these differences appeared among the adults, although there were tendencies for black adults to select stronger solutions than selected by white adults (Fig. 2). Race differences in preferences for sweet and salty might be observed among adults if larger samples are tested.

The younger black subjects differed markedly from the other groups in their preference for salt. Only a small percentage of the white adults, black adults, and white 9- to 15-year-old subjects (10, 12, and 9 percent, respectively) demonstrated a preference for the highest concentration of salt, whereas 30 percent of the younger blacks preferred the saltiest sample. High salt intake, particularly early in life, has been related to the development of essential hypertension (*9*). The incidence of hypertension is greater among blacks than among whites in the United States (*10*). This difference in the incidence of hypertension, rather than reflecting a genetic difference in susceptibility, may be due to dietary differences in amount and pattern (or both) of salt intake early in life. Those 9- to 15-year-old subjects with a preference for the taste of highly concentrated salt may select a diet that is high in salt, thereby disposing themselves to hypertension.

The differences described make it clear that human populations are not homogeneous in their preferences for sweetness and saltiness. Although there is considerable evidence that the human species has evolved with a preference for sweet, evidenced even in newborns (*11*), there are individual and population differences in the degree of sweetness preferred. The observed differences in preferences for sweetness and saltiness may reflect differences in caloric needs and requirements for sodium chloride. Alternatively, they may reflect differences in experience and learned dietary preferences, which may or may not correspond to optimum nutritional practices.

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3. This group (ages 18 to 64) included 92 males and 48 females; 52 were blacks, and 88 were whites.
4. All test solutions were made with deionized water and reagent grade chemicals. They were given in 30-ml samples and were at room temperature. The order in which the concentrations were sampled was varied. Rinse water was available throughout. The subject was required to rinse his mouth thoroughly before beginning the sucrose test and during 1-minute rest periods between successive tests.
5. The data for younger subjects used in these comparisons are the first choices of 618 subjects ranging from 9 to 15 years of age. There were 318 males and 300 females in the group. Racially, 310 were black and 308 were white (*2*).
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3 March 1975; revised 2 July 1975

Molluscan Gastrin: Concentration and Molecular Forms

Abstract. *Blood and gastrointestinal tissues of the sea hare* Aplysia californica *and the land snail* Otala lactea *contain immunoreactive gastrin in heterogeneous forms similar to those of mammals. The observation that blood concentrations in terms of a porcine gastrin standard are comparable to those of pig, man, and dog suggests significant homology between the structures of molluscan and mammalian gastrins.*

Current interest in the origin and evolution of the peptide hormones reflects the premise that a phylogenetic approach will provide new insight into their complex physiologic interrelationships and better understanding of the heterogeneity of their molecular forms. Theoretical proposals, for example, have related specific or hypothetical gastrointestinal peptides to proinsulin as evolutionary descendants and antecedents (*1*). However, a more precise picture of the development of the mammalian gastrointestinal peptide hormones awaits information concerning their presence in lower phyla. We now report the presence and molecular heterogeneity of immunoreactive gastrin in two molluscan species.

Gastrointestinal tracts from *Aplysia californica* and from active and aestivating *Otala lactea* were removed, and gastrin was extracted in ten volumes of boiling water. Extracts from the remaining portions of the animals were obtained similarly. The tissue extracts and blood that were collected from the animals were stored at −20°C prior to use. The blood samples in final dilutions of 1 : 250, 1 : 100, 1 : 50, and 1 : 25 were examined for gastrin by radioimmunoassay techniques (*2*). Amounts of the hormone are expressed as the mass content immunochemically equivalent to the stated mass of natural porcine heptadecapeptide gastrin (HG) used as standard. Samples of blood and tissue extracts were fractionated by gel chromatography on Sephadex G-50 fine columns (1 by 50 cm) (*3*).

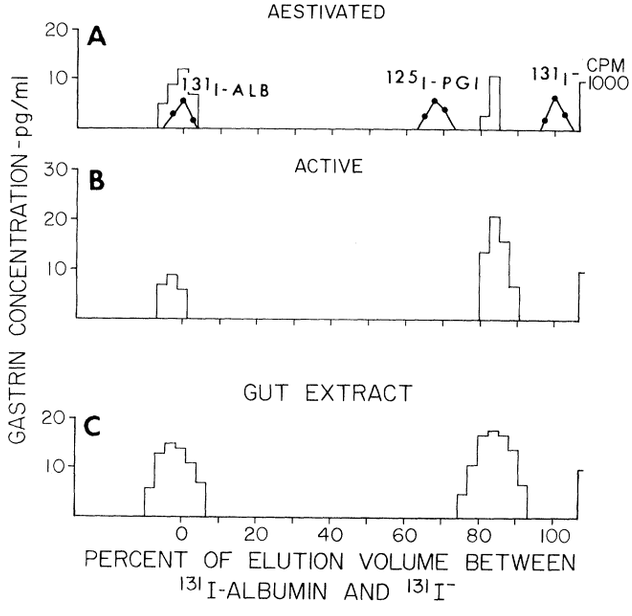

Fig. 1. Sephadex G-50 gel filtration of immunoreactive gastrin in the blood of the aestivated (A) and active (B) *Otala lactea* and in the gut extract (C) of the active *Otala*. ^{131}I-albumin and ^{131}I⁻ were added to samples before application to the column to mark the void volume and salt peak respectively. The elution volume of ^{125}I-labeled porcine gastrin I (PGI) is also shown.

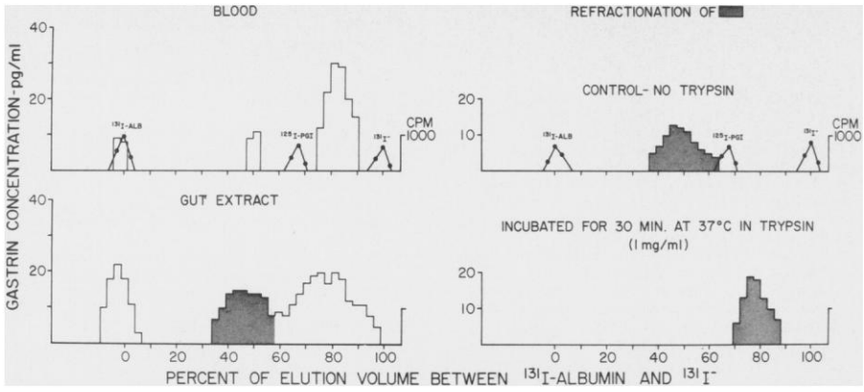

Fig. 2. Sephadex G-50 gel filtration of immunoreactive gastrin in blood (left top) and gut extract (left bottom) of *Aplysia californica*. Portions of the intermediate peak of immunoreactivity (big gastrin), shown in the shaded pattern, were pooled and refractionated before (right top) and after (right bottom) incubation with trypsin.

Pooled blood from *Aplysia* and from active and aestivating *Otala* contained mean concentrations of 150, 70, and 40 pg of immunoreactive gastrin per milliliter, respectively. Intestinal tissue from three *Aplysia* contained 5 ± 1 ng of immunoreactive gastrin per gram (wet weight), while that from ten active and ten aestivating *Otala* each averaged 1.5 ng/g. No immunoreactive gastrin was detectable in extraintestinal tissues of these mollusks.

Studies of mammalian plasma and tissues have revealed at least three molecular forms of gastrin (*3*). One of these has the size and charge characteristics of HG (molecular weight, ~2100), which was first purified by Gregory and Tracy (*4*); the second is a larger and more basic protein, big gastrin (BG), which was first described by Yalow and Berson (*3*) and which has a molecular weight of ~3900 (*5*); the third is a still larger protein, big big gastrin (BBG), that elutes in the void volume on Sephadex G-50 gel filtration and is presumed to have a molecular weight greater than ~20,000 (*3*). In mammals, HG and BG are known to be released by feeding (*3*) and to have biologic activity (*6*), while the plasma concentration of BBG does not appear to change on feeding and, at present, there is no information concerning its biologic activity.

Immunoreactive gastrin in the blood and tissues of these molluscan species also manifests molecular heterogeneity (Fig. 1). Two immunoreactive peaks are observed after Sephadex-gel filtration of the blood and gut extracts from the *Otala*, one in the void volume and one with an elution volume greater than that of ^{125}I-labeled HG (Fig. 1). As in mammals, the smaller molecular form is stimulated in the active, feeding state and BBG is not stimulated (Fig. 1). The relative distribution of the immunoreactive components of the gut gastrin did not differ between the active and inactive states. The former is shown in Fig. 1C; BBG represented almost 43 percent of the total gut immunoreactivity compared to less than 0.1 percent of antral gastrin in man (*3*).

Sephadex gel chromatography of blood and gut extracts from the *Aplysia* revealed a component corresponding to BG as well as to the two components corresponding to BBG and HG that were found in the *Otala* (Fig. 2, left). Each of the three peaks maintained its integrity on refractionation and, like BG of the mammalian species (*3*), the intermediate gastrin was converted, with no change in immunoreactivity, to the small form after 30 minutes incubation at 37°C in chymotrypsin-free trypsin (Sigma bovine trypsin—DCC treated type X1) at a concentration of 1 mg/ml (Fig. 2, right). The stability of the small form in trypsin suggests that, like mammalian HG, molluscan gastrin does not contain a lysine or arginine residue (*4*). The conversion by trypsin of the intermediate to the small form, with no loss of immunoreactivity, suggests that the small form is bonded in the larger form through an NH_2-terminal basic peptide, perhaps the same double lysine group as is found in mammalian BG (*7*).

Heptadecapeptide gastrin from a number of mammalian species (man, pig, cow, sheep, dog, and cat) have sequence variations of only one or two amino acids, and all share the COOH-terminal pentapeptide (*8*), in which resides the full spectrum of biologic activities of the molecule. The COOH-terminal pentapeptide is also found in mammalian cholecystokinin (CCK) and in caerulein, a hormone from the skin of the Australian amphibian *Hyla caerulea* (*8*). However, the guinea pig antiserum that was used in these studies, like others we have prepared by immunization with relatively crude extracts of porcine antral mucosa, reacts very poorly with CCK and with gastrin fragments as small as the sequences consisting of residues 10 to 17 (*9*). Therefore, the finding that molluscan gastrin cross-reacts in our assay system and that the concentrations in blood are comparable to that found in the mammalian species (*3*) suggests significant homology in the structure of molluscan and mammalian gastrins. The observation that a molecular form corresponding to BBG is more prominent in the gastrointestinal tract of mollusks than of the higher animal species lends some support to the hypothesis of the precursor nature of this larger peptide and suggests also that the system for conversion to the smaller hormonal forms is not as well developed in the lower phyla.

In mammals, gastrin is the most potent stimulus for the secretion of acid by gastric parietal cells, plays a role in gastrointestinal motility, and functions as a trophic hormone with respect to the growth of gastrointestinal mucosal tissue. That molluscan gastrin resembles the mammalian gastrins, in some functions at least, is suggested by the observation that in the molluscan gastrointestinal tract the gastric portion has the lowest luminal *p*H (*10*).

These observations, when viewed together, indicate that the gastrin family of peptides has an evolutionary history reaching back at least to the mollusk.

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28 July 1975; revised 25 August 1975

Vocabulary Richness: A Sociolinguistic Analysis

Abstract. *A regression analysis of lexical diversity in the informal speech of 120 mature speakers of French in Montreal reveals no direct effect of socioeconomic level or residential milieu. All social effects are mediated by a single variable: educational attainment. The analysis also confirms a continuing enrichment of productive vocabulary with increasing age.*

The linguistic correlates of social stratification have provoked a variety of evaluative attitudes about the nature of "upper-class" versus "lower-class" speech. These range from the verbal deprivation (*1*) and distorted communication (*2*) descriptions of ghetto or working-class speakers, through the more subtle assessments of differentiated functional capacities of "elaborated and restricted codes" (*3*), and finally to the relativism characterizing much urban sociolinguistics (*4*). In our work on a million-word corpus of spoken French in Montreal (*5*), focusing on phonological (*6*), syntactic (*7*), and semantic (*8*) differentiation according to socioeconomic and demographic characteristics of 120 speakers, we have found no justification for positively or negatively evaluating any of the linguistic attributes that distinguish among these speakers. We have begun a computer-assisted analysis of lexical usage in the corpus, and in this area there do exist quantifiable notions such as the range or richness of vocabulary which might provide grounds, however superficial, for such evaluation. We report here the first results of this study.

The quantitative data we analyze are the number of different words, D, in each of the 120 interviews, compared to the total number of words, T, in the same interviews, and six socioeconomic and demographic factors pertaining to each speaker. The interviews averaged about 1 hour and all covered the same broad topic, everyday life in Montreal, past and present, a subject with which all speakers were equally familiar. The word counts, from a computer-stored transcription, were not corrected for homonymy, nor for differently conjugated or declined forms of the same root, but these sources of error apply to all of the speakers in a presumably uniform way.

In general, the number of different words in a text is a nonlinear function of its total length. In our data it appears to be of the form $D = a + bT^r$ where a and b are constants, and r is approximately 0.7. We have repeated the analyses reported below using a range of values of r between 0.65 and 0.75, without substantially changing the results.

The demographic data include age (from 15 to 85 years) and sex, and the socioeconomic factors are mean income of speaker's residential area, educational level attained, and index of occupational status of the head of speaker's household, and a similar index for the speaker himself. Needless to say, these last four are highly correlated. To find which factors contribute independently to D in a significant way, we carried out a multiple regression of D on T^r and the six variables, allowing for quadratic terms and products, and using the "forward selection procedure" (*9*) to determine which coefficients are statistically significant.

Apart from T^r, only one term has a significant coefficient ($P < .05$), namely the product of age, A, and educational level, E. Even when the other factors are "forced" into the regression, they have small coefficients, while the age-education interaction effect remains large and significant. Detailed investigation of this interaction results in the regression

$$D = 24.7 + 1.912T^{0.7} + 2.775A^{0.7}E$$

where A is measured in years and E in coding categories 1 to 5, each representing an increment of about 4 years' schooling. This formula indicates that in the population represented by our sample, each person incorporates new words into his productive vocabulary at a slowly decreasing rate over time, but this rate can be magnified up to five times through extensive education.

Allowing less strict significance criteria ($P < .1$) does not enable any of the factors other than A or E to attain significance. By allowing higher order terms in A and E, such as A^2E, we can modify the regression function somewhat so that D initially rises faster in the case of highly educated speakers, peaks near age 50, and then declines slightly, but this effect is of borderline significance. Within each of the five educational categories considered separately, the data contain too much scatter to confirm the relationship between A and D in any detail. However, for all five categories, by forcing A into the regression we always obtain a positive coefficient and preclude the significance of any of the other social or demographic factors.

The important fact that emerges from this analysis is that any contribution to richness of vocabulary (as indicated by D) from such socioeconomic factors as residential milieu or occupational status of parent are completely accounted for by the effects of these factors on educational attainment. This lends no support to theories that linguistic competence is degraded by an "impoverished" childhood environment.

Also of interest is the importance of age. Enrichment of productive vocabulary continues at least until age 50.

These two observations tie in with other work on the same speech community. Linguistic competence with respect to syntax of children from different socioeconomic milieus (but in the same school grade) shows little systematic variation (*10*). The lexicon is among the most malleable components of a language and the most responsive to the circumstances of language use (*11*). This is illustrated by the systematic, although highly variable acquisition rates we find among adults. Such acquisition does not generally occur among adults, as far as is known, with respect to phonology or syntax. This malleability of the lexicon explains why the language of educated people can be lexically richer, while no comparable objective measure exists which might reveal a "better" phonology or a more functional or logical syntax.

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