of the anodic portion of the gel, there was one large and one small peak of xanthine dehydrogenase activity. The large peak consists of two maximum points separated by a 1 mm wide zone of lower activity; whether this pair of maximum points represents different isozymes or merely double bands of a single isozyme (*12*) cannot at the present time be decided. By the formazan technique, only the large peak was detected. From our experience with LDH (*10*), the low activity of the small peak would be below the level necessary for the formation of a formazan band. Also, the narrow gap between the two maximum points of the large peak would probably not be detected by the formazan technique, since the purple band is rather faint, although clearly visible.

Assuming a subunit hypothesis similar to the one advanced for LDH (*3*), the results could be explained in two ways. If both ry^+ and $ma\text{-}l^+$ loci controlled the synthesis of a different polypeptide (henceforth called the r and the m subunit, respectively), and if these subunits then assembled in groups of four, one would expect five combinations to occur: r^4m^0, r^3m^1, r^2m^2, r^1m^3, r^0m^4. The first and the last would be enzymatically inactive (or would not be made at all), since both homozygous *ry* and *ma-l* flies lack XDH activity. Thus, three bands would be expected in this scheme. If, on the other hand, the two subunits assembled in groups of three, four combinations could occur: r^3m^0, r^2m^1, r^1m^2, r^0m^3. Again, the first and the last trimer would be enzymatically inactive (or would not be made), leaving two active bands. Our zymograms clearly show one large and one small peak. This distribution could be explained by the assumption that the two subunits are present in different amounts and that the r subunit is limiting. If the molecule were a tetramer and the large peak represents only one isozyme, then the large peak would represent the r^1m^3 tetramer, the small peak the r^2m^2 tetramer; the r^3m^1 tetramer would be produced in such small amounts as to be undetectable by our methods. If, on the other hand, the XDH molecule is a trimer, the large peak represents the r^1m^2 trimer, and the small peak the r^2m^1. In either model we assume that the r subunit is limiting. That this may indeed be so is suggested by gene dosage studies (*13*) which have shown that XDH activity increases as the number of ry^+ alleles is increased ($1\ ry^+ < 2\ ry^+ < 3\ ry^+$), but remains constant when the number of $ma\text{-}l^+$ alleles is increased ($1\ ma\text{-}l^+ = 2\ ma\text{-}l^+ = 3\ ma\text{-}l^+$). Furthermore, this shortage of r subunits may also account for the observation that offspring of $ry/+$ flies are not maternally affected, whereas offspring of $ma\text{-}l/+$ flies are (*14*).

The method presented promises to be valuable for investigating the genetic control of isozymes and for testing the proposed subunit hypothesis. However, the data obtained thus far do not rule out other models (*15*) that have been proposed (*16*).

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Inverted Indexing on Edge-Notched Cards

Abstract. *Edge-notched cards in an inverted system of indexing may be used satisfactorily to analyze research data which concern a small series of individuals but a large number of highly variable characteristics in a short-term research project.*

In the course of a research project on the teaching of preventive medicine in the United States, we were faced with the problem of analyzing a large mass of descriptive data from field notes and material from questionnaires, correspondence, and published references. These data could be characterized as: (i) representing a small series of individuals (medical schools); (ii) describing many characteristics or traits; (iii) possessing great diversity; (iv) not having ready-made categories into which they might be grouped satisfactorily; and (v) being part of a short-term (3-year) study and not a continuing information storage and retrieval system.

We searched for a tool which might be useful in handling these data and decided upon the use of edge-notched cards in an inverted indexing system. The purpose of this report is to discuss this method; details of the actual research project will be described in a final report (*1*). Although data-processing systems in general are discussed elsewhere (*2*), here we describe briefly the two main manual punch-card systems of indexing or grouping, and their respective physical equipment.

In the first conventional system, edge-notched cards are used (*3*) and each card represents an individual event, person, document, or other item. The coded positions around the margin of the card represent characteristics or terms, while the remaining surface of the card may be used for recording other data. Data are stored on the card by notching positions around the margin for any particular characteristic. Data are retrieved manually by passing the sorting needle through the hole in the position which represents the desired characteristic and allowing the notched cards to fall free. These cards represent all those individuals in the deck who have this particular characteristic.

In the second inverted system, peek-a-boo cards are used (*4*) and each card represents a characteristic or term. The coded positions distributed over the card represent individuals. Data are stored by punching or drilling a hole in a coded position for an individual in all the cards representing characteristics possessed by the individual. Data are retrieved by withdrawing the card representing a desired characteristic and identifying the individuals having the characteristic by visually noting the holes at the coded positions.

Since edge-notched cards do not have sufficient positions for storage of a large number of characteristics, and since conventional indexing is cumbersome in the process of developing categories requiring frequent modification, this system did not suit our requirements. Peek-a-boo cards in the inverted system were also unsuitable, because they do not have space for writing on them, they have more positions than we needed, and they require special equipment for storage and retrieval. We could have used pre-scored, manually punched, smaller cards (I.B.M. Port-a-Punch) but these also have no space for writing on them (*5*). Therefore, we decided to use conventional edge-notched cards (*6*) in an inverted indexing system. The cards are stock items and no elaborate equipment is needed, so that the cost of the material required was low (less than $60).

Since the study was a descriptive ecology of the teaching of preventive medicine, it involved a large amount of data which had to be categorized topic by topic. As with any punch card system, once the data were organized and coded, it was a simple matter to store this information by punching the cards. The only equipment needed was a hand punch. In descriptive studies such as this one, a good deal of effort is spent in arriving at realistic categories. The method used here allowed one to modify categories, add or delete characteristics, without having to "start from scratch" each time. In working through the data, storage of satisfactorily classified information was not disturbed by alteration of other categories. Also, once each category was satisfactorily classified, coded, and stored on the cards, cross-comparisons among different categories was easy.

In utilizing this system, we assigned each medical school and school of osteopathy one of the 92 positions on the card. Each card was assigned a particular characteristic. Characteristics included such information as size of the city of location, nature of the academic complex, organizational pattern, components of curriculum, and responses of chairmen to opinion questionnaires. In arriving at categories or characteristics, we found it helpful to make notations on the face of cards as we proceeded, so that we could modify categories without going back to the "raw data" again. Characteristics were tabulated by counting notches. Several characteristics could be compared by superimposing the appropriate cards and counting the notches in common. For example, it was relatively simple to compare the age group of the departmental chairmen with the responses given on the opinion questionnaire.

For those engaged in short-term, small-scale research, where a small series of individuals are included, together with a large number of widely variable characteristics which do not lend themselves easily to ready-made categories, the use of edge-notched cards in an inverted indexing system is satisfactory for handling the data analysis.

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Venom Collection from Honey Bees

Abstract. *A device that provides an electric shock makes it possible to collect pure venom from several thousand honey bees* (Apis mellifera). *The collection apparatus fits underneath the brood chamber of a colony of bees and may be moved from hive to hive. Each colony is "milked" for 5 minutes. An average of 20 hives must be "milked" to obtain 1 gram of venom. Under optimum conditions this quantity of venom is produced by 10,000 worker bees.*

Bee venom has been used medicinally in Europe for several decades, especially for the treatment of rheumatic diseases. Both live bees and extracted venom have been used. The material has not been widely used in this country because it has never been available in sufficient quantity for analysis or clinical testing. In fact, because of a lack of knowledge of the chemistry of the substance, its use has been frowned upon by some, except for purposes of desensitization. The subject has been reviewed by Haydak (*1*) and Beard (*2*). The desensitization of some persons adversely affected by stinging insects has been accomplished through the use of extracts of whole insects. These extracts are used in part because venom has not been available in quantity. Some of the antigens responsible for allergic reactions in hypersensitive people seem to be common to bees and wasps (*3*).

Markovič and Molnar (*4*) were probably the first to subject bees to electric shock to obtain venom. Bees returning to the hive were caught between two revolving cylinders, where they were shocked and squeezed to make them sting. Plastic, rubber dam, and filter paper were tested as materials for the bee to sting. Since the bees were crushed, the filter paper was contaminated. The bees left their stings in the plastic and in the rubber dam (they died as a result). Moreover, the protruding stings made it difficult to scrape off the venom. As a final solution, Markovič and Molnar used a rubber dam with filter paper underneath.

In 1958 Weide (*5*) found that bees would sting moist filter paper when they were subjected to shock at low voltage. The treatment apparently did not harm the bees. He presumed that a method of obtaining venom, presumably for commercial use, by subjecting bees to electric shock was then in use in Germany.

Palmer (*6*) developed an apparatus for administering electric shock to obtain bee venom. His device consists of a magazine which holds as many as 200 bees; the bees sting through a sheet of silicone when shocked. The venom remains on the underside of the sheet when the current is turned off, and the stings are withdrawn. The magazines must be loaded before and after each shock. At Ohio State University bees were placed in "electric chairs" and shocked to obtain venom (*7*). O'Connor *et al.* (*8*) reported a similar method.

The stylet (shaft) of the sting of a honey bee is about 2.0 mm long. From its sharp tip, it widens until it is about 0.1 mm in diameter where it joins the shaft bulb. There are several barbs on the stylet, some of them as long as 0.03 mm. It is these barbs which hold the sting in the body of an object that has been stung, and which usually cause the honey bee to lose its sting. In the process of stinging, the shaft normally becomes imbedded for about half its length.

The best material that we have found to date is nylon parchment taffeta. The bees do not pierce the individual nylon strands; rather, the stings are inserted into the holes between strands. The strands of the taffeta filling are 0.18 to