have arisen by direct ligation of these ancestral RNA genetic modules. Such fusion would have improved the efficiency of protein domain assembly. Consequently both RNA and encoded proteins would have had a structural mapping, with more or less discrete modules strung together by connecting loops and a direct correspondence between protein and RNA motifs.

If introns subsequently invaded the genome with an ability to 'self-splice' into RNA⁵, those regions most susceptible to insertion could well have included the relatively unstructured connecting loops between RNA domains. Introns could thus have been preferentially directed to positions corresponding to protein structural divisions. Different RNA molecules would have had different degrees of structure and different abilities to direct insertion. There would even have been a tendency for introns to insert at similar, but not identical, locations in different lineages, giving the appearance of intron slippage. As in other models, introns would have arrived in the DNA genome by reverse transcription, perhaps using intron⁶ or retrovirus-encoded enzymes.

The selective advantage of discrete folding in coding sequences would probably have declined as riboprotein complexes and other systems evolved to handle RNA. However, the need to maintain encoded protein sequence and the benefits of increased stability could have acted to retain ancestral RNA structure for some time. Even now, some degree of internal folding in transcribed exons could be advantageous in improving the energetics of splicing.

In summary, the positions of many introns may truly be nonrandom. However, their positioning need not mean that ancient introns participated in the original assembly of genes. Introns could instead have been inserted at later times with their positions determined by how well ancestral RNA structure was retained. The successful prediction of a novel intron position in TIM may thus be the result of an insightful analysis of protein structure rather than a validation of the idea of ancient, intron-mediated gene assembly.

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Life expectancy and reproduction

SIR—Recent developments in life-history theory predict that organisms will alter reproductive behaviour if life expectancy declines¹⁻³. Here we report that a parasitic wasp responds to changes in barometric pressure associated with thunderstorms, which are known to cause considerable mortality among small, frail insects⁴.

Parasitic wasps usually do not lay eggs in low-quality (already parasitized) hosts; this is an adaptive behaviour for maximizing lifetime reproduction^{2,3}. We predicted³ that wasps will oviposit in such poor hosts if the gain in lifetime reproduction associated with acceptance is higher than it would be for rejection. This trade-off is determined in part by the availability of hosts (habitat quality) and in part by life expectancy, which can change very suddenly with the approach of storms. The two main predictions of the theory³ are that a wasp will spend more time on a patch of previously parasitized hosts and will superparasitize (lay an egg in a previously parasitized host) more often if the risk of mortality increases.

To manipulate the perceived quality of

the habitat, we raised the parasitic wasp *Leptopilina heterotoma*⁵ on host patches with only unparasitized fruit fly larvae (good world, G) or only parasitized larvae (bad world, B) (see ref. 3 for explanation). To manipulate perceived life expectancy, we conducted the experiment under steady barometric pressure (S) as would occur during a fair summer day or rapidly dropping barometric pressure (D) as would occur several hours before the onset of a large storm. We placed wasps and patches containing only parasitized hosts in sealed plastic chambers, which were then connected to a microprocessor-driven air pump controlling internal air pressure. At the start of the experiment, we randomly chose the boxes to correspond to the steady pressure or dropping pressure, which decreased at 1 mbar per hour. Six hours later, we released the wasps individually on to the patches and recorded times on patches and number of superparasitisms.

The wasps are sensitive to barometric pressure in the manner predicted by theory. Wasps in the low life-expectancy treatments searched longer ($P < 0.02$; part *a* in the figure), encountered more hosts and superparasitized more frequently ($P < 0.00014$, part *b*). Explanations other than decrease in life expectancy are possible, but our previous work³ shows that wasps respond in a similar manner to a completely different cue (photoperiod) that indicates short life expectancy. Hence it is life expectancy and not the cue that is shaping reproductive behaviour. We cannot firmly state that the wasps respond only to dropping barometric pressure or to changes in barometric pressure. However, the point could be moot as it may be the indication of change (and the uncertainty associated with such change) that has shaped the behaviour of the wasps.

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a, Amount of time wasps allocated to searching patches before emigrating. SG, steady pressure, good world; SB, steady pressure, bad world; DG, dropping pressure, good world; DB, dropping pressure, bad world. *b*, Number of times wasps superparasitized. Data are shown with $\pm$ standard error.

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