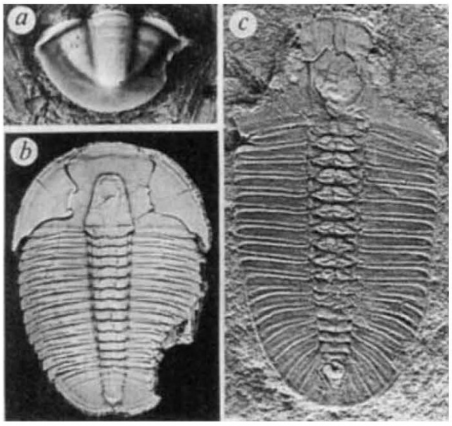

Middle Cambrian trilobites from Utah showing healed arcuate scars resulting from injury during predation, all in collections of the University of Kansas Museum of Invertebrate Paleontology (KUMIP). *a*, *Asaphiscus wheeleri* Meek, pygidium, KUMIP 203889, × 2.0. *b*, *Elrathia kingii* (Meek) with a regenerated, abnormally elongated, pleural tip, KUMIP 204773, × 0.9. *c*, *Bathyuriscus elegans* (Walcott), moulted exoskeleton lacking free cheeks, arrow indicates scar, KUMIP 204774, × 0.7.

damage include spines, facial sutures, bilamellar fringes and tips of thoracic segments, so we treated scars in these areas as of uncertain origin. Among 158 specimens with healed injuries, 81 show scars attributable to predation (see table).

Most marginal predation scars are arcuate in outline (see figure). One widespread Cambrian animal, *Anomalocaris*, has been suggested[1] as a possible predator of Cambrian trilobites, and the arcuate injuries preserved on some trilobites (*a*, *b* in the figure) are similar in size and shape to the opening between the mouth plates of this enigmatic organism. Trilobite remains have been observed in the gut contents of other Cambrian animals[2,3]. The fossil record of post-Cambrian marine predators is more diverse and those predators were a continuing source of injury to trilobites until the Permian, when trilobites became extinct.

Sublethal predation scars are more common on the right side of the trilobite body than on the left (see table), whereas locations of injuries of uncertain origin do not significantly differ from a random distribution. Our results indicate that lateralized behaviour had developed by Cambrian time, 500 million years earlier than previously observed. This is the first evidence of behavioural asymmetry in the fossil record, except for hominids, and supports the hypothesis that brain laterality has an evolutionary history[4,5].

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Mating success in male pheasants

SIR—Von Schantz *et al.*[1] report that in a population of Swedish pheasants, male spur length is positively correlated with male viability and with male mating success. It is not clear why males with longer spurs survive better, but their greater mating success appears to be explained in this population by female sexual preference for males with longer spurs, a result supported by experimental shortening and elongation of the spurs.

In an accompanying News and Views[2], Kirkpatrick comments that this is a surprising and mysterious result. Surprising, because the standard interpretation of darwinian sexual selection predicts that attractive secondary sexual characters, like spurs, that enhance mating success, should decrease male survival[3]. Mysterious, because if spurs are so beneficial, why are they not very rapidly increasing in males and why are they absent from females?

Kirkpatrick offers two solutions to this puzzle. First, that the measurement of selection by von Schantz *et al.* is unrepresentative and in normal years viability selection acts against long spurs; and second, that there is no additive genetic variance for male or female spur length in this population. As Kirkpatrick states, neither of these explanations seems likely. I would like to suggest a much more straightforward explanation, that spur length is a condition-dependent character[4–7].

Imagine that males vary in quality for environmental or genetic reasons and that, other things being equal, higher-quality individuals survive better. High-quality males can have higher viability and longer spurs if their quality advantage more than compensates for the loss in viability incurred from having longer spurs. Formally, if a marginally better-quality male survives better by α and makes a greater allocation to spur length which increases his mating success but reduces his viability by β, then mating success and viability will both increase if α is greater than β. Condition-dependent expression of spurs will be favoured as long as the increase in mating success outweighs the net loss in viability. Clearly there is now no real difficulty in explaining why spurs are absent from females — spurs would not increase female mating success but they would reduce female viability.

This natural intepretation may provide the solution to Kirkpatrick's mystery. The equation — longer spurs equals lower survival — is valid only when male quality is held constant. Once variability in quality is considered, survival and spur length can rise together. This interpretation also adds weight to the conclusion of von Schantz *et al.*[1] that the pheasant data support the 'good genes' theory (sexual preference for high-viability genes). Recent theoretical investigations[5,6] show that condition-dependent traits are particularly favourable for the evolution of 'good genes' female preference.

But several uncertainties remain about the observations of von Schantz *et al.*. Are male spurs particularly good indicators of differences in male quality? Do female pheasants prefer longer-spurred males in choice experiments when other variables are held constant (for example, territory quality)? And does the variation among males and their offspring have a genetic basis? These questions need to be investigated by experimentation.

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Hazards of sulphur

SIR—Meisenhelder and Hunter (*Nature* **335**, 120; 1988) have drawn attention in Scientific Correspondence to the fact that volatile radioactive gas is released from the vial when containers of ^{35}S-methionine or cysteine are first opened. Unfortunately, the situation seems to be even worse.

We have found that ^{35}S-γ-thioATP, which we use for post-translational modification of proteins, also liberates radioactive material and that this material rapidly contaminates any container in which the compound is enclosed. We also have the impression that radioactive volatiles escape from unopened containers as they warm up.

We suggest that the same problem would arise with α-thioATP and perhaps should be considered whenever any radioactive sulphur compound is used. We note that methionine containing a specific pyridine inhibitor is now available and believe that such inhibitors should be widely used by manufacturers. We also suggest that a hazard warning should be printed in all catalogues as well as on data sheets supplied with ^{35}S-compounds.

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