relatively little importance in natural immunity in Sudan, could it be the basis of an effective vaccine there? If genetic differences between the populations at risk have to be taken into account in malaria vaccine development, it will greatly complicate the task.

What is CFF? The short answer is that we do not know. As long ago as 1953, Trager and McGhee identified a factor in the sera of birds immune to malaria that inhibited infection by Rous sarcoma virus[9]. From this has arisen the possibility that CFF is related to the ill-defined tumour necrosis factor[10,11]. Alternatively, it may be related to certain reactive oxygen intermediates that bring about the occurrence of crisis forms both *in vivo* and *in vitro*[12,13]. However reactive oxygen intermediates are probably too short-lived to produce directly the effects recorded by Jensen *et al.*, although they could be involved in reactions with lipids to produce toxic substances such as aldehydes[14].

What must happen now is a switch of attention away from *Plasmodium* antigens that elicit the production of antibodies to those that elicit CFF. Since CFF is probably a product of macrophages, these cells and the T cells that activate them require much more attention. At a very basic level, however, we now know that CFF kills malaria parasites and thus, if characterized, could be used to treat the rapidly increasing number of drug-resistant cases for which there is no obvious alternative treatment. Further studies of CFF might also provide clues to the development of new antimalarial drugs. □


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## 100 years ago

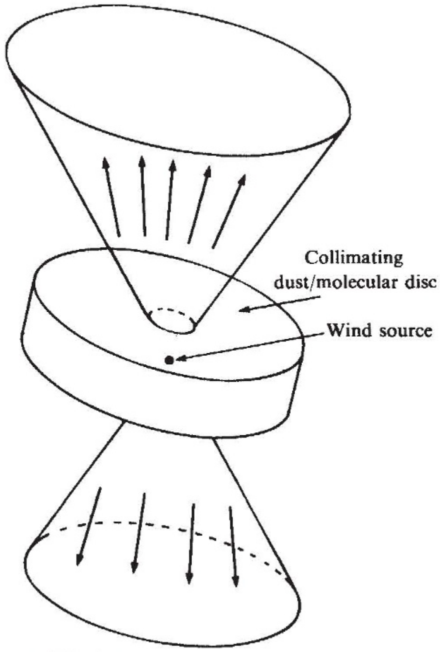
THE *Bolletino* of the Italian Geographical Society for May contains a brief account of Signor Maurizio Buonfanti's late expedition across North Africa. After some trips to Yakoba and other little-known parts of Sokoto, he made his way through Gando to the Niger at Say, about midway between Timbuktu and the Binue confluence. Here he turned north, and for the first time *ascended* the Niger as far as Timbuktu. This feat, hitherto supposed to be impossible, was performed *in the dry season*, and the problem thus successfully solved possesses considerable geographical and commercial importance in connection with the attempts now being made to establish regular lines of water communication between Western and Central Sudan and the Gulf of Guinea. From *Nature* **30**, 131, 5 June 1884.

**Astronomy**

# High-velocity winds in Orion

*from Ben Zuckerman*

THE biggest surprise to emerge from a decade of observational study of the formation of stars has been the realization that this process is accompanied by massive outflowing winds. The winds, which can be sporadic, are millions of times stronger than the solar wind and are generated by most, perhaps all, young stars either shortly before or, more probably, shortly after they initiate the burning of hydrogen into helium in their interior. Since it is natural to think of star formation as a process of collapse, or infall, the ubiquitous occurrence of an accompanying outflow comes as a bit of a shock. Now D.J. Axon and K. Taylor have described new optical spectra indicating very high-velocity winds in the most famous region of star formation in the heavens, the Orion Nebula (*Mon. Not. R. astr. Soc.* **207**, 241; 1984). Their spectra point towards the existence of a biconical pattern of outflow and suggest the presence of a substantial disc of molecular gas and dust grains close to a putative stellar source of excitation, located in the giant molecular cloud behind the nebula.




Model of biconical protostellar wind in the Orion Nebula. (From Mon. Not. R. astr. Soc. **207**, 246; 1984.)

As a result of isolating the 6,300 Å wavelength forbidden transition of neutral oxygen, which is prominent in shock-excited regions but relatively weak in photoionized gaseous nebula such as the Orion Nebula, Axon and Taylor discovered a 'family' of six shock-excited objects which, in the plane of the sky, are located near a group of strong infrared-continuum sources discovered in the 1960s. The latter are believed to constitute a very young, but highly obscured, star cluster behind the Orion Nebula. The oxygen atoms display a very wide range of line-of-sight velocities extending from near 0 km $s^{-1}$ (the velocity of the molecular cloud) to an approach velocity of nearly 400 km $s^{-1}$. When projection and other effects are taken into account, the implied wind velocities are of the order of 1,000 km $s^{-1}$ — similar to that of winds from the most massive main-sequence stars in our Galaxy.

Taking into account previous observations of Orion, primarily at infrared and microwave frequencies, Axon and Taylor conclude that the most plausible model of the region is one in which a biconical protostellar wind originates from one (or more) of the massive young stars that are embedded in the molecular cloud, as in the figure. Although the star itself must be obscured from our view by an optically thick disc that lies, presumably, in its equatorial plane, the wind can escape from the polar regions. In their model, the shock-excited objects, detected by neutral oxygen emissions, are the result of the impact between the winds and gas blobs ('knots') located at the front face of the molecular cloud, just behind the Orion Nebula itself.

These results bear on more general questions related to star formation and massive winds. Observations of many other regions of star formation indicate that bipolar or biconical outflow is the rule rather than the exception. Orion has now been reasonably securely added to this class. If the collimation is due to a disc of gas and dust located near the stars, as Axon and Taylor, like many others before them, suggest, then it is possible that at least the raw material necessary to make planets can be found in the vicinity of most young stars. Since not a single planet has been identified with certainty outside our Solar System, the implied ubiquitous existence of this raw material is of considerable interest.

Material which may be distributed in the form of a small disc with dimensions only about three times that our Solar System has very recently been seen directly (via scattered light at 2 μm wavelength) near the very young star, HL Tauri, by two different teams (S. Beckwith, B. Zuckerman, M. Skrutskie and H.M. Dyck, and S. Strom and G. Grasdalen, *Astrophys. J.*, in the press). However, it still remains to be shown how frequently a gaseous disc, as opposed to some other physical mechanism such as a magnetic field, is actually responsible for collimation of the winds that accompany star formation. □

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