particular, the use of tetanus toxoid in recent years. No tetanus toxin-antitoxin mixture has ever been used, and the use of toxoids in the immunization program represents a change of technique and an improvement in accomplishment worthy of record.

Universal immunization with tetanus toxoid would free us from that disease, as the Armed Forces experience has demonstrated. Each one of us is a potential, if not too likely, case of tetanus as a result of the accidents of home, field, shop, school, travel, combat, or recreation. All such injuries of any importance at all are usually treated with an injection of tetanus antitoxin—a serum which, if it protects, does so for one time only, and which may confer serum sensitivity on an individual or even induce an attack of serum sickness. Toxoid lacks these undesirable qualities, and in particular it confers an immunity of substantial duration. Properly given, it obviates the need for antitoxin. I feel that for adults tetanus toxoid is the most valuable vaccine now in use and that at the childhood level tetanus and diphtheria toxoids share honors in importance with the bacterial vaccine for whooping cough and the virus vaccines for smallpox and poliomyelitis.

Comment was made concerning Table III because I felt the title was not a happy one. The author does not bring that point into the discussion. If he wishes to present a table covering an era limited to the last two decades of the 19th century that is his privilege, and I should not propose admission to the group of the anthrax bacillus, which, no matter how many other virtues it may have as a scientific landmark, obviously does not belong. By the same token, of course, the leprosy bacillus should be removed from his table, since G. A. Hansen's paper appeared in 1874.

I agree wholeheartedly with the final paragraph of Rosen's letter.

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Names for Binary Numbers

In "A system of names for binary numbers," [*Science* **128**, 594 (1958)], Joshua Stern proposes a nomenclature to aid users of binary arithmetic to "think binary." Despite the utility of the system for small numbers, Stern concedes that long sequences of syllables become awkward at rather small numerical magnitudes and that recourse must be had to calling off the sequence of digits.

However, long binary sequences *can* be communicated (and remembered) economically by a better technique than calling off digits. This method, widely used by computer engineers, consists of dividing the number into groups of three digits, replacing each group by the corresponding digits from zero to seven, and using the resulting octal-based number. Groups of three, rather than four, digits must be used, for we do not have convenient single-element symbols for all quantities up to fifteen.

Thus, to use one of Stern's examples, the number 87_{10} or $101,0111_2$ (bruonedag bruapone) would be divided 1,010,-111_2 and read as 127_8—or one (octs^2), two (octs), seven—where (octs) represents 8_{10} units, (octs^2) represents 64_{10} units, and so on. I leave to Stern, with his "ap"titude for naming digits, the selection of names for these quantities. His term "cid" might be used for the first power of eight, of course.

A minor difficulty with the nomenclature proposed by Stern is the use of the nonphonetic English word "one" in the midst of sequences of unfamiliar phonetic terms. This leads to pronunciation difficulties for English speakers, and would not endear the system to non-English speakers. I suggest that the phonetic term "bit," with its useful connotations, might be employed instead of "one," without undesirable consequences.

LAWRENCE ROSLER
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The 12 Sept. 1958 issue of *Science* [**128**, 594 (1958)] contains an article entitled "A system of names for binary numbers." In the article the author runs these named binary numbers into one another, stating, for two such names: "the larger value . . . being named first signifying *addition*" and "the smaller value being named first signifying *multiplication*." This is all very well as long as only two such quantities are involved. What is not stated is the law relative to a string of three or more such named quantities, which the author actually uses in the table of examples.

Consider, for instance, hiapdag. This is, according to the rule stated, hi + ap × dag. The question is, however, does the addition precede the multiplication, or vice versa? In other words, does hi + ap × dag mean (hi + ap)dag or hi + (ap × dag)? It will be noted that these are different. One might assume that the latter is correct, since that interpretation alone will cause the first example, hiapdagcidone, to equal 297, as we are told is the case. But not so, for in the very next example bruonedag must mean (bru + one)(dag) in order for it to equal 87. Likewise, in the third example aponedag must mean (ap + one)(dag).

One might hope to find the clue in the author's statement, "numbers not specifically named are expressed as sums and products of the named values analogous to conventions used with the decimal system." In the decimal system the named digits have values dependent upon their position, and thereafter ad-

(*Continued on page 279*)

(*Continued from page 238*)

dition is always implied; thus, 123 means 100 + 20 + 3. The proposed system incorporates the positional notion in the binary names, and thus we might suppose, if it is analogous, that thereafter addition alone is implied.

I trust the author will see fit to remove such ambiguities and prove that the resulting rules enable one to express any number, and that this representation will be unique for whole numbers.

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With reference to the letter of Lawrence Rosler, the octal system is certainly more economical than the binary system for communication of large numbers. The hexadecimal system is still more economical and shares with the octal ease of interconversion with binary numbers. Neither of these, however, is a binary system. If I may apply the "ap"titude for naming digits with which the letter credits me, I suggest use of the name "eight" for the first power of eight.

Criticism of the term "one" has come to me also from F. T. Jung of Evanston, Ill. Jung suggests the French "un" as alternative. "Bit" implies a choice of two alternatives rather than unity. Changes such as those suggested can be considered if the system acquires formal recognition.

In regard to the letter of Donald B. Houghton, I can best reply by asking whether he would raise the question: "Does twenty-three thousand mean twenty + (three × thousand) or (twenty + three) thousand?" In the light of the above illustration, I do not understand the statement that "in the decimal system the named digits have values dependent upon their position and thereafter addition is always implied. . . ." The statement appears to confuse symbolic representation of numbers with naming of numbers.

A few examples will demonstrate the unambiguous application of the rule for naming binary numbers: In hiapdag, ap is smaller than dag, hence ap multiplies dag; hi is larger than apdag, hence hi adds apdag. Applying the same rule to bruonedag, one is smaller than dag, implying multiplication; bru is larger than one, hence bru and one add; bruone is smaller than dag, hence bruone multiplies dag. The rule works equally well from the most significant end. Thus, in the number 11,1100,1011, aponehicidbrudagcidapone, ap adds one; apone multiplies hi; aponehi adds cid and bru; cidbru multiplies dag (. . . hicidbru cannot mulptily dag because it is larger than dag); cid, ap, and one add together and add to the preceding. Thus we get: (ap + one) hi + (cid + bru) dag + cid + ap + one.

The other question raised, that of assuring unique representation of whole numbers, is beyond the scope of my proposal. I am not convinced that such rigidity is desirable. Certainly it does not exist in the decimal system, where one has the choice, for example, of "billion" or "thousand million" and of "twenty-two hundred" or "two thousand two hundred." I doubt that such rigidity can be imposed by rules. If rigid uniqueness is desirable, I prefer that it develop through usage, or that it be established by official groups.

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Meetings

Reticuloendothelial System

The 3rd International Symposium on the Reticuloendothelial System was held in Rapallo, Italy, from 28 through 31 August. As with previous meetings, every attempt was made to keep the numbers of participants small and to have all participants reside in a single hotel or villa to provide the best possible communication both during and in between official sessions.