CRICKETS

# Genetics of Call

from our Neurophysiology Correspondent

MALE crickets make highly standardized calling songs which they can develop in isolation, without hearing a model. Each call consists of a chirp containing four to six sound pulses, followed by a series of trills containing up to fourteen sound pulses. The call patterns depend on activity in small groups of neurones within the thoracic ganglia; these drive fast muscles each of which contains no more than three motor units. Muscular activity produces stridulation by opening and closing the wings. The neural networks produce the song following an endogenous rhythm that can be entrained by the normal light–dark cycle. Such stereotyped behaviour patterns, under the control of small networks of identifiable neurones, are ideal subjects for the investigation of the mechanisms underlying the formation of neuronal connexions and its translation into behaviour.

D. R. Bentley (*Science*, **174**, 1139; 1971) has crossed two species of cricket with very different calls, *Teleogryllus commodus* and *T. oceanicus*, and has then made back-crosses between the male $F_1$ hybrids and their parents. (The female $F_1$ hybrids were sterile.) He recorded the calling songs of the parents and all the crosses and investigated various of their characteristics including the number of trills within a call, the number of sound pulses within a trill and the intertrill interval. He also recorded the activity of the wing opener and closer muscles, the action potentials of which are produced by the discharge of a single neurone. The pattern of the bursts of action potentials from the muscles determines the pattern of sound pulses, and the number of action potentials within each burst determines the amplitude of the sound pulses.

Bentley's results show that there are at least several genes involved in determining the sound pattern of a call and that these are on more than one chromosome because some call characters are sex-linked whereas others are not. The genetic control may be very precise, for in one instance there was a genetically determined difference of a single action potential in the bursts from single, homologous, neurones of different genotypes. Indeed, it might be expected that the developmental control system specifying the parameters of a calling song would be both polygenic and capable of very precise action. Presumably the features of a song have evolved in a more or less continuous fashion; this process can occur as the result of changes in activity of several muscles as well as in the structure of various skeletal elements. Selection leading to the divergence of species-specific song patterns could therefore have acted at many independent loci. This is obviously likely to be the case for any piece of behaviour, however simple, depending as it must on the interaction of many structures of different developmental origins.

BIOPOLYMERS

# Make and Break

from our Molecular Biology Correspondent

THERE are no doubt people—molecular biologists even—who will receive the news that the kinetics of oligonucleotide pairing have been measured and analysed with an equanimity bordering on indifference. Nevertheless, for anybody with a serious interest in such processes as codon-anticodon interaction and unwinding of DNA, two new articles covering essentially identical ground will repay close study. They concern the equilibrium between oligomers of adenylic acid and uridylic acid, and their two-stranded complexes. Much work has in the past been done on the kinetics of melting of DNA, but this is a problem of hideous complexity. In the first place there are two kinds of base pair, with presumably different kinetic characteristics; in denaturation, rotational friction effects become important at appreciable molecular weights, whereas in renaturation intrastrand interactions, multiple nucleation and other unsought-for phenomena manifest themselves. There is consequently much to be said in favour of starting from the relatively tractable situation presented by simple oligomers.

Craig, Crothers and Doty (*J. Mol. Biol.*, **62**, 383; 1971) have used the temperature-jump method to examine the interaction of oligomers of chain lengths from 4 to 7, whereas Pörschke and Eigen (*ibid.*, 361) have worked with a series of

# A "Non-internalizable" Mitogen for Lymphocytes

THERE is little agreement as to the general nature of regulators of mitosis among somatic cells; contact inhibition, hormones, chalones, and quasi immunological processes number among the very many controls which have been proposed. The technical difficulties of establishing exactly what is happening in a solid block of tissue are in fact formidable and it may be many years before these problems can be fully resolved. In the interim the lymphoid system and lymphocytes in particular provide an interesting analytical tool. Mitoses are part of the reaction pattern of the lymphoid system to antigenic stimulation and lymphocytes can be stimulated to mitotic activity *in vitro* in a number of different ways. In next Wednesday's *Nature New Biology* (January 19), Greaves and Bauminger set out to explore this last phenomenon and to point the way to further understanding of the manner in which somatic cells can be made to divide.

Greaves and Bauminger have covalently bound the well known plant mitogen, PHA, to 'Sepharose' beads. These beads are insoluble cross linked polysaccharide aggregates the surface of which can be activated by cyanogen bromide in such a manner that covalent binding of proteinaceous material is possible. The ability of the 'Sepharose'-PHA conjugates to induce transformation and DNA synthesis (and presumably mitosis) in populations of B and T lymphocytes was studied. B cells were obtained from the spleens of thymectomized irradiated mice which had been given haematopoietic tissue therapy consisting of anti-$\theta$ treated syngeneic bone-marrow (to eliminate T cells in the marrow), and T cells were collected from the thymuses of cortisone treated mice. It is accepted that cortisone-resistant cell populations in cortisone-treated mice are roughly equivalent to true thymus derived cells collected outside the thymus. It was found that both T and B cells responded to PHA on the surface of 'Sepharose' beads.

This result is of interest in a number of ways. First, the capacity to respond to PHA has been used as an identifying characteristic of T cells. It is now shown that if PHA is presented to B cells in an appropriate manner they will also yield to its persuasive urge to reproduce. Second, and more important, it suggests that a cell can be made to divide by surface stimulation as Greaves and Bauminger believe that the PHA is retained on the 'Sepharose' bead surface—in their quaint terminology, it is non-internalizable. Evidence is indeed presented that less than 2 per cent of the bound PHA leaches off the bead and that this is insufficient to account for the effect observed. The unlikely possibility that polysaccharide fragments from the bead itself are responsible is disregarded.

Greaves and Bauminger suggest that stimulation of lymphocytes by PHA is comparable with their activation by other antigenic materials and they point to analogies with stimulation of cells *in vitro* by covalently bound peptide hormones. Without precluding the possibility that pinocytosed material can be of significance in relation to cell division, the finding of Greaves and Bauminger could well establish the important principle that the initiation of division of a somatic cell takes place at the cell surface.