George C. Williams' "Adaptation and Natural Selection" Précis

The significance of George C. Williams' analysis in "Adaptation and Natural Selection" lies in his detailed argument of why natural selection functions on the level of the individual and not the group. His defense of Darwinism rewrites the generally held assumption that adaptation characterizes species and populations, and emphasizes the role that natural selection plays in shaping the individual genotype. He thus makes possible the explanation of evolution without the use of terms such as 'group selection,' 'population adaptation,' or 'progress.' While Williams acknowledges that group selection plays a significant role in some of earth's biota, such as the eukaryotes, individual selection characterizes most organisms which reproduce sexually (xii). In the process of showing why individual selection vis-à-vis group selection is significant, Williams also, significantly, argues that the term adaptation cannot yet be understood in terms of any principles or procedures.

The significance of Williams' starting point – a clarification of what an adaptation is and isn't – is definitional. An evolutionary 'adaptation' has specific meanings: 1) Adaptations should only be called 'functions' when shaped by design and not chance (8); 2) the level of organization of an adaptation shouldn't be higher than that admitted by the evidence (19); 3) only natural selection could have given rise to adaptations (8). Thus the scientific study of an adaptation awaits more developments in biology.

Williams argues that natural selection operates and is effective only at levels measured statistically (22), for example, in terms of rates of random change, quantitative relationships among sampling errors, and selection coefficients (37). Mendelian populations selected for at the level of alleles exclusively meet these requirements (24). For Williams, natural selection of alternative alleles operates to choose between worse and better options at the level of individuals in a population (45).

Genetic, somatic and ecological factors, i.e. the environment, contribute to selecting for genes. Thus, environmental factors don't directly affect populations (58).

Williams identifies processes relating to the genetic system, such as sex-determining mechanisms (156), stability of genes (138), diploidy (126), introgressive hybridization (144), and the way sexual and asexual reproduction in the life cycles are distributed in the life-cycle (133) as short-term adaptations. Group survival, therefore, is a chance consequence of these adaptations, as well as related errors such as mutation and introgression. In chapter 5, Williams also suggests that decent evidence does not exist for other mechanisms of evolutionary change or other genetic system adaptations, thus highlighting the exclusive role of natural selection in shaping life.

Reproductive physiological variations of organisms seem designed to maximize organisms' reproductive success. Instances such as unbridled fecundity (161) and sex differences in reproductive strategies all suggest that an individual organism's reproductive strategy is oriented to replicating its own genetic information and not the groups' or the populations'.

The significance of Williams' analysis of social adaptations (193) suggests that the benefits of cooperative social adaptations leading to cooperative relations among related individuals rest on a genetic basis; cooperation with individuals of alternative genetic information is less significant. For Williams, therefore, benefits to groups are consequences of incidental statistics; harmful group effects may accumulate in a similar way.

Williams concludes (251) by arguing that there are no established guidelines to answer the question "What is the function of an adaptation?" The approaches he outlines are significant because they lay the groundwork for further developments in biology to understand what an adaptation is in terms of individual selection.

Scott Macleod - http://scottmacleod.com – Dec. 9, 2002