Individuals vary their immune response according to age, sex and the costs

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The sexes face differential immune investment costs as they mature from nest-bound juveniles to independent adults. Credit: Oliver P. Love

Is it always good to respond maximally when pathogens or disease strike, or should individuals vary their immune response to balance immediate and future costs? This is the question evolutionary physiologists Oliver Love, Katrina Salvante, James Dale, and Tony Williams asked when they examined how a simple immune response varied at different life stages across the life-span of individual zebra finches (*Taeniopygia guttata*), in a study published in the September issue of the *American Naturalist*.

When transitioning from nest-bound juveniles to adults, female immune responses matured slowly whereas males showed dramatic variation

potentially due to the costs of molting into their colorful sexually dimorphic plumage. Adult males showed little variation in immune response despite changes in resource quality.

Likewise, when females laid eggs under high-quality resource conditions, immune responses were also consistent with those during non-breeding and similar to male responses. However, when laying on reduced resources females reduced their immune response and their reproductive output consistent with a facultative (resource-driven) effect of reproductive effort on immunity.

Moreover, even under high-resource conditions during the chick-rearing stage mothers showed reduced immune responses compared to fathers suggesting a residual energetic cost of egg-laying. Perhaps most importantly, immune responses of juveniles of both sexes did not predict their subsequent adult responses.

Immune responses of adult females were only predictable when the quality of the environment remained constant; as soon as conditions deteriorated, individual females required flexibility in both the immune and reproductive systems. However, the degree of flexibility came at a cost as only individuals with high immune responses as non-breeders had the capacity to reduce responses when times became tough.

These results underlie the fact that immunity is a highly plastic trait that can be modulated in a sex- and context-dependent manner. Given the need for individual flexibility in the immune system, this suggests that an immune response at one stage may provide limited information about immune response at future stages.

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