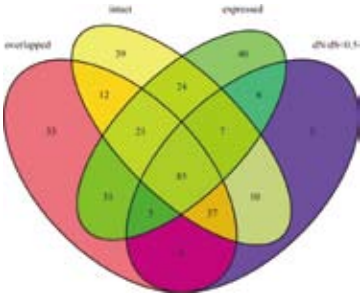
Coelacanth Retrocopies Provide Insights into Evolution of Coelacanth and Water to Land Transition

Coelacanth follows the oldest known living lineage of Sarcopterygii (lobe-finned fish and tetrapods) and evolved into roughly its current form approximately 400 million years ago. It is the closest living species to tetrapods besides lungfish, providing a glimpse of the vertebrate evolution of "water to land" transition. During the "water to land" transition, vertebrate may gain new gene for adaptation. One resource to gain new genes is retrocopy. Retrocopy is a kind of gene copy technique based on the reinsertion of that gene's mRNA. They have been believed for a long time to be preudogenes lacking regulatory elements, but recent studies revealed that some retrocopies have turned into functional "retrogene" by hitchhiking adjacent genes' regulatory elements.

Recently, a research group led by Prof. HE Shunping from the Institute of Hydrobiology, Chinese Academy of Sciences identified 472 retrocopies in the genome of African coelacanth. These retrocopies revealed an age distribution that is similar to that in tetrapods' retrocopies, rather than ray-finned fish, indicating a genomic transformation that accompanied vertebrate evolution from water to land.

Among the 472 retrocopies, 85-355 were shown to be potential functional "retrogenes". In addition, these retrogenes are more prevalent in old than young retrocopies, implying that most retrocopies may have been eliminated during evolution, even though some retrocopies survived, attained biological function as retrogenes, and became old. The study identified 23 retrocopy-related genes that have been lost in tetrapods, which are potentially related to the vertebrate evolution from water to land.

Their work revealed novel insights into the potential role of genomic retrocopies in coelacanth evolution and vertebrate adaptations during the evolutionary transition from water to land. The results have been published online by *BMC Genomics* with the title of Evolutionary Fate and Implications of Retrocopies in the African Coelacanth Genome.



Venn diagram of the unique and common retrocopies among different categories. Red: retrocopies that overlap with Ensembl genes. Yellow: retrocopies with intact ORFs. Green: retrocopies with evidence of transcription. Blue: retrocopies with dN/dS ratios significantly <0.5.

Coelacanth. *Image Credit: Chip Clark, Smithsonian Institution*