theless remain significantly elevated for periods of at least 1 year. This postregression plateau is in most cases within the 2000 to 6000 unit level, which corresponds quantitatively to the first host-response plateau seen shortly after tumor implantation but prior to the appearance of the tumor.

Since the values for lactic dehydrogenase activity in plasma have responded to the successful treatment of the established tumors which we have tested, and since they have also reflected tumor inhibition prior to visible or measurable changes in the tumor mass, these enzyme methods are being explored to determine their potential usefulness as additional indices in the screening of antitumor compounds and of extending the understanding of tumor-host-enzyme relationships (*7*).

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Communicative Mandible-Snapping in Acrididae (Orthoptera)

Abstract. *Paratylotropidia brunneri* Scudder is the first insect known to possess a long-range mandibular sound signal. This signal probably evolved through a stage in which feeding noises were significant; it is believed to be a functional analog of other insect calling sounds.

Many insects with chewing mouthparts make audible noises while feeding, but only among the short-horned grasshoppers are cases known in which sounds made by movements of the empty mandibles operate as intraspecific communicative signals. This ability has appeared in scattered genera in three subfamilies of Acrididae: Acridinae, Oedipodinae, and Cyrtacanthacridinae (*1, 2*). In most cases the sounds appear to be no more than relatively nonspecific reactions to disturbances, produced by nymphs and adults of both sexes when they contact one another or when they are disturbed by the activities of other animals. However, in *Calliptamus italicus* (L.) (Cyrtacanthacridinae), several mandibular noises occur as significant signals in situations similar to those which are regulated by tegmino-femoral stridulation in the Acridinae and Oedipodinae. Mandibular sounds are produced by adults of both sexes when they are disturbed, and by males during aggressive encounters with other males, during courtship, when courtship is interrupted, and during copulation (*2,3*). The single finding that keeps this series of situations from paralleling those in which tegmino-femoral stidulation is significant in Acridinae and Oedipodinae is that *C. italicus* has no calling sound—no signal produced by lone males in the absence of other individuals which results in the coming together of the sexes or has any of the other side effects of this signal in various Orthoptera and Homoptera (see *4*).

On 20 June 1959 I tape-recorded a mandible-snapping noise made by *Paratylotropidia brunneri* Scudder (Cyrtacanthacridinae), which is not only the first sound recorded for this species but also appears to represent a close parallel of the calling sound in other Orthoptera and in Homoptera. This large grasshopper was abundant in a hill prairie along the crest of the Mississippi River bluff south of Valmeyer, Ill., in Monroe County. A similar prairie just south of this one has been described and illustrated (*5*). The dominant plant is *Andropogon scoparius* Michx.; there are occasional clumps of *A. gerardi* Vitman present, along with several other native prairie plants and animals. During the day in late spring and early summer, the principal sounds in the prairie are the calling songs of three Acridinae: *Chloealtis conspersa* Harris, *Pseudopomala brachyptera* (Scudder), *and Eritettix simplex* (Scudder) (*6*). The tiny grassland cicada, *Beameria venosa* (Uhler), and three largely nocturnal crickets, *Acheta fultoni* Alexander, *Miogryllus verticalis* (Serville), and *Oecanthus argentinus* Saussure, were the only other singing insects heard in the prairie on three separate visits at this time of year. This is perhaps the only habitat in eastern North America in which slant-faced grasshoppers are at any time the dominant noisemakers.

Several *Paratylotropidia brunneri* were collected before it was discovered that series of soft ticks heard almost continually here and there across the prairie were being produced by this species. A male was approached and watched as he made the noise; his mandibles could be seen moving in time with the sound. Individuals spaced a few feet apart seemed to be responding to one another by repeating series of ticks in rapid succession, each one beginning about a second after his nearest neighbor had finished. My attempts to get a response by tapping various metal objects together were unsuccessful until finally a nearby male delivered a series of ticks immediately following an imitation made by striking a metal thermometer case against a brass belt buckle. In each of many subsequent trials, the insect responded to the imitation after an interval of about 1 second (0.9 to 1.0 second in five tape-recorded trials). This was the same interval as was occurring between successive series of ticks by neighboring grasshoppers, and an irregular juggling of the time of delivery of the imitation left no doubt that the grasshopper was responding to it.

The mandible-snapping of *Paratylotropidia brunneri* is a simple sound, resembling a low-intensity abbreviated version of the ticking song of the katydid, *Microcentrum rhombifolium* (Saussure) (*4*). It is audible from a distance of several yards. Audiospectrographic analysis shows that the ticks have a nearly continuous frequency spectrum up to at least 15 kcy/sec, with intensity peaks at about 3, 5, and 8 kcy/sec. The ticks are delivered at rates of 6 to 7 per second (*7*); of 16 tape-recorded series, 12 series were comprised of 4 ticks each, and the other four, of 2, 3, 5, and 6 ticks each (*8*).

Every aspect of this observation suggests that the ticking of *P. brunneri*—produced by lone males and elicited consistently by auditory stimuli—is functionally analogous to the calling songs already known for Acridoidea, Tettigonioidea, and Auchenorhynchous Homoptera. This is a significant addition to our knowledge of insect acoustics, representing another instance of parallel evolution in the development of long-range sound signals. Further observation on this species is likely to reveal that mandibular sounds function in several situations, as they do in *Calliptamus italicus.*

Communicative mandible-snapping has probably evolved in every case through a stage in which the noise made by feeding grasshoppers was the initial auditory stimulus. Visually significant motion of the mandibles seems a less likely precursor, though it may have appeared as an intermediate stage in some cases; Acrididae are generally most active in bright sunlight, and vision is important in their close-range behavioral interactions. Lépiney (*9*) has shown that the odor of crushed leaves acts as an attractant to migratory lo-

custs, and this could have been a precursory stage to aggregation through response to feeding noises.

The mandibles of *Paratylotropidia brunneri* show no special modification indicative of a role in sound production. Because of the importance of mandibular structure in feeding, it seems unlikely that mandibular sounds could ever become as extensively elaborated as the tegminal and tegminofemoral stridulations of other Orthoptera. It is probably significant that *P. brunneri* occurs in a habitat where there are few other sound-producing insects, and where a soft, simple sound is more likely to become an effective long-range signal.

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Dialysis of Certain Sugars through Cellophane

Abstract. Of several sugars examined, alkali most affects the rate of dialysis through cellophane of alpha-beta-D-mannose and alpha-beta-maltose. The rates of dialysis of these two sugars are influenced by 0.01 and 0.1*N* solutions of sodium and potassium hydroxide. The rate of dialysis of sucrose is not influenced by the solutions employed.

During applications of the procedure of Craig (*1*, *2*) for the selective dialysis of solutes, it was observed (*3*) that changes in chemical environment affect the rates of dialysis through cellophane of certain sugars more than the rates of others. Particularly clear was the effect of hydroxyl ion on the dialysis rate of some sugars. Since the effects could be reversed by neutralizing the alkali, chemical degradation of the carbohydrate could not account for the observations.

Seven milliliters of a 0.2- to 0.4-percent sugar (reagent grade) solution known to be at equilibrium with respect to the alpha and beta anomers were dialyzed through cellophane (19 mm diameter when round, No. 10886, Will Corporation) into 70 ml of the indicated solvent at room temperature. Every effort was made throughout to keep the dialyzing surface at approximately 52 cm^2. The procedure outlined by Craig (*2*) was employed. The selected time for dialysis, 45 minutes, was the approximate half escape time for most of the sugar solutions. All analyses were by means of the *o*-aminobiphenyl procedure (*4*). An analysis was considered satisfactory when the total sugar calculated from the concentration of the 70-ml dialyzate and the 7-ml bag contents agreed with the total sugar calculated from the measurement of the concentration of the original solution. Values in Table 1 are differences obtained by substracting the percentage of sugar remaining in the dialysis bag after 45 minutes in the indicated solvent from the corresponding value when water was the solvent. For example: at 45 minutes 41.8 percent of D-mannose remained when dialyzed in water, while 70.8 percent remained when the solvent was dialyzed in 0.10*N* sodium hydroxide. The difference, 29, appears in Table 1. For this same sugar placed in 0.1*N* sodium hydroxide for 45 minutes, neutralized with HCl and dialyzed, the percentage remaining was 43.1, a value sufficiently different from the value obtained when dialyzed in sodium hydroxide that the cause for the difference between rates in alkali and water could not be deterioration of the sugar in sodium hydroxide. Percent remaining values represented mean values which for three determinations would differ by no more than 4.5 percent of the mean. The analysis, as would be expected, for a sugar showed a smaller deviation. For example, when 300 μg of glucose were measured in ten trials, the mean for the ten observations was 299.6 and the standard deviation was 6.3.

To further test the reliability of the measurement of the observed dialysis rates, a hexose mixed with pentose was dialyzed with water as the solvent. The sugars remaining in the cellophane bag after dialysis were chromatographically separated (*5*) and the relative quantities of sugar found were compared with the relative quantities of the sugars in the original solution of the mixed pair before dialysis.

When D-glucose and D-arabinose were dialyzed mixed, the absorbance ratios of the *o*-aminobiphenyl derivatives of the chromatographically separated sugars agreed within 1 percent with the ratios of the optical densities such derivatives of the sugars separately dialyzed.

The date of Table 1 indicate that the dialysis rates of D-mannose, D-arabinose, maltose, and cellobiose are most affected by 0.1*N* sodium hydroxide. Of these four sugars, all but D-arabinose are affected by 0.01*N* sodium hydroxide. The dialysis rates of D-mannose and maltose are most affected in both concentrations of sodium hydroxide. Increasing the concentration of sodium hydroxide from 0.1*N* to 0.5*N* (not shown in Table 1) did not increase the effect of sodium hydroxide on mannose (rate in 0.5*N* sodium hydroxide minus rate in water was 26.4). How significant an increase the corresponding difference for maltose, 25.2 in 0.5*N* sodium hydroxide, is over the value in 0.1*N* sodium hydroxide (20.7 in Table 1) is not decided by these data. The data show that 0.01*N* potassium hydroxide has a greater affect on the dialysis rate of maltose than does sodium hydroxide of comparable concentration. The dialysis rates of D-mannose and maltose were not changed by increasing the concentration of potassium hydroxide from 0.01 to 0.1*N*.

Table 1. Comparison of rates of dialysis of certain sugars in water and alkaline solutions. The values shown are the rate of dialysis in alkaline solution minus rate in water.

Sugar	Alkaline concentration	
	0.01*N*	0.10*N*
	Sodium hydroxide solution	
D-Glucose	3.2	9.1
D-Galactose	4.1	10.4
D-Mannose	11.4	29.0
D-Arabinose	2.2	18.3
L-Arabinose	0.1	10.3
D-Xylose	1.9	5.3
L-Xylose	3.5	11.5
Sucrose	0	3.6
Maltose	12.0	20.7
Cellobiose	10.2	15.1
	Potassium hydroxide solution	
D-Glucose	0.8	9.5
D-Mannose	12.8	12.7
D-Arabinose	6.7	12.8
D-Maltose	18.2	17.8

The sugars D-mannose and maltose, the dialysis rates of which are most affected by the changes in chemical environment examined above, are considered "alkali sensitive" by Reeves (*6*), when optical rotation is the index (*6*). Changes in conformation of the sugars, claimed for the effect of alkali on optical rotation (*6*), cannot explain here the failure of sucrose to dialyze at a lower rate than that observed. By the same reasoning, cellobiose would be expected to dialyze more rapidly than it did here. It is unlikely that the alkali effect observed here in dialysis could be attributed entirely to the influence of the hydroxyl ion on the equilibrium between the alpha and beta forms of the sugars. If influence on mutarotation were the explanation, one would presume that glucose, maltose, and cellobiose might be similarly influenced, since each has the same percentage (*7*) of