

Preface

This SpringerBrief concerns the condition-dependent effects of intraspecific competition on a mammal's reproductive rate, as well as actions available to an individual (hereafter "type" [genotype and phenotype]) in the face of competition. Group-formation, group-maintenance, and sociality may be favored by selection when genes of social types increase relative to non-social types, beyond some threshold level in a population. When "social" and "sociality" are defined as *responses facilitating the reproduction of one or more conspecific*, sociality is not a conspicuous feature of Class, Mammalia. Facilitation appears in response to density-dependent conditions characterized by "thermal stress" (stimuli negatively impacting reproductive rate) when niche spaces ("thermal zones") of (conspecific) types (genotypes and phenotypes: individuals, organisms) overlap relative to variations in resource dispersion (distribution, abundance, and/or quality of food, mates, and/or space). The previous conditions constitute intermediate or high levels of competition for limiting resources, resources influencing the reproductive rates of types. Group-formation and group-maintenance are necessary, but not sufficient, precursors to the evolution of sociality, and recent treatments show that coexistence of different types is best studied using a "trait-based approach". In theory, a type can be decomposed into a set of expressible traits with varying values dependent upon condition. Social traits expressed by types include "alloparenting", cooperation, reciprocity, and altruism, unambiguous and measurable features of phenotypes permitting independent quantitative analyses within and between populations and species.

Mammals were preadapted for solitary living during the Triassic when mammal-like reptiles escaped reptilian competitors by adopting nocturnal habits. Consistent with the ancestral patterns of extant mammals and reptiles, the former are, primarily, nocturnal and solitary, the latter, primarily, diurnal. In general, extant adult male mammals are intolerant of other males and of the young, while adult females, unless signaling sexual receptivity, are intolerant of conspecifics other than their offspring and of males. The whole-organism phenotype of one mammal is exposed to abiotic (soil, climate) and biotic (plants, predators) environments that may or may not be correlated across space and time. Ultimately, selection acts on genetically-correlated phenotypic traits and, from a genotype's perspective, copies of alleles and their associated traits may be carried or expressed throughout a population and, sometimes,

a region (“metapopulation”). For a given genotype, phenotypes will vary spatiotemporally within and between individuals bearing a trait or traits. Mammals found in aggregations (temporary assemblages of one or more than one species), or spatiotemporally recurrent groups, may or may not occur in proximity to individuals bearing the same genotype because dispersing types may travel near (“viscosity”) or far from their natal groups. A type will be designed to do the best it can do to maximize its relative fitness (growth rate) in a population, even though niche spaces of similar types will overlap, yielding competition for limiting resources (e.g., food, mates, space). Thus, interests of types may not coincide, particularly kin whose niche spaces are bound to overlap, and responses influencing reproductive rates of similar or different types may have beneficial or deleterious effects on per capita rates of population growth.

Expanding other treatments, intensities of within- and among-species competition in local (“patch”) and regional (population, metapopulation) regimes are expected to determine benefits and costs to each mammal’s current and future reproduction via condition-dependent interactions between genotype and environment (“reaction norms”), including interactions with other members of an aggregation or integrated group. Throughout the present review, mammals are assumed to reside in a competitive context, within the individual mammal’s group, between groups, and within populations, communities and ecosystems, and interactions between or among conspecifics may be categorized as facilitation, tolerance, or inhibition. The topic of the present synthesis is mammalian social evolution, and, throughout the text, “facilitation” is employed generically to mean facilitation of a type’s relative reproductive interests via the facilitation of another type’s reproductive interests, usually another group member and often a relative.

Evolutionary transitions to sociality within and between mammalian taxa are central to a scientific understanding of sociality as a phenomenon, since the Class constitutes the most ecologically dominant terrestrial vertebrate fauna, including grades of population structure from “solitary” (“sexually-segregated”) to eusocial (overlapping generations, cooperative breeding, reproductive division of labor). Sterile castes have, apparently, not evolved among mammals; thus, in the present brief, cooperatively breeding and eusocial molerats are classified as “primitively eusocial”.

In addition, this monograph discusses factors associated with group-formation, group-maintenance, group population structure, and, other, events and processes (e.g., physiology, behavior). Within- and between-lineages, features of prehistoric and extant social mammals, patterns and linkages are discussed as components of a possible social “tool-kit”, and “top-down” (predators to nutrients), as well as, “bottom-up” (nutrients to predators), effects are assessed. The present synthesis also emphasizes outcomes of Hebbian (synaptic) “decisions” on Malthusian parameters (growth rates of populations) and their consequences for (shifting) mean fitnesses of populations. Ecology and evolution (EcoEvo) are connected via the organism’s “norms of reaction” (genotype $\times$ environment interactions; life-history tradeoffs of reproduction, survival, and growth) exposed to selection, with the success of genotypes influenced by intensities of selection as well as neutral (e.g., mutation rates) and stochastic effects. At every turn, life history trajectories are assumed to arise

from “decisions” made by types responding to competition for limiting resources constrained by Hamilton’s rule (inclusive fitness operations).

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