

ES 10 January 31 and February 5 2003 J. Bartolome
Origins of Life, Evolution

Subtopics:

1. Definition of Life
2. History of Early Life Forms
3. Evolution: The formation of new species from pre-existing species
4. Biological species
5. Later evolution of life (the past 500 million years)
6. Key points about evolution
7. Links to physical systems

Some definitions:

Life: the process of being an organizing entity.

Evolution: the formation of new species from pre-existing species.

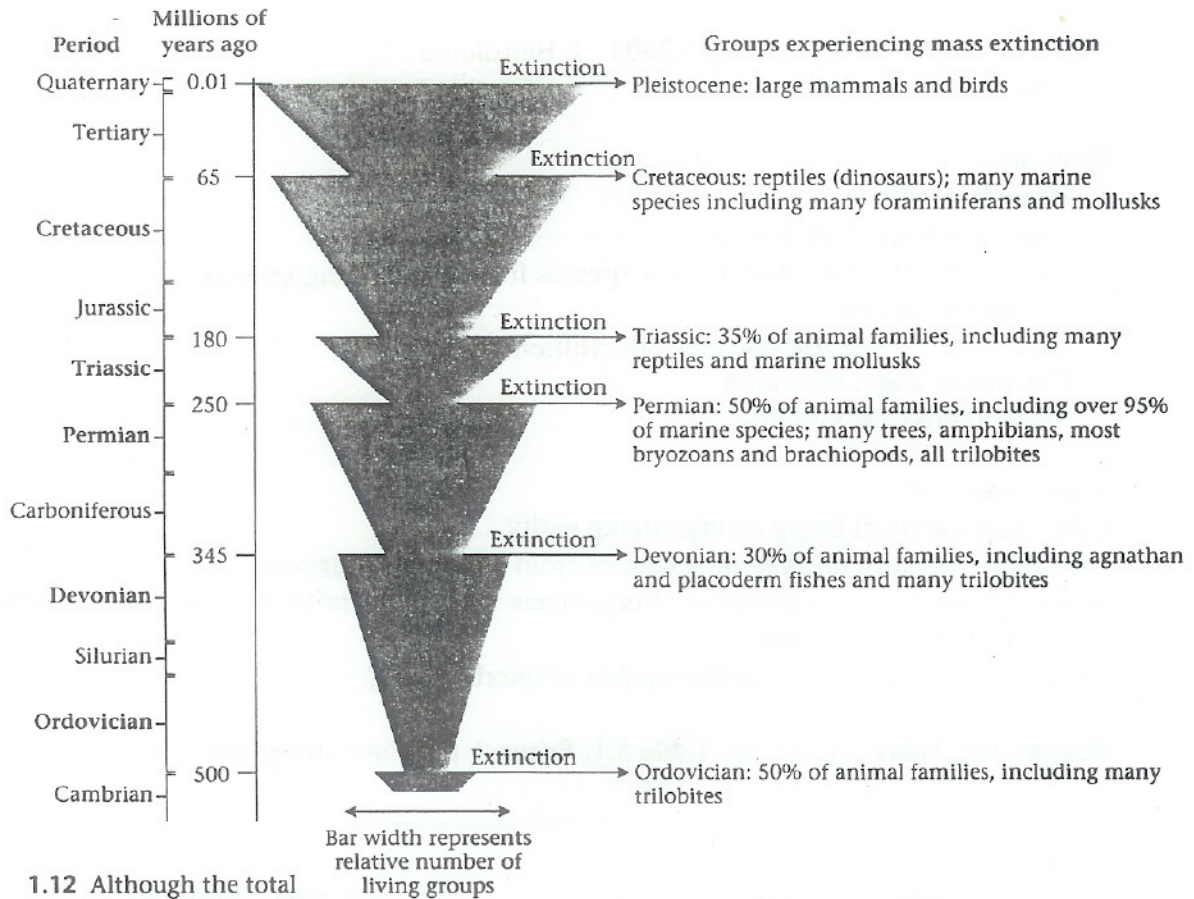
Taxon (plural Taxa): a grouping of organisms with a similarity in either characteristics or evolution or both.

Species: A group of individuals capable of interbreeding.

Below: BK Table 7.1, Allaby Table 5.1, Primack pie chart and graph 1.11, 1.12.

Kingdom/Phylum Subphylum/Class	Mader, 1997	Campbell, 1996	Raven, 1999	Margulis, 1998	E.O. Wilson, 1988
Viris				100000	1000
Monera			100		4760 (+Archaea)
Archaeobacteria			7500		
Cyanobacteria			70000		
Fungi		100000	790	100000	575
Chytridiomycota	600	600	1060		665
Zygomycota	30000	60000	32300	600	28030
Ascomycota	16000	25000	22300	tens of thousands	10000
Basidiomycota	25000	60000		25000	
Deuteromycota				thousands	
Protista			8000		
Ciliophora	8000		700		500
Myxomycota	560		200		
Cryptophyta			2000-1000		
Dinophyta			100		
Ctenophora	580		100		580
Ctenophora	1000		100		800
Dinoflagellata	1000		90	800	1100
Sarcodina	40000			several thousand	
Sarcodina	3600				
Chrysophyta	11000		1000		12500
Bacillariophyta			100000		
Phaeophyta	1500		1500	10000	1500
Rhodophyta	4000		4000-6000	1500	4000
Chlorophyta	7000		17000	4000	7000
Plantae				7000	
Bryophyta	12000		9500	24000	16600
Hepatophyta	10000		6000		
Anthoceroophyta	100		100		
Pallophyta	several		several		9
Lycophyta	1000		1000	1000	1275
Spermatophyta	15		15	40	15
Filicinophyta				12000	10000
Pterophyta	12000		11000		
Coniferophyta	550		550	550	
Gymnosphyta	100		140	100	
Gnetophyta	70		70	70	
Anthophyta	65000		235000	230000	
Monocotyledones	170000				50000
Dicotyledones					170000
Animalia					
Porifera	5000	>1,000,000		10000	5000
Cnidaria	9000	10000		10000	9000
Platyhelminthes	13000	20000		15000	12200
Rotifera	2000	1800		2000	2000
Nematoda	12000	80000		80000	12000
Mollusca	110000	50000		110000	50000
Annelida	12000	15000		5400	12000
Arthropoda	>6 million	nearly 1,000,000		500000	989761
Cheliceriformes					
Insecta					
Anoplura	2400				
Coleoptera	500000				
Diptera	1000				
Hymenoptera	8000				
Lepidoptera	55000				
Hemiptera	90000				
Hymenoptera	2000				
Lepidoptera	140000				
Orthoptera	5000				
Siphonaptera	30000				
Trichoptera	1200				
Crustacea	7000				
Brachiopoda	6550				
Echinodermata	45000				
Chordata	44000				
Vertebrata	850				
Chondrichthyes	20000				
Osteichthyes	39000				
Amphibia	6000				
Reptilia	9000				
Aves	4500				
Mammalia	4500				
Mammalia				335	6100
Mammalia				6000	845
Mammalia				45000	18150
Mammalia					4184
Mammalia					6500
Mammalia					9040
Mammalia					4000

Note: With ~15,000 new species described every year, a changing classification system, and no central data registry, it is not surprising that species estimates differ between publications and years.
Sources: E. O. Wilson, 1988; L. Margulis and K. V. Schwartz, 1988; Sylvia L. Mader, 1997; Neil A. Campbell, 1996; P. H. Raven, R. F. Evert, and S. E. Eichhorn, 1999.



1.12 Although the total number of families and species has increased over the eons, during each of five episodes of natural mass extinction a large percentage of these groups disappeared. The most dramatic period of loss occurred about 250 million years ago, at the end of the Permian period. We are now at the start of a sixth episode, the Pleistocene extinction, as human populations eliminate species through habitat loss and overharvesting.

Table 5.1 Number of species described and the likely total number

Group	No. described (thousands)	Estimate of total no. (thousands)
Viruses	5	500
Bacteria	5	400
Fungi	7	1000
Protozoa	40	200
Algae	40	200
Nematodes	15	500
Molluscs	70	150
Crustaceans	40	100
Arachnids	75	600
Insects	950	4000
Vertebrates	45	50
Higher plants	250	300
Total	1605	8000

1.11 Approximately 1,413,000 species have been identified and described by scientists; the majority of these are insects and plants. Large numbers of insects, bacteria, and fungi are still undescribed, and the eventual number of identified species could reach 5 million or more. (Data from Wilson 1992.)

