Are Statistics Trite?
On the Contrary, They're

THE POETRY OF SCIENCE

By F. EMERSON ANDREWS

POETRY is the only form in which some of our oldest stories and ideas have come down through the ages. In many periods it has been the vehicle for man's most advanced thinking. It has sometimes described events and even concrete objects more memorably and accurately than any prose. In setting moods and stimulating imagination its power cannot be approached. Poets have been the first to express most of our deepest philosophic thoughts; and poetry has many times been amazingly prophetic.

Let us cite one trite but remarkable example. Before 1842, considerably more than a century ago and more than sixty years before the Wright brothers upset scientific thinking by proving that heavier-than-air flying machines were possible, Alfred Lord Tennyson wrote these lines in "Locksley Hall":

For I dipt into the future, far as
human eye could see,
Saw the Vision of the world, and
all the wonder that would be;

Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight,
dropping down with costly
bales;

Heard the heavens fill with shouting, and there rain'd a
ghastly dew
From the nations' airy navies
grappling in the central blue;

Far along the world-wide whisper of the south-wind
rushing warm,
With the standards of the peoples plunging thro' the thunderstorm;

Till the war-drum throbb'd no
longer, and the battle-flags
were furl'd
In the Parliament of man, the
Federation of the world.

Poetry reached these achievements against what must seem insuperable odds. Consider. Traditional poetry had to preserve intricate metrical patterns. Worse still, much of it was rhymed, so that in some types of verse not only were all words constricted to the rhythm pattern, but every fifth or sixth word had to be paired in sound with a companion word.

Poets are not, I think, a different race of men with minds so incomparably fine that they can think more effectively and see farther ahead than the rest of us. They have minds no better than ours, and sometimes worse. If they often reach more effective ideas and expressions, it is not in spite of the handicaps of meter and rhyme; it is because of those handicaps.

The mind works on two levels, the conscious and the subconscious. We can set it to work, as in adding a grocery bill. Consciously adding, it is often correct; sometimes it is wrong. But when addition becomes automatic, proceeding without thought of the individual numbers, the answer is always right. The subconscious mind, we are told, is a flawless mechanism that works even when we sleep. Out of that wide universe of knowledge and experience that have by any means found entrance to it, this machine brings up toward and sometimes through the threshold of consciousness answers that correctly combine all the data it has assembled.

The poet wishes to say something. The trite, common, unconsidered word that first flashes into his conscious mind does not fit the meter. In prose, that word would be used; in poetry, it must be rejected. The poet tries to find a better metrical fit. He turns the whole idea around and around, looks at all sides of it, considers alternatives. He tries out variations, even perhaps the negative of the original idea.

Meanwhile, his subconscious mind is also at work. Suddenly a wholly new idea flashes from the subconscious into consciousness. We call this inspiration; it came to the poet and not to the writer of prose because the poet was forced, by the hurdle of rhythm and rhyme, to delay and reconsider.

Statistical analysis is to scientific thought what poetry has sometimes been to philosophic and other thought forms. Statistics are the poetry of science. When we begin to reduce knowledge to statistics, organize it into tables, check and double-check it, and work out relationships, we are doing something remarkably akin to handling the rhythms and rhymes of poetry. For when a tabulated trend seems uniform and then suddenly the next item breaks the pattern, the tabulator, like the poet, must stop. His rhythm is broken. Data must be checked; they may be wrong. If they are right, a reason for the break in pattern must be sought elsewhere. All the components of the erratic figure and all the surrounding data must be examined in detail. The tabulator's fingers must stop and his mind must work. Out of such forced study and speculation, major discoveries rise.

I have known scientists in high position who turn their statistical work over to subordinates and clerks. Few practices are more dangerous. True, some types of research involve such massive data that a team approach and division of statistical labors are inevitable. But it is in the very handling of the statistical detail that one is forced to look at the individual nontypical case, to reconsider columns which add to results other than expected, to critically re-examine previously assumed "facts." The subconscious has time to work its prescient miracles, and science changes in function from dead storage to creativity.

SOME statistics from the Treasury Department that I have lately been playing with may be illustrative, and not too forbidding if we take one simple proposition.

It is widely known that wealthy people give generously to charity. This is our prose "fact." Treasury Department income-tax reports have often been presented in comprehensive proof. For example, the 1,860 persons with incomes of $250,000 or more in 1949 gave to charity a total of $67 million out of adjusted gross income of $955 million, which is obviously at a rate of 7 per cent. Since the general average of giving for the United States is about 2 per cent, obviously . . .

Now it happens that for that particular year the Treasury Department has supplied contribution data not available for any other year—data that show how many persons from given income groups contributed within given ranges. We can embroider our "prose fact" with a number of tables. They may show nothing new, but we are curious.

For simplicity, we develop a tiny table relating to one small group of wealthy people: those reporting ad-

justed gross income of $150,000 and less than $200,000 in 1949. Here are the government figures for these 2,658 persons reporting a total of $22 million contributed at a rate of 4.9 per cent.

	Number	%
Total itemized returns	2,658	100
No contributions reported	28	1
Under $600	230	9
$600 under $1,200	258	10
$1,200 under $2,100	319	12
$2,100 under $3,000	237	9
$3,000 under $6,000	404	15
$6,000 under $9,000	255	10
$9,000 under $12,000	175	6
$12,000 under $15,000	153	6
$15,000 under $30,000	599	22

The gross data underlying this table —2,658 persons contributing $22 million out of a reported adjusted gross income of $455 million—supports our "wealthy people give generously" thesis with an overall rate of 4.9 per cent.

But *how many* contributed at or above the 2 per cent general average for all income groups? Here the table is full of surprises. A great number of these wealthy persons made only token charitable contributions. Indeed, twenty-eight of them appear to have made no contributions whatever. And since with an income of at least $150,000 a contribution of at least $3,000 is required to reach even 2 per cent, all of the first five groups in the table (1,072 persons) fall below this rate. A more complicated computation indicates that about 81 of the next group were also giving at a rate of less than 2 per cent.

So, we must radically revise our prose statement, "Wealthy people give generously to charity." For this group (and similar analyses of still higher income groups support the same conclusion) we must now say, "Many wealthy people give very little to charity; about 44 per cent of the sampled group gave less than 2 per cent, although they were in the 90 per cent tax group, in a position to give dollars that cost them only 10 cents."

We need also to look at the rest of the table. Without going into the detailed analysis, it is obvious that the groups in the second segment of the table were giving at intermediate ranges, from a little below 2 per cent up to 10 per cent. Finally, all the 599 persons in the last group gave at least 7.5 per cent, and the large majority of them contributed the full tithe, or more.

So we have another refinement of our first assumption: "A small group of wealthy persons give extremely generously, averaging more than a tenth of their adjusted gross incomes. It is the heavy contributions from this small group that keep up the general average for high-income groups as a whole."

THIS small exercise in statistics, which actually shed new light on one aspect of philanthropy, is presented here as an example of the way statistics often trigger the deeper thinking and fresh formulations which make science creative. With tongue only partly in cheek, one might venture a rash assertion. The creativity is due to the impediments and hesitations introduced by the statistical data, and is not necessarily related to accuracy!

Of course, I think accuracy of the utmost importance. Every possible effort should be made to obtain, and then to check and doublecheck, every relevant fact. Serious error can spring from inaccurate data. But my point is something else.

Science has sometimes been defined as organized knowledge. But creative science springs not so much from a body of organized knowledge (which also is a definition for an encyclopedia) but from the *process* of organizing knowledge. Creativity is a living thing, the result of a process; and the process may be of more importance than the inert factual data with which it must deal.

When we train students, and particularly those who show promise of research capacity, it is not important that we store in their brains the maximum number of previously discovered scientific facts in their chosen discipline. It is important that these students conduct major experiments for themselves, even though the "discoveries" they may make have been made a thousand times before; that they pass through the process of organizing the knowledge in the field of their interest, and be encouraged to explore aspects that are new to them.

In our day it may be more important for race survival to discover the fundamental laws of attraction and repulsion among men and nations than how to make a still more destructive H-bomb. But the social sciences are scarcely science; even the simplest relationships involve interactions that cannot be wholly reduced to precise mathematical formulations. Particularly in such areas, our major discoveries may well come from the infinite correlations that spring from a trained mind delayed and hindered by the inadequacy of data to the point of bringing subconscious appraisals as well as proved statistical data to the threshold of consciousness.

STATISTICS HAVE BEEN THE POETRY of F. Emerson Andrews ever since 1923, when he was graduated from Franklin and Marshall College in his native Lancaster, Pa. Being also the rhyme of philanthropy, statistics bore young Mr. Andrews rather naturally to the Russell Sage Foundation. There he directed philanthropic research from 1928 until last year, when popular ignorance of the values of organized giving prompted America's foundations to document their contribution to democratic society. A study sponsored by the Carnegie Corporation of New York led to the creation of The Foundation Library Center and to Mr. Andrews's appointment as its director. Last December 10 the Center officially opened its doors, making a full collection of foundation reports, additional data on foundation mechanics and grants, and literature on other aspects of philanthropy available to individuals, organizations, universities, the press—in short, to anyone interested. Now in his fifties, of medium height and rather on the lean side, Mr. Andrews talks of his hopes for the Library's expansion with a sense of pride, a touch of modesty and a smile in his eyes. Although his work, as in the past, keeps him very busy, he still finds time for "informal" mountain climbing, tennis and writing. He is the author of a dozen books on subjects ranging from philanthropy (*The New York Times* called his "Philanthropic Giving" "the most comprehensive study in philanthropy ever undertaken in this country") to mathematics (his "New Numbers" concerned counting by twelves and resulted in formation of the Duodecimal Society of America) and entertainment for children (the latest of these volumes, "Upside Down Town," is, like the earlier ones, drawn from a background provided by his own three sons, all at the moment in college). Known among his neighbors in Tenafly, New Jersey, as a skilled statistician and a poet of sorts, Mr. Andrews here discusses the poetry of science. —NAOMI WEBER.

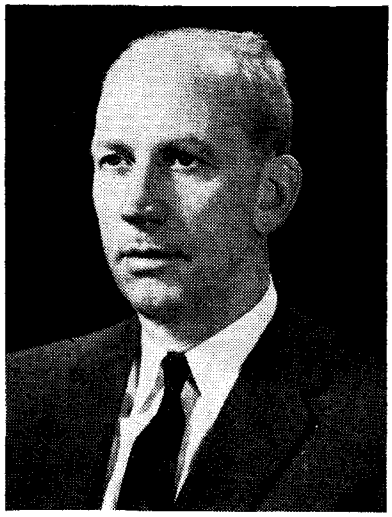
—*Foundation Library Center.*

F. Emerson Andrews.

PERSONALITY PORTRAIT—XIX

ACHELESS TOOTH PROPHET

Professor Roy Orval Greep Says Decay Is Preventable



—Harvard News Office.

ALTHOUGH American dentists are the best in the world, nearly all Americans have tooth trouble. As the population increases, and a higher percentage of the people seek dental care, it will become more difficult to make a date with a dentist. The colleges cannot produce enough of them. The alternative to increasing the number of dentists is to improve the quality of dentistry, and this is the goal of Dr. Roy Orval Greep.

Dr. Greep is a member of a long list of professional and scientific societies, chairman of the Committee on Dentistry of the Division of Medical Sciences of the National Research Council, and editor of one of the nation's leading scientific journals—*Endocrinology*. He never expected to become a dentist, and has never practised dentistry. He is dean, nevertheless, of the Harvard School of Dental Medicine.

Now in his early fifties, a father of three, Dr. Greep is a tall, blond man who speaks slowly and diffidently. New friends are surprised by his wry sense of humor; old friends respect him for his scholarly research—and also recall the near-beer that he spiked at a graduate-student picnic. He writes on such topics as "the morphological autonomy of the zona glomerulosa of the adrenal cortex in the rhesus monkey," but could easily be mistaken by the panelists on "What's My Line" for a Kansas farmer.

His unplanned academic career began in a one-room country schoolhouse near Badger Creek, eighteen miles north of Abilene, Kansas. He is now an honorary fellow of the Obstetrical Society of Boston, but he was born in a farmhouse at Longford without obstetrical aid. His schooling was interrupted for three years by farm work. He was captain of a basketball team that terrorized its territory while he was in high school, and his teachers encouraged him to think of becoming a newspaperman.

Now he is doing work which the newspapers have trouble interpreting. It includes, for example, studies of the action of hormones in vertebrates. A growth hormone taken from the pituitary glands of cattle will induce growth in various animals, but not in man. Thousands of tiny glands from monkeys that were being used to produce polio vaccine recently became available. Dr. Greep and his associates took growth hormone from these glands. They injected this into monkeys whose growth had been interrupted and the monkeys began to grow again. This inspired others to see what could be done with growth hormone from monkey and human sources in man.

What does this have to do with teeth? Maybe nothing. No one knows. But the growth of teeth is a phase of the growth of the human body, and better understanding of the phenomenon of growth could help to explain how teeth grow.

In any event, Dr. Greep is professor of anatomy at the Harvard Medical School in addition to being dean of Dental Medicine. He is not just interested in teeth. In this respect he is merely continuing the study of glands and secretions which he began in a general science course at Kansas State College. And he is still as fascinated by the subject as he was when, as an undergraduate assistant in zoology, he cheerfully hauled tubs of cow urine from the college farm to the chemistry laboratory.

At the University of Wisconsin (where he earned his master's degree and doctorate) Roy Greep mastered the surgical skill necessary to remove the pituitary gland from a rat. He went on to Harvard with a team of scientists who were studying pituitary substance. After serving as a research