Hierarchical complexity and the limits of organism size

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Acknowledgements

- Jennifer Saltzman & History of Life Interns
- Margaret Deng, Meghan Faerber, Linda Hambrick, Galen Griggs, Sam Sanghvi

School of Earth, Energy & Environmental Sciences





Maximum Organism Size



Payne et al. (2009)





McShea (1994)



Stanley (1973)

Maximum Organism Size



Payne et al. (2009)

Geozoic Megatrajectories

Intellige	 Ability to preserve ideas and communicate them through time permits building on past experience Application of technology results in ability for conscious and intentional control of environment, reversing the traditional relationship between organism and environment
Invasi of th	 Biomass of producers becomes a major component of environmental systems Biomass of producers becomes a major component of environmental systems Coevolutionary exploitation of interdependence of producers and consumers Evolution of ability to maintain function under widely varying ambient conditions
Aqua Multicell	 Open-ended size scale for life Significant "packaging" of biomass Ilarity Establishment of complex food chains Life and life activities impact or become part of physical environment
Unicell Eukary Diversifi	ular – Functional variety ote – Increased sizes ation – Initial secondary (consumer) ecosystem
B Prokar Diversifie	- Metabolic variety - Life processes alter environment - Primary ecosystem Increase in structure Ecospace
To Life as we know it	e in cy Increase in Ses Ecospace
	Time

Knoll & Bambach (2000)

Geozoic Megatrajectories

Solitary Multicellular Eukaryotes

Solitary Eukaryotes

Solitary Prokaryotes

Viruses





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The Prokaryotes

4th Edition

Alphaproteobacteria and Betaproteobacteria



D Springer Reference



















Geozoic Organism Size



Size Distributions



Size Distributions





Size Distributions





McShea (1994)



Take Home Points

- The central tendency in size increases as structural complexity increases
- The range of size increases with structural complexity, with the maximum size increasing more than minimum size
- Complexity limits maximum and mimumum size, but there may be a variety of evolutionary tempos and modes of size evolution within each level of structural complexity