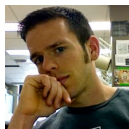


SEARCH BLOG FLAG BLOG SHARE Next Blog>>

DENIM and Tweed

Ignoti, sed non occulti.

ABOUT ME



JEREMY YODER

I'm a baptized Mennonite studying evolutionary biology, an East-Coast liberal

living in Idaho, and a fan of David Foster Wallace who also appreciates "Battlestar Galactica". See also my personal site.

[VIEW MY COMPLETE PROFILE](#)

DENIM AND TWEETS

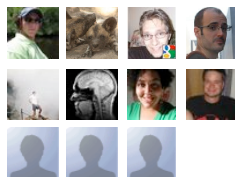
- Going home for my first post-marathon run. I'm feeling ready. [about 14 hours ago](#)
- 2009.10.09 - *Tamias umbrinus* [pic] <http://ff.im/-9ww3V> [about 15 hours ago](#)
- Those palms and firs that grew in your garden/ Falling down and nearing the rose beds/ The roots are shooting up through the tool shed/ [about 18 hours ago](#)
[follow me on Twitter](#)



Follow

with Google Friend Connect

Followers (11)



Already a member? [Sign in](#)

BLOG BLING

Research

From my blog:

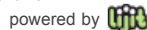
[No room for group selection in disease evolution?](#)

June 2009

From my content:

[Denim and Tweed: No room for group selection in...](#)

More results for "inclusive fitness" gardner...



26 JUNE 2009

No room for group selection in disease evolution?



Parasites coexisting within a single host have been proposed as one of the best examples of individuals sacrificing their own reproductive fitness for the benefit of a group. A new theory paper in last week's

Nature suggests that the apparent effect of "group selection" in this case can be explained by [individual-level selection instead](#) [5-a].

Group selection posits that organisms sometimes evolve traits that hurt their individual fitness but benefit their social group. Charles Darwin originally proposed it to explain the evolution of human moral systems: in a tribal society, helping your neighbor might cost you, but it might still help your whole tribe to compete against other tribes. So natural selection on individuals *within* a tribe may act in one way, but be opposed by *group selection* arising from competition among tribes.

This process has also been proposed to explain a common phenomenon in the evolution of disease organisms: the [trade-off between transmission and virulence](#) [PDF]. Simply put, if it's easy for a disease-causing critter to spread through a host population, it tends to do more damage to its hosts; and if it is less easy to spread, the disease [tends to do less damage](#) [5-a]. A classic case of this effect is documented in [cholera](#), which has evolved lower virulence when good sanitation practices cut off the easy route of transmission through sewage-contaminated drinking water.

Proponents of group selection say that this occurs because, under difficult transmission conditions, disease organisms must throttle back their production of offspring [lest they kill their shared host](#). But it's also possible to describe a verbal model by which reduced transmission selects for lower virulence without invoking group selection, courtesy of [kin selection](#).

Kin selection takes into account the effect of natural selection on not just the copies of an individual's genes within that individual's body, but also the copies borne by close relatives; if you're a parasite that reproduces inside your host, making more offspring also means making more *competitors* for your offspring, and thereby reducing the fitness of the genes that you share with the next generation. So, unless it's easy to disperse to new resources -- uninfected hosts - - natural selection can actually favor prudent reproduction by a parasite, which keeps the host alive longer.

The new paper in *Nature* puts some math behind this verbal model. The authors, Wild *et al.*, building on a standard disease-modeling framework, assume a world of patchily-distributed hosts infected by a single parasite species. Parasites are transmitted by host-to-host contact; it's assumed that the number of offspring a parasite produces is proportional to the chances that some of those offspring are transmitted to another host, so that more virulent parasites have a better chance of sending offspring to new, uninfected hosts.

Under this model, the authors show that the fitness of a mutant, more virulent parasite, differs from that of its less-virulent competitors in several important ways: A more virulent mutant has

- an increased chance of killing its host;
- an increased chance of sending offspring to another patch of hosts;
- increased competition from the offspring it produces that do not disperse to another patch;
- increased competition experienced by those offspring; and
- a greater chance that, by killing its host, it will make way for an uninfected replacement host for its offspring.

When the parasites can disperse to new patches with maximum efficiency, they simply evolve to maximize their own fitness at the expense of the host -- but

KEEP UP WITH D&T

Posts

Comments

95 readers
BY FEEDBURNER

[Receive D&T by e-mail](#)

NEW READER?

You might want to check out [this note](#) to see why there are funny tags after some links.

DENIM & TEES



There must be *dozens* of people interested in a t-shirt illustrating the [Wright-Fisher model](#), right?

TOP POSTS - POSTRANK

- 10.0 I wish I could say this made me think less of them ...
- 10.0 The omnivores' solution: Tadpoles independently solve a common problem the same way
- 10.0 That possum you just ran over? It might have saved you from Lyme disease
- 10.0 How it does a body good: The selective advantage of drinking milk depends where you drink it
- 9.7 Evolution 2009: Day two
- 9.5 Bat-eating tits!

Topic:

MY PICKS

Lijit Search

Visitors Map

Recent Readers



UNSOLICITED ENDORSEMENTS

- [ACLU](#)
- [Doctors Without Borders](#)
- [NPR](#)
- [Mennonite Central Committee](#)
- [PULSE](#)
- [PinkMenno](#)
- [ProPublica](#)

BLOGOSPHERE

- The Daily Dish | By Andrew Sullivan**
Breaking News
1 hour ago
- Slate Magazine**
Meet the new progressive CEOs.
2 hours ago
- Research Blogging - Biology**
Telomerase and Wnt signaling
8 hours ago
- kottke.org**
Updates on previous entries for Oct 9, 2009*
9 hours ago
- The Other 95%**
Nautilus Night - Cephalopod of Diamonds
14 hours ago
- Schneier on Security**
Friday Squid Blogging: Squidsoup
16 hours ago
- slacktivist**
TF: An approved wanton
16 hours ago
- ProPublica: Articles and Investigations**
KNBC TV Examines Sketchy Mortgage Rescue Company
17 hours ago
- FiveThirtyEight.com**
Reforming the Democratic Presidential Nomination
18 hours ago
- Good Evening**
BAN BACON
19 hours ago

as dispersal becomes more restricted, the costs of competition exert selection on *individual parasites* to evolve reduced virulence.

Wild *et al.* conclude that, because their model replicates the transmission-virulence trade-off without invoking group selection, they can reject the group selection hypothesis. In fact, they strongly suggest that group selection may not matter much in natural systems:

The multilevel (group) selection and kin selection (inclusive fitness) approaches to social evolution have long been known to be mathematically equivalent and, if the analyses are performed correctly, do not lead to conflicting predictions. Thus, *irrespective of the relative strengths of within-group versus between-group selection, individuals are predicted to maximize their inclusive fitness.* [In-text citations removed; emphasis added.]

Clearly this result shows that group selection isn't necessary to create the transmission-virulence trade-off. On the other hand, it doesn't provide a good comparison of group-level and individual-level selection, because (so far as I can see) it doesn't explicitly *contain* an effect of group selection. It's one thing to show that group selection isn't necessary, but it's another to show that its effects would be overwhelmed by individual-level selection.

References

Cochran G.M., Ewald P.W., & Cochran K.D. (2000). Infectious causation of disease: An evolutionary perspective *Persp. Biol. Medecine*, 43 (3), 406-48 DOI: [10.1353/pbm.2000.0016](#)

Day, T., & Gandon, S. (2007). Applying population-genetic models in theoretical evolutionary epidemiology *Ecology Letters*, 10 (10), 876-88 DOI: [10.1111/j.1461-0248.2007.01091.x](#)

Frank, S.A. (1996). Models of parasite virulence *Quarterly Rev. Biol.*, 71 (1), 37-78 DOI: <http://www.jstor.org/stable/3037829>

Wild, G., Gardner, A., & West, S. (2009). Adaptation and the evolution of parasite virulence in a connected world *Nature*, 459 (7249), 983-6 DOI: [10.1038/nature08071](#)

Wilson, D., & Wilson, E. (2007). Rethinking the theoretical foundation of sociobiology *Quarterly Rev. Biol.*, 82 (4), 327-48 DOI: [10.1086/522809](#)

SHARE

POSTED BY JEREMY AT 00:05

LABELS: DISEASE VIRULENCE, EVOLUTION, RESEARCH BLOGGING, SCIENCE

1 COMMENTS:

- Regis** said...
At any rate, I liked some of the vadlo biology cartoons!
JUNE 29, 2009 7:56:00 PM PDT

[Post a Comment](#)

LINKS TO THIS POST

- [Create a Link](#)
- [Newer Post](#) [Home](#) [Older Post](#)
- Subscribe to: [Post Comments \(Atom\)](#)

- [The cost - and benefits - of hostility to strangers](#)
- [Evolution applied: Biological warfare against mosquitoes](#)
- [Science 2.0 revisited](#)
- [What evolution can teach Christianity](#)
- [DNA barcoding:A glitch in the system?](#)

TOPICS

[Barack Obama](#) [Carnival of Evolution](#) [Charles Darwin](#) [Christianity](#) [Christmas church and state](#) [climate change](#) [coevolution](#) [darwin2009](#) [ecology](#) [economics](#) [education](#) [environment](#) [evolution](#) [evolution vs. creationism](#) [evolution2008](#) [Evolution2009](#) [history](#) [Joshua tree](#) [me](#) [media](#) [Mennonites](#) [nature](#) [NPR](#) [peace](#) [politics](#) [reading](#) [religion](#) [Research Blogging](#) [say what?](#) [science](#) [science 2.0](#) [scientific methods](#) [speciation](#) [torture](#) [travel](#) [video](#) [xkcd](#)

ARCHIVE

- ▼ 2009 (182)
 - ▶ [October](#) (3)
 - ▶ [September](#) (16)
 - ▶ [August](#) (12)
 - ▶ [July](#) (13)
 - ▼ [June](#) (18)
 - [No room for group selection in disease evolution?](#)
 - [For wasps' pheromones, quantity predicts quality](#)
 - [Attention: followup](#)
 - [John Hodgman on Obama the nerd](#)
 - [Evolution 2009: Day four](#)
 - [Evolution 2009: Day three](#)
 - [Evolution 2009: Day two](#)
 - [Evolution 2009: Day one](#)
 - [Evolution 2009: Warm-up hike](#)
 - [Evolution 2009: Underway](#)
 - [When plant siblings play nice, everyone loses](#)
 - [Hey, Morning Edition](#)
 - [Things I learned today](#)
 - [So many links, so little time](#)
 - [Walking the Jesus Trail](#)
 - [Familiarity breeds contempt: Mockingbirds recogniz...](#)
 - [The benefit of the doubt](#)
 - [Carnival of Evolution #12 at Deep Sea News](#)
 - ▶ [May](#) (21)
 - ▶ [April](#) (29)
 - ▶ [March](#) (16)
 - ▶ [February](#) (36)
 - ▶ [January](#) (18)
- ▶ 2008 (185)
- ▶ 2007 (50)
- ▶ 2006 (6)

[Show All](#)

MY PHOTOS

