

ABSTRACTS OF PAPERS OF 1968 SPRING  
MEETINGS, COLLEGIATE SECTION,  
TENNESSEE ACADEMY OF SCIENCE

*Self Perception as it Relates to Preferred Social Roles in College Men of Military Age.* Morgan F. Hotaling, Tenn. Wesleyan College. It was the purpose of the experiment to validate the theorem that the social role chosen by an individual would be the one about which he felt most positive. The assumption in measuring any given personality characteristic (trait, ability, attitude, value, or motive) is that people vary in the amount of the characteristic, and that each person can be assigned a specific numerical score based on behavioral data. The behavioral data may be simple (e.g., check marks on a sheet of paper or very complex (e.g., patterns of interpersonal nature in a group problem-solving situation). Whether simple or complex, the data may be scored in one of two main ways:

- (1) Objective scoring, this involves the mechanical counting of responses. The Q-sort in this experiment was scored objectively, the positive and negative statements were counted as such.
- (2) The subjective scoring was not used because the subjective content of the statement was not taken into consideration.

The hypothesis was that the social role chosen by selected college males would be one about which they had the most positive feelings.

The subjects were asked to choose one of the four social roles with which they identified most. These were: (1) Marine Hero, (2) New Soldier, (3) Conscientious Objector, (4) Draft Dodger. Each was then asked to empathize with each of the above-mentioned social roles and to describe his understanding of his self-concept. While there was no significant tendency for subjects to choose the exact social role toward which he accorded the most positive statements, there was a highly significant tendency for them to be related when the roles were grouped into active and passive types (i.e. if the highest percent positive was of those typed as "active," then the subjects' choice of roles would be one of those within the active category). If the chosen social role was either "Marine Hero" or "New Soldier", it was likely that the highest percent positive would be either that of "Marine Hero" or "New Soldier." The same tendency was evidenced with the passive social roles of "Conscientious Objector" and "Draft Dodger." This research lends support to the theory that the social role one chooses to play is one which is most satisfying to him and about which he feels most positive.

*A Preliminary Report on the Chemical Condition of the Wolf River, Memphis, Tennessee.* J. Vincent Nabholz, Pollution Research Lab. Christian Brothers College. (Grant No. B004-Tenn.). This report is the result

of two distinct studies: the first consisted of daily water samples (11:15 am) during the week of December 17-23, 1967; the second consisted of sample collections every two hours over the 24 hour period (7 am to 7am) of January 22-23, 1968. All samples were of surface water off the Thomas St. bridge. Meteorological conditions and concentrations (ppm) of three dissolved gases were immediately recorded. Samples were later analyzed for turbidity, pH, total hardness, silica, and five chemical ions. One liter from each sample was sand filtered; the sand washed to produce a 25 ml volume of concentrated filtrate. One ml samples were then examined for organisms. Fluctuations of chemical conditions in the daily study seemed to be correlated to climatic conditions of rainfall and temperature. Chemical conditions of the 24 hour period show no such fluctuations, but do show unpredictable changes.

*The Operon.* Peggy Robertson, Union University.

The deoxynucleotide sequence called a gene or cistron participates in two different chemical processes known as replication and transcription. Transcription is the gene specifying the molecular structure of a protein or polypeptide chain. The operon concept was proposed by Jacob and Monod in 1961 to explain the regulation of the transcription of RNA messages from DNA. Each DNA cistron acts as a template for messenger RNA synthesis to which the cistronic polynucleotide sequence is transcribed. The type of protein produced is determined by structural genes whose transcriptive activity is coordinated by a single operator gene. An operon may be defined as an operator gene attached to one or more structural genes and may be considered the unit for primary transcription. A regulator gene produces an RNA transcript that is a cytoplasmic repressor which associates with an operator gene to block the initiation of transcription of the whole operon that is controlled by that operator. Structural genes, regulator genes, and operator genes are discussed in detail as are the processes of repression, polarity and operon kinetics.

*A Survey of Domestic Pollution in the Forked Deer River: Madison County, West Tennessee (Spring 1967).* Gene Pickler, Union University. A two mile segment of river with three major identifiable sources of pollution was analyzed quantitatively and the fluctuations in some of the environmental and biotic components were evaluated. These changes were, for the most part, related to oxygen content which is known to be so critical in maintaining stability in lotic ecosystems. The dissolved oxygen content at designated sampling stations was determined by the Winkler method. The organic matter content, chiefly of animal origin, was

measured by the method of Dixon and Jenkins, an indirect method involving a modification of the Winkler method. The pollution sources were mainly municipal raw sewage outlets. Therefore, a count of enteric coliform bacteria was taken by the Millipore filter method. The results of these tests showed that the composition was measurably affected although the fluctuation did not appear to be large. Lasting conditions probably were never established, however, because of the time of year in which the survey was conducted. During this period there were several heavy rainfalls which caused the river to flood on three separate occasions. If this study had been done during a more stable period the results would probably have revealed a more pronounced effect.

**Red Cell Morphology** Richard Griffith, Christian Brothers College. Many morphological differences are noted in erythrocytes from patients with sickle cell anemia. Miscellaneous, target, oval, spherical and other bizarre types besides the sickled and normal cells are well defined in the literature, especially for patients with pulmonary infarctions or other chest symptoms as confirmed by autopsy. Twenty-one blood smears were selected from the available slides of the person in question. The smears ranged from first diagnosis of sickle cell anemia until death. Three groups of seven slides each were studied, the first from 1953 to 1957, the second from 1957 to 1961, and the third from 1961 to 1966. Differential counts were made on three oil immersion fields on each slide. There was a significant rise in the number of blister cells from to .25 in the first group, to 0.69 in the second group, to .25 in the third group. All other miscellaneous cells stayed in a range of 0.45 of the total normal and abnormal cells counted.

**To Determine, by the Method of Least Squares the Equation of the Parabola that will Best Fit a Set of Data.** Susan Lee Williams, Lambuth College. Two metals A and B form an alloy from which wire is made. Metal B makes the alloy harder and up to a certain point it also makes the wire stronger. At this certain point the strength of the wire falls sharply as the alloy becomes harder. Assume the parabola to be:

$$y = ax^2 + bx + c$$

where x is hardness as measured by pounds of pressure needed to be applied to an instrument to make a scratch in the metal. Y is the strength in pounds necessary to break the wire.

GIVEN:

x	y	xy	x'	x'y	x <sup>2</sup>	x' <sup>2</sup>
1	1	1	1	1	1	1
2	4	8	4	16	8	16
3	5	15	9	45	27	81
4	8	32	16	128	64	256
5	13	65	25	325	125	625
6	11	66	36	396	216	1296
7	8	56	49	392	343	2401
28	50	243	140	1303	784	4676
$\Sigma x$	$\Sigma y$	$\Sigma xy$	$\Sigma x'$	$\Sigma x'y$	$\Sigma x^2$	$\Sigma x'^2$

We assumed  $y = ax^2 + bx + c$   
 let  $e = y - ax^2 - bx - c = \text{residual (error)}$   
 $e' = y' + a'x' + b'y' + c' - 2ax'y - 2bx'y - 2cy$   
 $+ 2abx' + 2a'bx' + 2bcx$

Let R = sum of squares of the residuals.  
 (1)  $R = 2y' + 2a'x' + 2b'y' + c' - 2abx'y - 2b'ax'y - 2c'bx'y - 2a'bx'y - 2b'ax'y - 2c'bx'y$

We wish the sum of the squares to be least for our curve over any other parabola so we arrange (1) as a quadratic in a, b, and c, and then set the derivatives with respect to a, b, and c to zero.

- (a)  $a'x' + 2a(-x'y + bx' + cx') + \dots$
- (b)  $b'y' + 2b(-xy + ax' + cx) + \dots$
- (c)  $c' + 2c(-y + ax' + bx) + \dots$

Setting the derivatives equal to zero we get:  
 $a'x' + b'bx' + c'cx' = 2x'y$   
 $a'bx' + b'bx' + c'bx = 2xy$   
 $a'cx' + b'cx + c'cx = 2y$

Substituting for  $2x, 2y, 2x'$  etc. from our table we get:  
 1)  $4676a + 784b + 140c = 1303$   
 2)  $784a + 140b + 28c = 243$   
 3)  $140a + 28b + 7c = 50$

Solving we get:  
 $y = -.485x^2 + 5.42x - 4.78$

**STANDARD ERROR OF ESTIMATE**

x	y	Eq.	D	D'	
1	1	.155	.545	.714	
2	4	4.12	.120	.0144	St. Error of Est. =
3	5	7.115	2.115	4.473	
4	8	9.14	1.14	1.299	$\sqrt{21D'} = \sqrt{16.8325}$
5	13	10.195	2.805	7.868	$\frac{16.8325}{7}$
6	11	10.28	.720	.5184	
7	8	9.395	1.395	1.946	= 1.55
				16.8325	

Suppose we have a hardness  $x = 8$  as registered by our instrument in pounds. We get  $y = -.485(8^2) + 5.42(8) - 4.78$

$$y = 7.524 = \text{strength of wire}$$

**The Normal Probability Curve.** Song Kuang Su, Lambuth College. Find the value of an unknown by observations. Errors of observation follow a mathematical law — as the number of observations increases. Constant errors must be eliminated. The equation we seek is the probability curve.

We seek  $y = f(x)$  where  $\int_{-\infty}^{\infty} f(x) dx = 1$ .

We make observations  $s_1, s_2, \dots, s_n$  on a quantity having true value  $x$ , and having errors  $x_1, x_2, \dots, x_n$

$$\begin{aligned} s_1 &= s - x_1 \\ s_2 &= s - x_2 \\ &\vdots \\ s_n &= s - x_n \end{aligned}$$

(1)  $\Sigma x = \Sigma s - \Sigma x$

Assume arithmetic mean is best value to be assigned to  $s$ .

$$\Sigma x = x_1 + x_2 + \dots + x_n = 0$$

Let smallest measured interval be  $\Delta x$ .

$f(x) \Delta x = \text{probability of error } x$   
 $f(x) \Delta x = \text{probability of error } x$   
 $f(x_n) \Delta x = \text{probability of error } x_n$

Therefore  $P = f(x_1) f(x_2) \dots f(x_n) \Delta x$   
 = Probability of occurrence of the set of errors.

We maximize  
 $\ln P = \ln f(x_1) + \ln f(x_2) + \dots + \ln f(x_n) + n \ln \Delta x$   
 Square derivative of  $\ln P$  to zero.

$$(2) \frac{f'(x_1)}{f(x_1)} \frac{dx_1}{dx_1} + \frac{f'(x_2)}{f(x_2)} \frac{dx_2}{dx_2} + \dots + \frac{f'(x_n)}{f(x_n)} \frac{dx_n}{dx_n} = 0$$

$$\text{from (1)} \quad \frac{dx_1}{dx_1} = \frac{dx_2}{dx_2} = \dots = \frac{dx_n}{dx_n} = -1$$

Denote  $\frac{f'(x)}{f(x)}$  by  $t(x)$  (2) becomes

$$(3) t(x_1) + t(x_2) + \dots + t(x_n) = 0$$

We had  $x_1 + x_2 + \dots + x_n = 0$

Assume  $t(x)$  a power series.

$$(4) t(x) = a_0 + a_1x + a_2x^2 + \dots$$

We get from (3)

$$(5) na_0 + a_1 \Sigma x + a_2 \Sigma x^2 + \dots = 0$$

Since by (3)  $\Sigma x = 0$ . Therefore equation (5) is satisfied if  $a_0$  is arbitrary and the other  $a$ 's are zero.

$$(6) \therefore t(x) = \frac{f'(x)}{f(x)} = a_1x$$

Integrating (6) we get  $\ln f(x) = \frac{a_1x^2}{2} = \ln C$ .

For convenience write  $\frac{a_1}{2} = -h^2$

$$\text{We have } y = f(x) = Ce^{-h^2x^2}$$

Now determine C.

$$\int_{-\infty}^{\infty} Ce^{-h^2x^2} dx = 2C \int_0^{\infty} e^{-h^2x^2} dx = 1$$

$$\text{Let } I = \int_0^{\infty} e^{-hx^2} dx = \int_0^{\infty} e^{-h^2y^2} dy$$

$$I^2 = \int_0^{\infty} \int_0^{\infty} e^{-h^2(x^2 + y^2)} dy dx.$$

Turn to polar coordinates

$$I^2 = \int_0^{\frac{\pi}{2}} \int_0^{\infty} e^{-h^2r^2} r dr d\theta$$

$$= -\frac{1}{2h^2} \left[ \int_0^{\frac{\pi}{2}} e^{-h^2r^2} \right]_0^{\infty} d\theta$$

$$= \frac{\pi}{4h^2}$$

$$I = \frac{\sqrt{\pi}}{2h}$$

$$\therefore y = \frac{h}{\sqrt{\pi}} e^{-h^2x^2}$$

**Correlation of Monobutyl-O-Phenophenol Sodium Monosulfonate as an Addition Agent in Electrodeposition of Tin.** Lyle R. Brownson, Bethel College. Using a static plating cell of the Hull type, an evaluation was made of the effect of small additions of the cation monosulfonate to a plating bath used in the electrodeposition of tin. The basic plating solution contained stannous tin, phenosulfonic acid, and dihydroxy diphenyl sulfone. The range of additions investigated was 0 to 6000 ppm monosulfonate. A predetermined amount of tin was plated onto 8 square inch specimens. The maximum and minimum current density was established at which proper fine-grained, dense tin deposited for each addition of monosulfonate. Other characteristics of the tin deposit were noted in relation to the amount of monosulfonate. We found that, in comparison to no monosulfonate, the addition of approximately 100 to 750 ppm monosulfonate extended the range for good plating for both low and high current density. When additions significantly exceeded approximately 750 ppm, the effect was progressively deleterious rather than beneficial. Without either dihydroxy diphenyl sulfone or the monosulfonate in the bath, the tin deposit was not of good quality at any current density. In the

absence of dihydroxy diphenyl sulfone the deposit was improved by the addition of monosulfonate.

**Comparative Limnology of Two Recreational Lakes in Summer.** Beverly Trivelpian and Dennis Handricks, Bethel College. Neither Carroll Lake on Kentucky Lake or Paris Landing, both recreational lakes of West Tennessee, exhibits a stratification typical of some lakes during midsummer. The lack of stratification seems to be attributable primarily to two aspects of each lake: 1) relative shallowness which allows 2) the action of wind and man-made turbulence to effect nearly complete mixing of the water from top to bottom. Wind-generated turbulence seems to be about equal in both lakes. Turbulence produced by recreational activities apparently is greater in Kentucky Lake than in Carroll Lake as evidenced by the larger values of dissolved oxygen and greater per cent saturation of oxygen in Kentucky Lake. The much higher methyl orange alkalinity values for Kentucky Lake indicate that it is potentially more productive than Carroll Lake, even waters with higher methyl orange alkalinity afford a more stable environment with respect to buffering capacity and CO<sub>2</sub> reserve. This difference may be explained by the contrasting watersheds of the two lakes. The Kentucky Lake watershed is a limestone region, whereas, that of Carroll Lake is a clay region.

**Pythagorean Triples.** Iris Beth Brubaker, Bethel College. The classical formulas for obtaining primitive Pythagorean triples were presented, and a simple proof from McCoy's INTRODUCTION TO MODERN ALGEBRA was given. An example was used to illustrate the application of these formulas. New parametric equations from Sister Mary Loretta Archambault's article in the March 1966 issue of THE MATHEMATICS TEACHER were discussed and illustrated as a basis for grouping primitive Pythagorean triples into families. Also, the idea of grouping primitive Pythagorean triples into families by means of another parameter was advanced.

**The Biochemical Variability Between Isolates of Escherichia coli and Enterobacter aerogenes from the Raw Leverage of the McKenna Leverage Plant.** Barry B. Schwartz and John Schlegelner, Bethel College. The observations of Escherichia coli and Enterobacter aerogenes were made after the inoculation and incubation phenyl-red glucose, phenyl-red sucrose and phenyl-red lactose after twenty four hours at 37C. For E. coli, strain 2 showed no gas production and strain 6 produced a slight presence of gas in lactose fermentation. Eight of ten strains of E. coli produced gas in the fermentation of sucrose. For Enterobacter aerogenes strains 2, 5, 6, 8, and 9 showed production of acid and a slight presence of gas in glucose fermentation. Strains 5, 9, and 10 showed slow fermentation of lactose with production of acid and a slight presence of gas. Strain 7 showed no fermentation of lactose. Strains 1 and 6 showed lack of fermentation of sucrose. Strains 1, 5, 6, and 7 gave a positive test for indole. On the basis of our results it can be said that there is

genetic variation of E. coli and E. aerogenes within a raw sewage sample obtained in McKenna.

**A Progress Report of Some Experiments with Various Intervall and Extravall Environments and Their Effects on the Chick Embryo.** Beverly Annun, Caron-Newman College. In a series of experiments dealing with the external and internal environments of developing chick embryos the following procedure was followed. Unincubated, fertile eggs were placed in a triple thickness of leak-proof plastic bags which were evacuated and subsequently filled with pure nitrogen. The eggs were incubated for periods of seventy-two, ninety-six, or one-hundred-twenty hours. Temperature and humidity were optimum. Upon examination of the embryos in each incubation period, ninety-seven per cent were alive and none were more than eight hours behind normal developmental age. No observable abnormalities were noted at one hundred twenty hours.

**The Influence of a Thyroid Inhibitor on the Development of the Chick Embryo.** Linda d'Entackin, Siena College. Is the activity of the thyroid gland essential in the development of animals that do not undergo metamorphosis? In this preliminary experiment I injected eleven day old chick eggs with thiouracil, a thyroid gland inhibitor, and injected sodium chloride into the control eggs. The treated chick embryos which developed at various stages were approximately one half the size of those in the control group. I concluded that the activity of the thyroid gland is essential to the normal growth of a chick.

**The Isolation of a Bacteriophage.** Kenneth Flippo, Union University. A bacteriophage is a virus that makes a living bacteria dissolve or lyse. The virus assumes a parasitic role and uses bacterial cells for nourishment and reproduction. Several factors should be considered in the isolation of the virus. The type of bacteria that the virus uses for a host; the area where the samples are being taken from should be checked for treatment; the technique used to collect the samples should be taken into consideration; and such things as temperature, culture media, and special filtrations should also be considered. The actual virus being sought is one that is specific for Escherichia coli. The process is taken from a general bacteriology laboratory manual with some alterations. A plaque was found on the agar plates after incubation and tested, thus, confirming the isolation of the virus being sought.

**A Preliminary Study of Fresh-Water Diatoms in Shelby County.** Karen Mackey, Siena College. Water samples were collected from four stations in Shelby County from January through March, 1968. From the samples, diatoms were prepared for study under the microscope by a process of incineration. Identification of genera was made on the basis of the silica frustule structure. Diatom populations are related to water pollution in that small populations of many species indicate chemically well-balanced, healthy waters while large populations of few species indicate chemically unbalanced and possibly polluted waters. Several factors

were found to be involved in determining the size and type of diatom population, including rainfall, normal seasonal change in genera, and chemical content of the waters. Continuing studies will attempt to organize data on these pertinent factors and relate it to microscopic observations of diatom population. This study was partially subsidized by a grant from the Department of the Interior to Christian Brothers College OWRB 1004-Tenn.

**Comparison of Winter and Spring Algae in Selected Areas of Shelby County.** Therese Mangold and Marguerite Wagner, Siena College. From a study of six stations in Shelby County, on Nonconah Creek, Wolf

River, Harrison Creek, Mississippi River and McKellar Lake, a comparison was made of the number and kinds of algae collected from December through February to those collected in March and April. In most stations the number as well as the kinds of organisms increased in the spring. The counts were made with a Sedgwick-Rafter counting cell. By this method minute organisms (nanoplankton) can neither be counted or correctly identified. Further studies will include a correlation of algal forms present in a site to the existing environmental conditions. This study is partially subsidized by a grant from the Department of the Interior to Christian Brothers College OWRB 1004-Tenn.

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