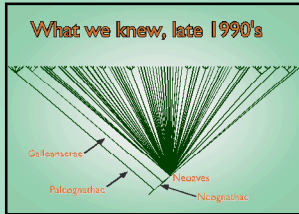




Early Bird: A Collaborative Project to Resolve the Deep Nodes of Avian Phylogeny

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State of Knowledge

Despite the volumes of information that have been gathered for birds at the species and distributional level, our understanding of the relationships among the major lineages remains uncertain. Published phylogenetic studies illustrate the problem—lack of resolution, short internodes and conflicting patterns. Our simulation studies (using a mixed model to capture among-locus heterogeneity) showed that 20 kb of sequence data would be required to resolve a series of divergence events that took place over a short period of time roughly 80 million years ago.

Project Goals

To collect 20,000 base pairs from 300-500 different taxa from a diverse array of nuclear markers (exons, introns, and untranslated regions), which map to different chromosomes.

Data Management

We have developed a web-based relational database to manage data and a web bulletin board to facilitate interaction among consortium members.



Progress to Date

In 2003-2004, we gathered a preliminary dataset of 40,000+ characters of aligned DNA sequence data (23,000 unaligned base pairs) from 19 different gene regions (21 different gene fragments) on 14 different chromosomes for 75 taxa of birds and their closest living relatives. In late 2004, we began to add 150 species to this sample.

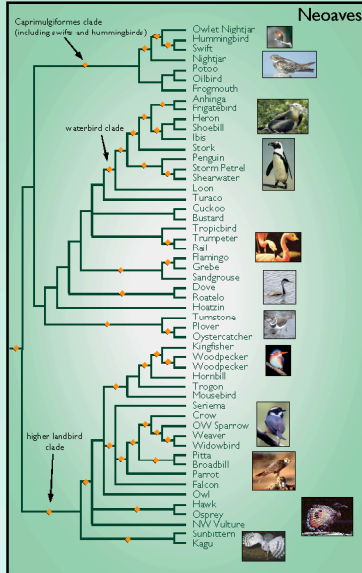
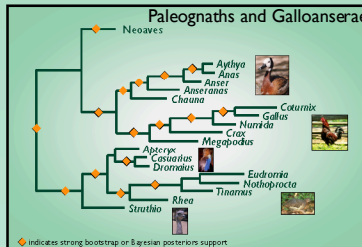
Gene Regions Studied

- Eukaryotic Elongation Factor
- Dimerization Co-factor of Hepatocyte Nuclear Factor X
- Rhodopsin B
- Clathrin Heavy Chain
- Alpha A Crystallin
- C-myc
- Somatotropin
- Interferon Regulatory Factor 1 and 2
- Nerve Growth Factor
- Brain-derived Neurotrophic Factor
- Neurotrophin 3
- Beta-Fibrinogen
- Transforming Growth Factor B-2
- Myoglobin
- Tropomyosin
- EGR-1 exon
- EGR-1 3' UTR
- High Mobility Group
- Aldolase B
- Muscle-specific Receptor Tyrosine Kinase

Introns 60%
Exons 35%
Untranslated Regions 5%

Preliminary Results

- Variation in rates of gene evolution exists, even among noncoding regions.
- Large datasets confirm that short internodes separate major lineages of birds.
- Preliminary trees show several novel and interesting relationships. We confirm previous hypotheses of a sister relationship between flamingos and grebes and have strong support for a sister relationship between kagu and sunbittern. We also find that tinamous are nested within the flightless ratites.



Scope of Early Bird

Early Bird is a large-scale, cooperative effort among six institutions in the U.S., one in Scotland, and two in Australia to determine the evolutionary relationships among all major groups of birds. The goals of this project are to provide a detailed, comprehensive, and robust estimate of the "Family Tree" of avian relationships, and to facilitate the use of that tree to organize and interpret other information about birds. The impact of this project on science and society will be far reaching. Birds are among the most prominent and engaging creatures in most ecosystems worldwide. They have been the subject of an extraordinary number and diversity of scientific studies that figure largely in our understanding of the natural world and humanity's place in it. Their position high in many food chains and their great mobility make them sensitive indicators of environmental quality, and monitoring of bird populations is widely used to set conservation and management priorities. Their powers of flight, physical beauty and captivating behaviors amaze and inspire us, and birds provide tremendous amounts of recreation for serious hunters and birdwatchers, as well as the millions of backyard birdwatchers each year. All of these human interactions with birds will be enriched by a better understanding of avian evolutionary history and genetic diversity.



Fossils and Collaborations

Our DNA data will be integrated with existing and new DNA, morphological, and fossil data to bring all relevant evidence to bear on the pattern and timing of avian radiations. This is an important area of collaboration between the Early Bird and Archosaur ATOL projects.

Needs

- improved data management tools to track data from specimens to publication
- improved analytical tools to take advantage of powerful computing resources

Outreach

Our data will be made accessible to other researchers through an online database with tools for analysis and export. This is another area of collaboration with the Archosaur ATOL project. We communicate our project to the public in a variety of ways (websites, educational tools for K-12 teachers, museum exhibitions).

