Does cultural transmission evolve because it is Lamarckian?

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03/11/2020, 12:00, at your nearest available Zoom machine

There are many influences on an organism's fit to current or upcoming environments. These include genetic effects, transgenerational epigenetic influences, environmental cues and developmental noise. I present an analytically-tractable evolutionary model, in which cues are integrated to determine mature phenotypes in fluctuating environments. Environmental cues received during development and by the mother as an adult act as detection-based (individually observed) cues. The mother's phenotype and a quantitative genetic effect act as selection-based cues (they correlate with environmental states after selection). Thus we can specify when such cues are complementary and tend to be used together, and when particular cues will predominate. Interestingly, as environmental autocorrelation increases the maternal phenotype becomes a more valuable cue both because the past selective environment has been more stable and because past juvenile cues are more relevant to current conditions. Indeed, since here a juvenile cue influences the adult phenotype, which in turn is passed on to offspring, this is essentially a form of Lamarckism (the inheritance of detection-based cues). From our analysis, this mode of transmission seems to be a very efficient way of maximising organismal "fittedness" (and therefore fitness), but mechanisms that can achieve it with high accuracy may not be widespread for most morphological and physiological traits, so Lamarckian effects could be limited by a noisy transmission of the maternal phenotype. Behavioural inheritance may be an exception and so this analysis suggests that we might expect cultural transmission to predominate in a wide range of conditions, the more accurate it becomes.

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