Architecture of adaptation

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Darwinian theory of organic evolution explains the evolution
of complex adaptations through the gradual accumulation of
innumerable slight mutations. Theoretical foundation of
this traditional view could be traced back to 1930s, when
theoretical population geneticists reconciled Medelian
genetics with Darwinian gradualism. Recent molecular
studies of complex traits, however, have revealed that many
adaptations have rather simple genetic architecture; they
are in many instances based on a small number of factors with
relatively large phenotypic effects. To see if such
empirical findings should be expected from the ordinary
population genetics theory, I here develop polygenic models
of phenotypic evolution and investigate the distribution of
the effects of mutations that become eventually fixed during
the course of evolution. Two issues are of special concern:
(1) the number of substitutional events that constitute an
adaptation, and (2) the relative magnitude of the effects
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those fixed factors. The results of the numerical analyses
will be discussed in light of these issues.