100 YEARS AGO

The February number of *Knowledge and Scientific News* gives an account of what appears to be the first successful achievement of artificial flight, by Messrs. Orville and Wilbur Wright. That these brothers have been successful in gliding experiments performed under gravity is well known, but they now appear to have succeeded in raising themselves from the ground by a motor-driven machine which, after running along a mono-rail for 40 feet, rose into the air, and was driven in the face of a gale blowing at about 25 miles an hour… In the last trial the machine flew half a mile relative to the air, or 852 feet relative to the ground. It is sincerely to be hoped that this success will not, as in so many previous instances, be followed by a fatal accident.

From *Nature* 18 February 1904.

50 YEARS AGO

The recent exchange of views in *Nature* regarding the biosynthesis of proteins prompts some comments from a geneticist. Campbell and Work take note of "the two main streams of thought on protein synthesis: one derived from the study of isolated enzyme systems and suggesting a stepwise coupling of many small peptide units; the other based on the study of genetic inheritance of protein specificity and preferring synthesis on templates, each template being specific for a single protein structure and probably identifiable with a gene". While not rejecting the latter view (one gene–one protein), they point to some of the difficulties with which it is confronted, and further suggest the possibility that a synthesis of the two ideas will be found to fit the facts… The similarity of the conclusions drawn from the two aspects of this work, that with *Drosophila* and that with *Neurospora*, is notable. In connexion with the previous discussion in *Nature*, it might be suggested that the synthesis of non-specific precursor occurs in a stepwise fashion, while specificity is the function of template action. If this is the case, the gene–template relationship cannot be simple… and perhaps the template itself is synthesized by a similar two-stage process. The genetic control of protein synthesis would in any event be indirect and complex, perhaps approaching the level of complexity of the genetic control of morphogenesis.

From *Nature* 20 February 1954.

Malaria

A changed climate in Africa?

Christopher Thomas

The rise of malaria in Africa is a subject of much debate. A new analysis emphasizes the influence of rainfall, but there appear to be few areas where climate has been a major driver of this change.

After decades of decline, malaria has been on the rise in many parts of Africa — an estimate[1] by the World Health Organization is that, in some parts of the continent, malaria mortality in young children almost doubled from the 1980s to the 1990s. The disease causes some 3,000 deaths each day and imposes huge losses in economic productivity[2].

Is this resurgence a sign of increased transmission caused by climate change? Probably not, according to results presented by Small, Goetz and Hay[3]. Writing in the *Proceedings of the National Academy of Sciences*, they describe their analyses of trends in climate suitable for the regular transmission of malaria in Africa between 1911 and 1995. Their conclusion does not imply that future climate change will not affect transmission, but it does focus attention on other contemporary trends.

Several studies have projected that global climate change will increase future malaria transmission in Africa[4–6]. However, the link between contemporary changes in malaria and climate is hotly disputed. Alternative explanations such as an increase in parasite resistance to the front-line drugs since the 1960s, poverty and a decline in many African health services are cited as more likely causes[7–9]. Undoubtedly, a mix of such reasons is behind the rise in malaria. But identifying the prime factors will help greatly in planning control measures.

One problem dogging the interpretation of changes in local disease patterns in relation to climate is that meteorological recording stations are sparsely distributed in many parts of the continent, so that long-term records from the same locality are rare. As an alternative, researchers have used so-called 'climate surfaces' — maps interpolated from these sparse data. But these surfaces often provide only a coarse representation of climate, and their usefulness in relation to the scale of the malaria data has been open to question[10–12]. To eliminate this mismatch, Small *et al.*[3] used a malaria transmission index calculated directly from the interpolated climate data. Refreshingly, for an area of science beset by untestable models, they then produced an 85-year 'hindcast' against which observed trends in malaria could be compared.

The malaria transmission index used by Small *et al.* was formulated in an earlier study to map zones of malaria transmission across Africa[13]. This index is based on the temperature and precipitation constraints within which the mosquito vector and malaria parasite can develop, and is pretty simple. It has nonetheless proved remarkably effective for estimating the distribution of stable

S. W. LINDSAY

Figure 1 **Water monitor — surveying mosquito breeding sites in Uganda.**

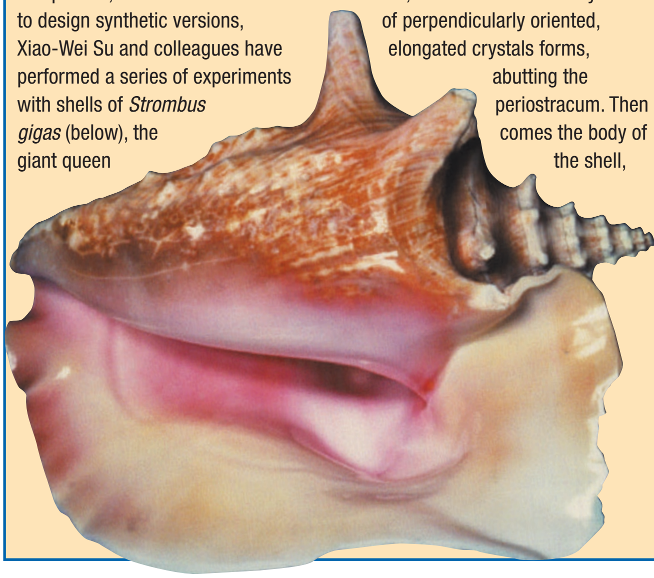
Materials science

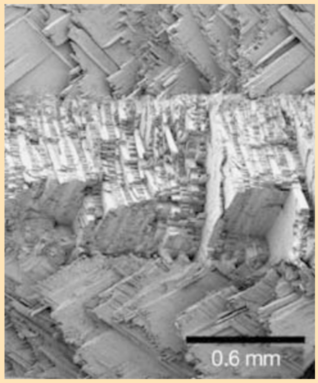
Give a shell a break

Giant conches are seldom treated with the respect they deserve. Their impressive shells are prized as holiday souvenirs, but size and aesthetics are only half the story. At the microscopic scale, they are one of nature's greatest engineering masterpieces: a stunningly intricate hierarchical architecture of inorganic crystals, interwoven with organic molecules.

In search of fresh insight into the synthesis of such biomineral composites, and clues for how to design synthetic versions, Xiao-Wei Su and colleagues have performed a series of experiments with shells of *Strombus gigas* (below), the giant queen conch of the Caribbean. They drilled holes in the shells of live juvenile specimens, then, through X-ray diffraction and electron microscopy studies, monitored how the animals repaired their shell tissue (*Chem. Mater.* **16,** 581–593; 2004).

In natural shell growth, an organic outer layer (the periostracum) is deposited first. It remains unmineralized but provides a base on which the mineralized shell is deposited. First, a micrometre-thick layer of perpendicularly oriented, elongated crystals forms, abutting the periostracum. Then comes the body of the shell,





which grows to a thickness of a few millimetres and has a three-layer 'crossed-lamellar' structure (left image, above).

Su *et al.* found that the process of shell repair is somewhat different from natural growth. In a wounded conch, 24 hours after damage, a transparent organic membrane was deposited over the drilled hole. Once the membrane was in place, Su *et al.* saw that fine crystallites of aragonite — a particular crystal form of calcium carbonate — nucleated rapidly on the organic membrane. Each conch generated a 100-μm depth of such abnormal tissue in the damaged area (right image). After 6–8 days, elongated crystals were deposited, oriented perpendicular to the direction of shell growth. As in normal shell development, the setting down of these elongated crystals preceded the formation of the crossed-lamellar microstructure (seen at the bottom of the image).

In uncovering the development of the unusual organic–inorganic layers in shell repair, Su *et al.* have provided a window onto the complex process of shell formation. It remains to be discovered how the interplay of organic and inorganic components is controlled at the molecular level, in conch shells as well as in other mineralized structures.

Rosamund Daw

malaria (as opposed to epidemics at unstable fringes) at coarse scales and is in operational use throughout the continent.

Using this index, Small *et al.* calculated the annual transmission suitability for each half-degree latitude–longitude grid cell (about 55 km × 55 km) across Africa from 1911 to 1995. Time-series analysis revealed that both positive and negative trends were restricted to a few limited zones, with only one (southern Mozambique) showing a consistent increase in climatic suitability for transmission. Obviously, a model at this spatial resolution will miss finer-scale patterns, for instance in climatically varied mountain areas, and will produce transmission suitability maps specific to the index used. Nonetheless, it might be expected that more widespread positive changes would have been found if climate has been a major driver of change in transmission in this period.

A notable finding, however, was that in those areas showing positive significant trends, precipitation, not temperature, drove most changes. Mathematical models of malaria transmission, often used to project events under changed climate conditions, are based mainly on temperature-dependent processes and incorporate precipitation only as a simple global threshold sufficient for mosquito breeding[5]. Clearly this needs to be improved, but we have very little empirical understanding of how rainfall, humidity and their interactions with temperature influence vector populations. Moreover, owing to natural variability, it is difficult to identify robust signals in precipitation patterns from climate models. This is particularly so in Africa[14] — a landmass that is strongly influenced by El Niño, the episodic disruption of the ocean–atmosphere system in the tropical Pacific which has a large-scale influence on weather and climate.

As far as climate change is concerned, then, the main message from Small *et al.*[3] is that malaria transmission needs to be understood in terms of precipitation as well as temperature. No doubt climate models will continue to improve and we can look forward to refinement in the projection of these parameters. Regrettably, however, knowledge of the basic ecology of malaria transmission lags behind — for instance, we cannot yet relate absolute mosquito abundance to climate[6]. The urgent need is for progress on the entomological front to guide future modelling work on transmission. ■

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