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Traits don't evolve for the benefit of the species but because they increase individuals' inclusive fitness

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1 **Traits don't evolve for the benefit of the species but because they increase individuals'**

2 **inclusive fitness**

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12 In a recent publication, (Besedovsky and Del Rey, 2022) asked why the immune system, which
13 evolved to protect the individual against disease, sometimes causes death. They argue that
14 lethal cytokine overreaction evolved for the benefit of the species by negative selection of
15 individuals that would otherwise spread the infectious disease.

16 Since the 1960s it has been realised that traits do not evolve for the benefit of the
17 species but because they increase individual fitness (Williams, 1966). If an allele leads on
18 average to a higher fitness in its bearers than in individuals not bearing this allele, then its
19 frequency in the population will increase. This is why biologists agreed that the best level to
20 study evolution is the individual. Other levels of organisation (gene, cells, groups, populations)
21 can also be mathematically considered. Explaining evolution on a higher than individual level
22 via the Price equation is sometimes called "new group selection" though the term "multi-level
23 selection" is preferred. The Price equation is mathematically identical to kin selection on the
24 individual level, which states that traits that favour the distribution of its underlying alleles

25 can spread not only by directly benefitting the carrier, but also if it benefits close kin that have
26 a high probability of carrying the same allele, which sums up to inclusive fitness (Frank, 1995;
27 Gardner).

28 Besedovsky & Del Rey (2022) review that cytokine storms during infections can be
29 lethal. They use the old group selection theory when they say that traits “contribute to
30 evolution as long as the survival of one individual would not threaten other members of the
31 group”. This has been proven to be wrong by multiple studies in behavioural ecology, where
32 males and females kill offspring of other group members, and the strategy of dominant
33 individuals is to increase their fitness by decreasing the fitness of subordinate group members.

34 The fact that cytokines causing cytokine storms are 700million years old implies that
35 they are evolutionary extremely successful, i.e. that they have on average a positive effect on
36 individual fitness, even if in some cases they lead to disease and death. Instead, Besedovsky
37 & Del Rey (2022) suggest that negative selection (the removal of deleterious alleles) can lead
38 to the spread of the very same alleles as it eliminates individuals from the population that
39 would otherwise spread infectious disease. The suggestion that removal of alleles could make
40 these alleles spread in the population is problematic. Individuals which die cannot spread the
41 alleles anymore. If these alleles nevertheless spread, then this must be due to positive
42 selection, either by 1. the same individuals having high reproductive success due to the same
43 allele in a life history stage before death (Straub and Schradin, 2016), and 2. the mean lifetime
44 reproductive success of individuals carrying these allele being higher than of other individuals.

45 In sum, their conclusion that “Immune-mediated negative selection can favour
46 emergence and expansion of species” is based on old group-selection arguments which has to
47 be rejected.

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