A Large Field Compensator for Measurement of Birefringence

A FROZEN stress compensator using a *C R* 39 resin strip, such as is described by Messrs. P. E. Jellyman and A. J. Milne in *Nature* of March 27, p. 477, was constructed and used at the Naval Construction Research Establishment, Rosyth, in 1944. It was briefly described in a paper read to the Edinburgh and District Association of the Institution of Civil Engineers in November 1944.

The instrument could not be made to be as stable as a quartz wedge compensator, but fulfilled a useful purpose while the delivery of a Soleil-Babinet compensator was awaited.

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The Swimming of Dolphins

DOLPHINS in the Gulf of Panama have been seen moving through the sea at a speed of ten knots, their entire bodies showing no apparent swimming motion. This performance was confined, in my observations, to the area immediately forward of the stem (prow) of a sea-going tug and to an estimated depth of one metre or less. Elsewhere near the bow, vertical oscillations of dolphins' tails were readily timed with a stop watch.

When this 'motionless' swimming was first noticed, the animals were in the normal swimming position. In this position it was difficult to be sure that vertical motions of their tail surfaces were not occurring, since the direction of such motions would be nearly parallel with the line of sight of the observer. However, on several occasions dolphins were seen to turn on their sides during the 'motionless' swimming in such a position that their usual swimming motions would have been normal to the line of sight. No motion was visible in these animals, which were clearly seen just below the surface of the water. One animal remained on its side in this manner for 59 sec., which represented a distance, at 5·15 m./sec. (10 knots), of 304 metres. At this time dolphins swimming near by used 1·9 tail oscillations per second in keeping pace with the vessel.

These 'motionless' dolphins seemed to be riding the bow wave (that is, falling down the inclined surface). However, if dolphins are equal in weight to the weight of the water they displace, wave riding is not possible. No data have been found concerning their density. Kellogg[1] says, however, that dolphins usually sink when shot. Is it possible that they are dense enough to fall down the advancing slope of the bow wave, having achieved terminal velocity initially by swimming? A low over-all resistance to motion through the water would seem to be required. Gray[2] has indicated that the work done by dolphin muscle in producing a speed of 10 m./sec. is comparable to the work of other mammalian muscle tissue, if laminar flow is assumed around the dolphin. With turbulent flow, Gray found that the work done by dolphin muscle at 10 m./sec. would be about seven times the work of other mammalian muscle. If a laminar regime exists at a speed of 5 m./sec., perhaps the over-all resistance to the motion of a dolphin is low enough to allow an animal, of sufficient negative buoyancy, to fall down the inclined water surface of a bow wave or other waves.

It may be thought that the dolphins were gaining a forward thrust by placing their tails against the ship's stem. Dolphins have been seen with their tails in momentary contact with the hull, but in the above observations of 'motionless' swimming the animals were clearly forward of the vessel.

Shoulejkin[3] suggests that the speed of motion of the dolphin's tail may be very rapid. Dolphins seen 'motionless' in the bow wave may have been using rapid tail oscillations of very small amplitude, causing them to appear to be motionless. If such swimming motions were in fact occurring, it is curious that the use of this propulsive technique should be confined to the immediate vicinity of the bow, while other dolphins a few metres away always used a large amplitude vertical tail motion with a period of about half a second (at 10 knots).

I would like to know whether other observers have seen this 'motionless' swimming, and what explanations may have been given.

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[1] Kellogg, Remington (personal communication), U.S. National Museum, Washington, D.C., 1948.
[2] Gray, J., "Studies in Animal Locomotion. VI. The Propulsive Powers of the Dolphin", *J. Exp. Biol.*, 13, 192 (1936).
[3] Shoulejkin, W. W., "Physics of the Sea", Publication Acad. Sci U.S.S.R., Moscow-Leningrad, see pp. 715–724 (1941).

Control of Cattle Trypanosomiasis

MRS. ELSPETH HUXLEY suggested in a letter in *The Times* (Sept. 16, 1947) that possibly cattle trypanosomiasis might come to be controlled by immunological methods. If this were achieved, resettlement of tsetse-infested land could be accomplished without such undesirable features as the destruction of plant and animal life. On the assumption that man and tsetse flies are ecologically incompatible, resettlement must cause recession of the 'fly'. Domestic stock are, therefore, the key to the problem, since tribal customs in East Africa are such that a threat to the stock constitutes a threat to the community. Resettlement is only possible if stock can be enabled to survive in 'fly'-infested areas.

There is a certain amount of evidence that, with intensified research, means could be found to 'salt' cattle, so as to enable this to be accomplished.

Survival of game in tsetse-fly areas. Carmichael at Entebbe (unpublished data) found that the young of game animals, notably duiker and sitatungu, which abound in tsetse-fly areas, are as susceptible as domestic animals to artificial infection with *T. congolense*. It follows that the immunity of some game animals at any rate is acquired and not hereditary.

Survival of cattle in tsetse-fly areas. Cattle in many parts survive in tsetse-fly areas, as reported from Kenya, Southern Rhodesia and the Gold Coast. Such cattle are usually deliberately exposed by the owners to tsetse-fly attack from birth onwards.

Immunity of cattle to T. congolense. Young calves usually recover from infection with *T. congolense*[1–3]. Taliaferro[4] has demonstrated solid immunity to *T. lewisi* in rats following recovery; the same has been demonstrated by Fiennes[5] in the case of cattle, but only to the infecting strain.

Laveran and Mesnil[6], in re-infection experiments with goats, could only demonstrate four strains of *T. congolense*.