A STUDY OF THE CURRENT BELIEF OF HIGH SCHOOL FRESHMEN IN POPULAR FALLACIES

A THESIS

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INTRODUCTION

Nature of the Study

General science as taught in high school is a preview of the general scientific field. Many pupils steeped in tradition and imbued with popular misconceptions should have their thinking influenced by the first year spent in high school, especially those students taking a course in general science. This thesis will attempt to show whether or not there is a relationship between a year of high school and the dispelling of the so-called "popular fallacies", whether or not there is a difference between boys and girls in their popular beliefs, and to a limited extent show whether a course in general science has an influence in correcting these beliefs.

Reason for the Study

Many pupils in high school have misconceptions or popular fallacies which should be corrected and the school should be influential in correcting misapprehensions of this nature. Teachers of science should feel obligated to aid students in this respect as it touches the scientific field. Does the school really accomplish anything in giving students an improved notion of popular errors, especially in the field of science? This study is designed to answer this question as it relates

to high school freshmen.

Previous Studies

Several investigators have made studies of popular misconceptions among various groups. Nixon[1] gave a test of thirty questions to 140 women and 219 men, students in elementary psychology in Columbia University, Columbia University Extension, and evening classes in New York University. He figured the percentage answering each statement correctly and also compared the scores made by the men and the women. Nixon's results indicated greater credulity among the women, as they accepted more of the statements true than the men.

> Garrett and Fisher[2] added ten more false popular statements to Nixon's questionnaire and presented it to 140 senior girls in Washington Irving and to 115 senior boys in the DeWitt Clinton High School in New York City. Their results, also indicating that the girls were slightly more credulous than the boys, show a small but reliable sex difference. . . . .

Negligible correlations were obtained between intelligence and the misconception scores.

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[1] H. K. Nixon, "Popular Answers to Some Psychological Questions." American Journal of Psychology, XXXVI (1925), 418-423.

[2] Garrett, H. E. and Fisher, T. R., "The Prevalence of Certain Popular Misconceptions." Journal of Applied Psychology, X (1926), 411-420, cited by Richard S. Hartner, "The Effects of Training Upon the Belief in Certain Popular Misconceptions." The Journal of Applied Psychology, XXI (February, 1937), 119-30.

Hartner[3] gave a questionnaire of forty statements to 94 women and 154 men students in elementary psychology at Temple University. The Garrett and Fisher questionnaire, which was a modified form of Nixon's questionnaire, was used.

Hartner's findings did not reveal any significant sex differences in credulity and there were very slight relationships existing between the degree of acceptance of these misconceptions and the factors of intelligence and scholarship. Comparison of results from a first and second test showed that there was considerable reduction in credulity, especially for those statements for which correct scientific information had been provided.

Conklin[4] made a report on returns to a questionnaire presented each year for four years (1913-1917) to the students beginning psychology at the University of Oregon. He found in a group of about five hundred college students that ninety per cent of the women and seventy-three per cent of the men could recall belief in or practice of superstitions.

Gilliland,[5] in his study of the effects of a course in

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[3] Richard S. Hartner, op. cit., pp. 119-29.

[4] Edmund S. Conklin, "Superstitious Belief and Practice among College Students." American Journal of Psychology, XXX (1919), 83-102.

[5] A. R. Gilliland, "A Study of the Superstitions of College Students." Journal of Abnormal and Social Psychology, XXIV (1930), 473-479, cited by Richard S. Hartner, op. cit., p. 120

general psychology upon common superstitions and prejudic also used a modified form of the Nixon questionnaire. Tw groups of students in general psychology were selected: 103 students from the College of Liberal Arts, and 46 students in the evening School of Commerce of Northwestern University. The questionnaire was given to each group at the first meeting of the class and again at the last meeting. In the first test, the better students were prone to be less credulous than the poorer students. The results of the second test showed that training was more advantagious to the better students, there being a greater reduction in credulity for this group.'

Sources of the Data

The radio, motion picture and actual class room experiences undoubtedly influenced the selection and application of the fallacies. In fact many of the fallacies selected were verified by application of scientific knowledge to be found in class room textbooks.

The greatest influential factor in selecting the fallacies was the newspaper. Such regular columns appearing in many of the larger newspapers as John Harvey Furbay's "Debunker", Robert L. Ripley's "Believe It or Not", and Albert Edward Wiggam's "Let's Explore Your Mind" were used. The "Debunker" has contributed much influence in selecting and verifying these fallacies. Although this column has not been used as direct proof of the fallacies in many cases the ideas presented originated in this column. In establishing the proofs reliable authority has been used. Those proofs which seemed weak or inadequate have been rejected.

Magazines and books have been used as the main source

of material to establish the validity of the claims as regards the test itself. In practically all cases additional proof could have been given, but except in those fallacies where extreme doubt existed the proof was limited to one authority. Many of the fallacies are so apparent to an educated individual that proof is scarcely needed.

Method of Procedure

The test on popular fallacies was given to more than 280 freshmen in Kansas high schools at Osage City, Ensign, Morrowville, Gypsum, Hiawatha, Lincolnville, Dighton, Lucas and Colby. These tests were given early in the school year and again just before school closed. No comment was made before or after the first test regarding the nature of the test and teachers were warned not to discuss the tests with the students. The students were not told that they would be given a second test. Most of the students completed the test in thirty minutes although there was no time limit set.

CHAPTER II

SELECTION AND PROOF OF THE FALLACIES

Original and Final Selection of Fallacies

The original fallacy test as used consisted of 140 true-false statements. Some of these statements were eliminated because of lack of sufficient proof, because the statement was ambiguous or, as originally intended, because about twenty-five items were included to mask the fallacies. One hundred statements, in the final analysis, were considered because they were free from error and definite proofs were established that they were fallacies.

Table I shows the test of the true-false statements used together with the correct answers which are indicated in the parentheses at the left of the statements. A plus sign (+) indicates the statement is true and a minus sign (-) indicates the statement is false. An asterisk (*) before a statement indicates that the statement is not to be considered a fallacy in the summary of results, but for some reason has been eliminated.

Proof of the Fallacies

The statements used in the test are presented in Table I together with the correct answers and the proofs. It will be observed in the table that each statement is numbered as in the

TABLE I

THE FALLACY TEST

*(+)	1.	Oxygen is necessary for life.
*(+)	2.	Burning is a form of oxidation.
*(+)	3.	The earth is a planet.
*(+)	4.	Hydrogen is the lightest gas known.
(-)	5.	Drowning persons always rise to the surface of the water three times.
(-)	6.	Frequently on opening old coffins the body features are seen exactly as they were at the time of burial, and then a moment after, the remains crumble to dust under the influence of the atmosphere.
(-)	7.	A person's character can be correctly told by the prominences of the skull.
(-)	8.	If a strand of copper wire be worn around a person's waist he will not suffer from rheumatism.
(-)	9.	A thick drinking glass withstands hot water better than a thin one without breaking.
*( )	10.	Moths eat clothes.
(-)	11.	Cats suck the breath out of sleeping children.
(+)	12.	Steam is invisible.
*( )	13.	The terms disinfectant and antiseptic are synonymous.
(-)	14.	The "stuffiness" of a room is due to an excess of carbondioxide gas.
(-)	15.	Cocoa is made from cocoanuts.
(-)	16.	Water as clear as crystal is pure.
(-)	17.	A man has one rib less than a woman.
*(+)	18.	Bacteria are very small plants which may cause disease.
(-)	19.	If a woman about to become a mother is suddenly frightened, her child will have a birthmark which will bear some resemblance to the cause of the fright.
(-)	20.	A person's hair grows after death.
*(+)	21.	Vitamins in foods help in preventing certain diseases.
(-)	22.	Some people have double joints.
(-)	23.	Hair on the chest of man is a sign of great strength.
(+)	24.	A pound of feathers weighs the same as a pound of lead.
(-)	25.	The moon causes a state of "moon madness" in some individuals.
(-)	26.	We have only five senses.

Read Table Thus: The correct answers are given in the parentheses at the left. A plus sign (+) indicates the statement is true and a minus sign (-) indicates the statement is false. An asterisk (*) before a statement indicates it is not to be considered a fallacy.

TABLE I (continued)

THE FALLACY TEST

(-) 27. During the moment of death, every event of the persons life is recalled.
(-) 28. Natural instinct is a perfect guide.
(-) 29. A person can, without seeing it, tell when he is being stared at from behind.
(-) 30. It is a relatively easy task to estimate a person's intelligence by looking at him.
*(+) 31. Mosquitoes are animals.
(-) 32. Having boils "cleans" the blood of the person who has them and tones up his system.
(+) 33. Malaria fever is not caused by bad air.
(-) 34. When one is burned heat should be applied to draw out the "fire".
(-) 35. A corn has roots.
(-) 36. It is good practice to feed a cold and starve a fever.
(-) 37. Strictly speaking, tuberculosis is hereditary.
*(+) 38. Gold is a metal.
(-) 39. Orange or grape seeds if swallowed are likely to produce appendicitis.
(-) 40. A cat sees better in the dark than in the light.
*(+) 41. Some glass is transparent.
(-) 42. The whale is a large fish.
*(+) 43. The volt is used in measuring electricity.
(-) 44. Camels carry water in their humps.
(-) 45. Bats are blind.
(-) 46. Ostriches, when pursued, hide their heads in the sand.
(-) 47. A small house fly if it lives will grow larger.
(-) 48. Making a noise with a frying pan, kettle, or warming pan, will cause a swarm of bees to settle.
(-) 49. It often "rains" frogs.
(-) 50. A scorpion surrounded by fire will commit suicide by stinging itself to death.
*(+) 51. Steam may be used for power.
*(+) 52. Filtering is a method of purifying water.
(-) 53. A poisonous snake stings with its tongue.
(-) 54. Live toads are found in solid rock.
*(+) 55. All living things are made of cells.
(-) 56. A snake, cut and hack as you please, will never die until sunset.
(-) 57. Sponges are plants.
*(+) 58. A barometer measures air pressure.
(-) 59. Snakes fascinate their prey before killing it.
(-) 60. The bite of a boa-constrictor is poisonous.
(+) 61. A spider is not an insect.

TABLE I (continued)

THE FALLACY TEST

(-)	62.	Wheat taken from Egyptian tombs will grow.
(-)	63.	Gold is the most valuable metal.
(-)	64.	"Shooting Stars" are falling stars as their name implies.
(-)	65.	The earth is nearest the sun in summer.
(-)	66.	Stars may be seen by the unaided eye in daylight from the bottom of a deep well or tall chimney.
(-)	67.	Red haired people have fiery tempers.
(-)	68.	People tend to marry persons having opposite characteristics.
(-)	69.	Warm water freezes sooner than cold water.
(-)	70.	A compass needle points to the geographic North pole.
(-)	71.	An animal is sucked into quick-sand.
(-)	72.	Lightning never strikes twice in the same place.
(-)	73.	Dew falls as rain does.
(+)	74.	The elements of which combustible materials are made are not destroyed by fire.
(+)	75.	A burned substance really gains in weight because of the union with oxygen.
(-)	76.	Water in a stream is purified after flowing several hundred feet over stones.
(-)	77.	When we look at an object light goes from the eye to the object.
*(-)	78.	In a hot air furnace the air that goes into the rooms is separated from the smoke that goes up the chimney by means of filters.
(-)	79.	One may take for granted that the claims made for patent medicines on the labels and in the advertising are essentially true.
*(+)	80.	Compressed air is used for drilling through stone.
(-)	81.	When talking over a telephone the voice travels along the wire.
(-)	82.	Fortunes can be readily told from the stars and the signs of the zodiac.
(-)	83.	People in China are forced to have their heads downward all the time.
(-)	84.	The clouds consist of smoke.
(-)	85.	Excessive firing of explosives will cause rainfall.
(-)	86.	Fat people are always more jolly than other people.
*(+)	87.	Green plants make their own food.
(+)	88.	The onion belongs to the lily family.
(+)	89.	Irish potatoes are thickened, underground stems.
(-)	90.	The bat is a bird.
(+)	91.	It is not a sign of sickness when a dog eats grass.

TABLE I (continued)

THE FALLACY TEST

(-) 92. Milk snakes suck milk from cows.
(+) 93. There is no lead in a lead pencil.
*(+) 94. The toad is a good insect destroyer.
(-) 95. Storage batteries store electricity.
(-) 96. Horse hairs change into snakes.
(+) 97. There is no difference between cane sugar and beet sugar.
(-) 98. Sugar is the sweetest substance known.
(+) 99. Children are no better able than adults to learn something new.
*(+) 100. Tuberculosis may be a lung disease.
(+) 101. German silver is not silver.
*(-) 102. Bright children are less healthy than others.
*(+) 103. A receding chin is not a sign of weak character.
(-) 104. Owls, prairie dogs and rattlesnakes live in the same holes.
*(-) 105. A high forehead indicates intelligence.
(+) 106. Rattlesnakes cannot spring through the air.
*(+) 107. Heat and cold are not two separate things.
*(+) 108. Dry ice is not ice.
(-) 109. Death usually occurs during the early morning hours.
(-) 110. Groundhogs come out on groundhog's day and indicate by their actions the coming of spring.
(-) 111. Metal objects are colder than wool materials in the same room on a cold day.
*(+) 112. The sun is the source of the earth's energy.
*)-) 113. Vegetables should be planted at a certain time of the moon.
*(-) 114. Absence makes the heart grow fonder.
*(-) 115. What you don't know won't hurt you.
*(-) 116. Snakes are always cold to the touch.
*(-) 117. Rubbing one eye will aid to getting a cinder out of the other eye.
*(+) 118. Practice does not necessarily make perfect.
(-) 119. When cousins marry the children of this couple will be defective.
*(-) 120. Weather can be forecast by some people because of feelings in their joints and muscles.
*( ) 121. There is such a thing as witching for water.
(-) 122. Tin cans are mostly made of tin.
(-) 123. The sun stands still.
(-) 124. A quick learner is a quick forgetter.
(-) 125. Thunderstorms cause milk to sour.

TABLE I (continued)

THE FALLACY TEST

	(-)	126. The respiration of plants is the reverse of that in animals.
	(-)	127. Mice grow up to be rats.
	(-)	128. Benjamin Franklin discovered electricity.
	(+)	129. The seventeen year locust is not a locust.
*	(-)	130. Old men have more wisdom than young men.
*	(-)	131. Musicians have more hair than other people.
*	(-)	132. Goats eat tin cans and rubber tires.
	(-)	133. Corals are plants.
	(-)	134. Flies live only three days.
	(-)	135. The elephant is the largest living thing.
	(-)	136. Aluminum cooking vessels may poison food cooked in them.
*	( )	137. A man falling from an airplane does not continue to fall faster and faster until he strikes the ground.
	(+)	138. Hair is a dead substance.
*	(+)	139. Some wild animals should be conserved.
	(+)	140. Air has weight.

original test. The correct answer is given in the parenthesis at the left. A plus sign (+) indicates the statement is true and a minus sign (-) indicates the statement is false. An asterisk (*) before a statement indicates it is not to be considered a fallacy in the summary of results, but for some reason has been eliminated.

*(+) 1. Oxygen is necessary for life. All living things respire or use oxygen.[1] Without an ample supply of oxygen living things cannot release energy necessary for growth and performance of the life functions. This release of energy is brought about by the combination of oxygen with other elements.

*(+) 2. Burning is a form of oxidation. Burning is a form of oxidation.[2] In burning fuels combine with oxygen, and when any substance combines with oxygen the process is called oxidation.

*(+) 3. The earth is a planet. The earth is a planet revolving around the sun once each year and rotating on its axis once each day. Pieper and Beauchamp[3] have this to say

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[1] George W. Hunter, Problems in Biology (Chicago: American Book Co., 1931), p. 181.

[2] George W. Hunter and Walter G. Whitman, Problems in General Science (Chicago: American Book Co., 1934), p. 126.

[3] Charles John Pieper and Wilbur Lee Beauchamp, Everyday Problems in Science (Chicago: Scott, Foresman and Co., 1925), pp. 4-5.

concerning the earth as a planet: "Each planet has its own path, or orbit. The third from the sun and the fifth largest in size is the earth." Planets do not give light of their own but shine because light which strikes them is reflected back to you.

*(+) 4. Hydrogen is the lightest gas known. Hydrogen is the lightest gas known.[4] For this reason it is often used in airships; but because of its inflammability, helium, a gas slightly heavier than hydrogen but lighter than air is used because it is non-inflammable.

(-) 5. Drowning persons always rise to the surface of the water three times. A drowning person does not always rise to the surface three times. "Should a swimmer be seized with cramps, he might sink before help could arrive. In many cases a person goes down three times but this is not always true, for some fail to come up the first time and some come up only once."[5]

"The popular belief that a person comes to the surface three times before finally sinking is a fallacy. He may not rise at all, his doing so depending on circumstances, especially upon the position of his arms during his struggles."[6]

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[4] George Howard Bruce, High School Chemistry (Chicago: World Book Co., 1933), p. 164.

[5] George L. Bush, Theodore W. Ptacek and John Kovats, Senior Science (Chicago: American Book Co., 1937), p. 753.

[6] "Drowning". The World Book Encyclopedia, 1937 edition, IV, pp. 2038-39.

(-) 6. Frequently on opening old coffins the body features are seen exactly as they were at the time of burial, and then a moment after, the remains crumble to dust under the influence of the atmosphere. We cannot deny that bodies are not uncommonly found in a wonderful state of preservation. However, in no case do they crumble into a heap of dust on being exposed to the air. Ackermann[7] has this to say concerning the opening of old coffins:

> . . . . it may be pointed out that if the alleged crumbling were due to a few seconds exposure to air, this would mean such a rapid oxidation that heat and even fire might be expected! Moreover, if the remains were in such a delicate state as is implied, the slightest vibration would probably cause them to crumble, and this vibration would probably be caused by the opening, so that the crumbling, if any, would take place before the features could be seen.

(-) 7. A person's character can be correctly told by the prominences of the skull. An editorial appearing in the Hygeia magazine states:[8]

> Another type of superstition which has from time to time been considered scientifically is the idea that it is possible to read from the lines of the face or the hands something of the character of the individual concerned. All these notions are based on symbolism. In the middle ages it was thought that a man with a sharp-tipped nose, like that of a dog, would have a snarling character. A man with a long hooked nose, like that of an eagle, was said to have a noble though grasping nature. It was believed that when people resembled

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[7] A. S. E. Ackermann, Popular Fallacies (Philadelphia: J. B. Lippincott Co., 1924), P. 96.

[8] "Health Superstitions." Hygeia (June, 1935), 493.

certain animals they would have the characteristics of these animals.

One of the early systematic attempts to analyze character was made by the phrenologists. It is only within the last thirty years that psychologists have begun to reject the phrenological theory. Professor Knight Dunlap[9] makes this statement concerning phrenology: "We need not dwell upon the series of bold assumptions involved in this system, since, from the scientific point of view, the system is of historical interest only."

The Americana[10] makes this statement: "Phrenology was disowned by science because too much was claimed for it, and too much expected."

(-) 6. If a strand of copper wire be worn around a person's waist he will not suffer from rheumatism. An editorial appearing in Hygeia[11] has this to say about wire placed around the waist to prevent rheumatism: There are superstitions which get their results by turning the attention away from some annoying condition to something else such as placing copper wire around the waist to prevent rheumatic

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9 Knight Dunlap, "The Reading of Character from External Signs." Scientific Monthly, XV (August, 1922), p. 156.

10 "Phrenology". Encyclopedia Americana, 1928 edition, XXII, p. 28.

11 "Health Superstitions". Hygeia (June, 1935), pp. 492-95.

pains.

(*) 9. A thick drinking glass withstands hot water better than a thin one without breaking.

> Glass is a poor conductor of heat, and when hot water is poured into a thick glass tumbler the inner layers of the glass are soon at a much higher temperature than the outer. The high temperature causes a greater expansion, and hence the outer layers are burst by the expansion of the inner ones. In case of a thin tumbler or chemists' glass beaker, the whole thickness of the glass is raised to practically the same temperature almost at once, and consequently all the parts expand equally at once, and no excessive stresses are produced.[12]

*( ) 10. Moths eat clothes. The larva of a clothes moth does feed on clothing but the adult does not. This statement as used in the test is ambiguous.

The larva of the clothes moth feeds upon hair, wool or feathers.[13] Adult moths fly lazily in darkened corners, preferring darkness. When clothing and other objects are suddenly moved the moths can be seen running rapidly or flying to conceal themselves. Moths lay 100 to 300 eggs. The newly hatched worm crawls readily and once on its food spins a shelter of silken threads. The U. S. Department of Agriculture in leaflet No. 145 makes this statement concerning the food habit of the adult moth:[14] "The parent moth does not eat

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[12] A. S. E. Ackermann, op. cit., p. 5.

[13] Frank E. Lutz, Fieldbook of Insects (New York: G. P. Putnam's Sons, 1921), p. 235.

[14] "Clothes Moth." United States Department of Agriculture Leaflet 145 (January, 1938), p. 2.

clothing."

(-) 11. Cats suck the breath out of sleeping children. Ackermann[15] has this to say concerning cats and sleeping children: The cat likes a warm, clean place to sleep and finding this on a child's cot proceeds to nestle on the child's breast and in some cases may shut off the breath of the infant. In no case does a cat suck the breath of the infant. It would be quite impossible for a cat to shut off air from the nose and mouth of an infant at the same time by using its own mouth to do this.

(+) 12. Steam is invisible. What we see issuing from a teakettle is condensed steam, which consists of small globules of water. As steam issues rapidly from a cock or teakettle spout there is nothing visible close to the cock or spout, but as we look farther and farther away we see white condensed steam become more visible. Fall[16] makes the following statement concerning the visibility of steam:

> After escaping steam is cooled by the air, it condenses into small drops which make a cloud or fog that is visible. This is not true steam, and if you will heat it by holding a flame near it, the droplets of water will again be changed into invisible vapor. Real steam is invisible.

-( ) 13. The terms "disinfectant" and "antiseptic" are synonymous. The evidence concerning this statement is very

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[15] A. S. E. Ackermann, op. cit., pp. 4-5.

[16] Delos Fall, Science For Beginners (Chicago: World Book Co., 1917), p. 61.

conflicting. Some of the earlier writers make a very decided distinction between the two terms. Some of the more modern writers tend to accept the terms as synonymous.

(-) 14. The "stuffiness" of a room is due to an excess of carbon dioxide gas. Pieper and Beauchamp state:[17]

> The ill effects of "bad air" are not caused by too much carbon dioxide. . . . . years ago it was thought that the bad effects resulting from poor ventilation were due to the addition of carbon dioxide to the air during breathing, and the decrease in the amount of oxygen in the air.

Recent experiments show that the ill effects of "bad air" are caused by: (1) bad odors, (2) high temperatures, (3) high humidity. A good system of ventilation will prevent the temperature and humidity of the air from becoming too high, will keep the air clear of bad odors, and will keep it in motion.

(-) 15. Cocoa is made from cocoanuts. The Encyclopedia Britannica[18] has this to say about cocoa:

> Cocoa is manufactured from the seed of the Cacao tree (generally Theabroma cacao, rarely T. pentagona or T. sphaerocarpa, small trees of the family Sterculiaceae), a native of tropical America but extensively cultivated elsewhere in the tropics. The raw product is known commercially as Cocoa or Cocoa bean; and scientifically as Cacao (Mex. Cacauatl). The word cocoa is peculiar English corruption of Cacao. . . . .

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[17] Charles John Pieper and Wilbur Lee Beauchamp, op. cit., p. 272.

[18] "Cocoa". Encyclopedia Britannica, 14th edition, V. 945.

Ackermann[19] has this to say concerning the Cocoanut palm and cocoa:

> The Cocoanut palm (Cocos nucifera), as the name implies, belongs to the order Palmaceae, which grows in the tropics . . . . Etymologically it is better to spell the name coconut, which is not so misleading as cocoa-nut.
> Hence we see Cocoa is a corruption of Cacao, the name of the tree, and cocoa-nut is a corruption of coco-nut, through a mistaken connection.

(-) 16. Water as clear as crystal is pure. Some water may be slightly discolored and yet be free of disease germs, while other water perfectly clear may be polluted with germs from sewage. Bruce[20] makes this statement concerning water:

> Water is never found pure in nature. Even rain water gathers dust particles, bacteria, and gases as it descends through the air. River water contains both dissolved and suspended matter, the latter being frequently mud. Sea water contains salt. Spring water practically always contains mineral matter such as compounds of calcium and magnesium. When water percolates through the earth's crust, it picks up soluble mineral matter and particles which it holds in suspension. It gathers also organic matter which is the result of the decay of animals and vegetables. When contaminated with sewage, it frequently contains bacteria that cause disease.
>
> Often water may appear clear, have no odor, be cool and pleasant to the taste, and yet be polluted with disease germs. The only sure way of detecting their presence or absence is by expert examination with a microscope. The appearance of water to the naked eye does not indicate its purity.[21]

(-) 17. A man has one rib less than a woman. This

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19 A. S. E. Ackermann, op. cit., p. 53.

20 George Howard Bruce, op. cit., p. 48.

21 George L. Bush, Theodore W. Ptacek and John Kovats, op. cit., p. 7.

fallacy has no doubt arisen from the account of creation as given in Genesis.

> In the Natural History Museum, South Kensington, there are two normal skeletons (of a man and woman) side by side and it will be found . . . . that the man, as well as the woman, has twelve pairs of ribs.[22]

*(+) 18. Bacteria are very small plants which may cause disease. Bacteria are microscopic one celled plants many of which are pathogenic.[23] Bacteria have a very wide range being found in all parts of the world. Many of these organisms are useful such as causing decay or fixing nitrogen in the soil. One must use a good microscope in order to see them as they are invisible to the unaided eye. Many diseases such as tuberculosis, typhoid fever and tetanus are caused by these tiny germs.

(-) 19. If a woman about to become a mother is suddenly frightened, her child will have a birthmark, which will bear some resemblance to the cause of the fright. "Perhaps the most illogical and at the same time the most widespread of all types of supposed transmission of acquired characters are so-called "maternal impressions."[24] . . . .

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[22] A. S. E. Ackermann, op. cit., p. 62.

[23] Arthur O. Baker and Lewis H. Mills, Dynamic Biology (Chicago: Rand McNally and Co., 1933), p. 97.

[24] Herbert Eugene Walter, Genetics (New York: The Macmillan Co., 1930), pp. 83-84.

Linsey[25] makes this statement concerning the belief of Aristotle: "He believed in prenatal influences and in inheritance of acquired characters, the former a fallacy and the latter still unproved."

(-) 20. A person's hair grows after death.

> 'A prevalent belief, strengthened by the opinion of several modern French writers on this subject, is that the hairs grow after death . . . . I fancy that I have seen an apparent growth of the downy hairs on the dead body, where the decomposition has made considerable progress, but I am unwilling to believe in such a phenomenon without further and more careful investigation. 'The lengthening of the hairs of the beard observed in a dead person is merely the result of the contraction of the skin towards their roots, and not a vital process continuing after death of the individual; indeed, it is identical with a similar pushing of the hair which is known to take place in posthumous plaster casts; a mere result of contraction of the plaster, an occurring where growth from nutrition could never be suspected.'[26]

*(+) 21. Vitamins in foods help in preventing certain diseases. Dietetic experiments upon animals and observation based upon the diet of man has given us our knowledge of the vitamins. The several vitamins are usually found in our regular diet. The vitamins are named after the letters of the alphabet such as A, B, C, D, E and G. Others will probably be discovered. Vitamins as a class either (1) promote growth or (2) prevent disease.

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[25] Arthur Ward Linsey, Textbook of Evolution and Genetics (New York: The Macmillan Co., 1929), p. 7.

[26] Erasmus Wilson, F. R. S., On Healthy Skin, p. 104, cited by A. S. E. Ackermann, op. cit., p. 91.

Baker and Mills[27] say this concerning vitamins:

> Even though we select the proper proportion of proteins, fats, and carbohydrates and the correct number of calories chosen chiefly from the alkaline-producing foods, our diet will be inadequate if it does not contain sufficient vitamins. These are protective substances in foods, the exact chemical nature of which is unknown. . . . . Their presence, however, seems to promote healthful chemical reactions in the body and prevent certain diseases.

(-) 22. Some people have double joints.

> There are no such things as double joints in the case of human beings--there may be in machinery. When people have what are popularly known as double joints, it means that the ligaments holding the ends of the two articulating bones together are slightly looser than usual, and this allows more freedom in the relative movement of the parts. Contortionists have permanently stretched the ligaments of their joints by repeated and increased contortions.[28]

(-) 23. Hair on the chest of man is a sign of great strength. The hair on the chest of man is not a sign of great strength.

> 'The glory of a woman is her hair,' so that if abundance of hair were a sign of muscular strength we should not hear fair women spoken of as the weaker vessel. A medical friend tells me that some consumptive men are 'as hairy as Esau.' Possibly the idea has arisen from the account of Samson and his hair.[29]

(+) 24. A pound of feathers weighs the same as a pound of lead. Black and Davis[30] make this statement:

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[27] Arthur O. Baker and Lewis H. Mills, op. cit., p. 235.

[28] A. S. E. Ackermann, op. cit., p. 97.

[29] Loc. cit.

[30] Newton Henry Black and Harvey Nathaniel Davis, New Practical Physics (New York: Macmillan Co., 1932), p. 9-10.

> Everyone knows that lead is "heavier" than cork; and yet the question is sometimes asked, "which is heavier, a pound of lead or two pounds of cork"? The word "heavy" has two distinct meanings. Two pounds of cork are heavier than one pound of lead in the same sense that two pounds of coal are heavier than one pound of coal. In this case the word "heavy" refers to the total weight of the material. On the other hand, lead is "heavier" than cork in the sense that a piece of lead weighs more than an equal bulk of cork. The word "density" is used to designate more precisely this inherent property of the lead and the cork. That is, lead has a greater density than cork.

In the same sense as above a pound of feathers weighs in air the same as a pound of lead. However, lead has a greater density than feathers. That is a pound of feathers would occupy a much greater space than a pound of lead.

(-) 25. The moon causes a state of "moon madness" in some individuals. Ackermann[31] says concerning the moon and insanity:

> That there was such a connection was believed by the ancient Greeks. The term "lunatics" is derived from the Latin word "luna," the Moon, and we find corresponding words in French, Spanish, Portugese and Italian similarly derived. The derivation thus embodies the old belief that persons mentally afflicted were affected by the changes of the moon. The word is seldom employed in medical literature, but in its common use it appears to be more particularly applied to those who become periodically insane, i. e., those who have lucid intervals . . . .
> . . . . . .
> Another notion connected with the moon is that it is dangerous to sleep with the moon shining on one. This appears to have as little foundation in fact as the other idea and its absurdity is apparent when it is remembered that the intensity of the light from the full moon is only 1/618000th that from the sun, while the heat from the moon is only 1/185,000th that from the sun.

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[31] A. S. E. Ackermann, op. cit., pp. 106-08.

(-) 26. We have only five senses. Concerning the senses Ackerman[32] has this to say: the said five senses are those of sight, hearing, taste, touch and smell.

The definitions of four of the senses named above are quite simple, but when we inquire into the sense of touch, it is not found to be so simple. We have a sense of resistance or muscular sense and a sense of temperature. The sense of temperature may be divided into two, namely the sense of heat and the sense of cold. We also have a sense of proportion, a sense of pleasure and a sense of shame. To these we may add a sense of locality (by this is meant a knowledge which enables us to define roughly which part of our skin is touched) a sense of color and a sense of time.

Williams[33] makes this comment about the senses:

> In animals life the development of the nervous system has produced certain groups of nerve cells for the purpose of carrying on particular tasks. The eye is a nerve structure which has undergone a remarkable development so that man may be more familiar with his environment. The endings of a nerve in the tongue make possible the distinction between sweet and sour, palatable and distasteful food. Sensory nerves in the skin inform us regarding the objects in the world around us. The touch sensation is compound. It conveys qualities of pressure, warmth, cold and pain. . . . . In addition, there are certain common sensations, such as hunger and thirst. We feel them as existing within the body.

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[32] Ibid., pp. 108-09.

[33] Jesse Feiring Williams, Healthful Living (New York: Macmillan Co., 1922), pp. 332-33.

Williams makes this brief classification:

Sensations	Special Senses	1. Taste 2. Smell 3. Sight 4. Hearing 5. Touch	Temperature-- Warmth Pain Cold Pressure
		6. Muscle sense	
	General Senses	Hunger Thirst	

(-) 27. During the moment of death, every event of a person's life is recalled. Ackermann[34] presents a number of incidents to illustrate that during the moment of death, especially by drowning, every event of a person's life is not recalled. A number of individuals having very narrowly escaped death have testified that at death's door they had no such chain of events recalled to them. In the first place it would be an impossibility for an individual to recall all the events of a busy life and in the second place in many cases the individuals are so busy thinking of saving themselves that all other thoughts are blotted out.

(-) 28. Natural instinct is a perfect guide. Man's instincts are no perfect guide as shown by Williams:[35]

Man possesses a stomach intended to digest the pure food of the open, obtained by activity in the open air. If

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[34] A. S. E. Ackermann, op. cit., pp. 113-117.

[35] Jesse Feiring Williams, op. cit., p. 191.

a man eats plain food and leads an active life, his appetite is a perfect guide. If he does not, it is unsafe to trust to appetite alone, for the reason that he lives under conditions unlike those for which this instinct was built up. A cow's appetite is a certain guide to her among poisonous plants and berries, yet she will eat a bucket of paint and harm herself; the bucket of paint is beyond the range of her inherited habits. Even if man's instincts had their early strength, they could hardly guide him among the many food concoctions and preparations undreamed of by primitive man.

> There can be no greater popular error than the supposition that natural instinct is a perfectly trustworthy guide, for there are striking contradictions to such an opinion in individuals of every description of animal. The most that we are entitled to say in any case is, that the prevalent instincts of each race are trustworthy, not those of every individual. But even this is saying too much, because when the conditions under which the race is living have recently been changed, some instincts which were adapted to the old state of things are sure to be fallacious guides to conduct in the new one. A man who is counted as an atrocious criminal in England and is punished as such by English law in social self-defense, may nevertheless have acted in strict accordance with instincts that are laudable in less civilized societies.[36]

(•) 29. A person can, without seeing it, tell when he is being stared at from behind. This matter has been experimentally and exhaustively treated by Dr. J. E. Coover who issued his report in 1917, and this was reviewed at p. 136 of

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[36] Sir Francis Galton, Inquiries into Human Faculty, p. 43, cited by A. S. E. Ackermann, op. cit., p. 117.

Nature for Apr. 17, 1919. This review[37] has been quoted in dealing with this fallacy. There is absolutely nothing to the idea. The people stared at refused to be affected. The idea is merely a superstition.

(-) 30. It is a relatively easy task to estimate a person's intelligence by looking at him.

> Mr. R. Pinter gives the results of an investigation he made for the purpose of testing the trustworthiness of these judgments. The author chose twelve photographs of children varying in intelligence from proved feeble-mindedness to unusually great ability, and asked a group of people to arrange the photographs in order of merit for intelligence. His groups consisted of physicians, psychologists, teachers, and miscellaneous people. He found that the group of psychologists was the most nearly correct, but that on the judgment of no one group or of no one person could any reliance be placed. Several observers were consciously influenced by children of their acquaintance whom a photograph happened to resemble, and irrevelant trivialities quite frequently biased the observer's judgment. The author concludes that, although perhaps a living person would be easier to judge than a photograph, nevertheless these haphazard judgments are too untrustworthy to be of practical value[38] . . . . .

*(+) 31. Mosquitoes are animals. Mosquitoes are animals belonging to the insect group.[39] Living things are classed as either plants or animals and undoubtedly mosquitoes would be classed in the animal kingdom.

(-) 32. Having boils "cleans" the blood of the person who has them and tones up his system.

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[37] Nature, April 17, 1919, p. 136, cited by Ibid, p. 125.

[38] Nature, October, 1918, p. 151, cited by Ibid., pp. 126-27.

[39] Arthur O. Baker and Lewis H. Mills, op. cit., p. 167.

> Boils, like most diseases, are caused by bacteria, this time by one named Staphylococcus pyogenes aurens, who has a nasty little habit of getting into the sebaceous glands of the hair-follicles. The entrance is often caused by the skin getting chafed, as by a collar. Not only do boils not "tone up" the system, but if they are large or numerous, they may cause extreme debility.[40] . . . .
> . . . . . .

(+) 33. Malaria fever is not caused by bad air. The Hygeia magazine[41] makes the following statement concerning malaria: There is an idea that sleeping in the night air will cause malaria. Malaria is an infection carried from one human being to another by mosquitoes and the mosquitoes are more likely to bite the person who is sleeping outdoors in the night air without protection than the one who sleeps indoors with protection.

Baker and Mills[42] state the cause of malaria in the following words:

> Until recent years it was difficult to combat malaria because people did not know what caused the disease or how it was spread. Today, however, we can fight the disease because all mystery has been eliminated. We know it is caused by a microscopic protozoan parasite, Plasmodium malariae, and that it is always spread by the female Anopheles mosquito.

(-) 34. When one is burned heat should be applied to draw out the fire.

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[40] A. S. E. Ackermann, op. cit., p. 158.

[41] "Health Superstitions." Hygeia (June, 1935), p. 493.

[42] Arthur O. Baker and Lewis H. Mills, op. cit., p. 111.

> Do not expose the burn to heat, though warm moist cloths are sometimes grateful if wet with a warm solution of baking soda (bicarbonate).[43] . . . .
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> . . . . Do not hold the hand, if that be the part affected, to the fire with the idea of drawing out the burn. Such a proceeding is actually painful and utterly useless.[44] . . . . .
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> . . . . . .

(-) 35. A corn has roots. The World Book[45] defines a corn as "a small area of hardened, thickened skin, resulting from continued rubbing." Not one word is said about a corn having roots.

> A corn originates in the same manner as a callous but usually only on the feet. The chief cause is badly fitting shoes. A corn is distinguished from a callous by the presence of a central ingrowth of the horny layer of skin. This ingrowth is in the shape of a cone pointing downward. Its growth compresses the underlying layers of the skin, which becomes thinner, and a cup shaped cavity is left when the corn is removed. Pain is caused by the pressure of the central ingrowth against the sensitive deeper layers of the skin.[46]

A corn does not have roots for absorbing nourishment in the sense that a plant has roots.

(-) 36. It is good practice to feed a cold and starve a fever.

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[43] Fred B. Kilmer, Editor, Johnson's Standard First Aid Manual (New Brunswick, N. J. U. S. A.: Johnson and Johnson, (1925) p. 30.

[44] T. D. Lister, Editor, Fye Chavasse's Advice To A Mother (16th ed.), p. 354, cited by A. S. E. Ackerman, op. cit., p. 164.

[45] "Corn" The World Book Encyclopedia, III, p. 1691.

[46] Howard W. Haggard, The Science of Health and Disease (New York: Harper and Brothers Publishers, 1927), p. 268.

A hundred years ago it was the practice to starve patients with fever and to let them have very little water. They became emaciated and suffered intensely from thirst; the debilitated condition thus induced undoubtedly increased the mortality.[47]

. . . . and many think this plan should be literally adopted, and proceed to act accordingly. I never properly understood the sense of the proverb until one of my professional friends explained to me that there was an ellipsis in the sentence, and that it should be understood as a brief way of saying, "Stuff a cold and you will have to starve a fever"; that is if you do not refrain from generous living during a cold, ten to one you will set up a fever in which you will have to abstain altogether. This is certainly a more sensible reading of it.[48]

(-) 37. Strictly speaking, tuberculosis is hereditary.

It was very common some years ago to hear of the importance of heredity in the acquirement of tuberculosis. Today there is no general acceptance at all that tuberculosis is inherited biologically; the term "tendency" is used to indicate that children of tuberculous parents are more likely to acquire the disease, because there is an inherited weakness or susceptibility. There is considerable reason for believing the "tendency" theory. It is true that children of tuberculous parents are often weak and malnourished, but the important thing to remember is that these children inherit tuberculous parents, that they come into a home where tuberculosis is active. In short, heredity in this disease is of very little importance; environment on the contrary, is exceedingly significant.[49]

*(+) 38. Cold is a metal. Bruce[50] has this to say

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[47] Ibid., pp. 439-40

[48] Chamb. Edin. Jour., 1849, p. 141, cited by A. S. E. Ackermann, op. cit., p. 180.

[49] Jesse Feiring Williams, Personal Hygiene Applied (Philadelphia: W. B. Saunders Co., 1928), pp. 248-49.

[50] George Howard Bruce, op. cit., p. 487-88.

concerning gold:

> Gold is a soft, yellow, very ductile, very malleable metal, about twice as heavy as silver and a good conductor of electricity. . . . . Gold is the money standard of most countries, and it is used also in making jewelry and other ornaments.

(-) 39. Orange and grape seeds if swallowed are likely to produce appendicitis. Appendicitis is caused by germs not seeds. Blount makes this statement regarding the appendix and appendicitis: "This degenerate organ is a favorite place for pus-forming bacteria to grow, causing appendicitis. The disease does not come from swallowing grape seeds or any other small solids, but from bacterial growth."[51]

(-) 40. A cat sees better in the dark than in the light. A cat does not see better in the dark than it does in the light, but it sees better in the dark than many other animals can see in the dark. The World Book[52] says this about cat's eyes:

> The pupils can be wonderfully expanded or contracted, sometimes being just a vertical slit with a pin hole at each end through which the light enters. Because of this power, cats see well in the dark. Hearing and touch are also keen; smell and taste are not. Cats' whiskers are useful as feelers and warn their owners of near obstacles in the dark.

If it were possible for cats to see better in the dark

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51 Ralph E. Blount, The Science of Everyday Health (Chicago: Allyn and Bacon, 1936), p. 142.

52 "Cats." World Book Encyclopedia, 1937 edition, III, p. 1235.

than in the light, which it is not, then they would have no need for feelers as stated above.

> In the natural state a cat's prey comes out of twilight; hence the cat hunts then, and this gives rise to the idea that it sees better in the dark. . . . . but in absolute darkness all animals are equally helpless as regards their sense of sight.[53] . . . .

*(+) 41. Some glass is transparent. Pieper and Beauchamp[54] in speaking of glass say: "Probably its most important property is its transparency; because of this property no good substitute for it has been found."

(-) 42. The whale is a large fish. The whale is not a large fish but a cetacean. All cetaceans are destitute of hair, many have teeth, but many are toothless. Their skin is smooth, without scales; their blood warm and they produce their young alive. Hornaday[55] says concerning the order of whales and porpoises:

> Although the cetaceans are very fish-like in form, and also in mode of life, they are warm-blooded mammals, which breathe air instead of water, drown if submerged too long, bring forth their young alive, and nourish them with milk from their own bodies.

*(+) 43. The volt is used in measuring electricity. Black and Davis[56] in speaking of the volt say:

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[53] A. S. E. Ackermann, op. cit., pp. 222-23.

[54] Charles John Pieper and Wilbur Lee Beauchamp, op. cit., p. 305.

[55] William T. Hornaday, The American Natural History, vol. II (New York: Charles Scribner's Sons, 1914), p. 138.

[56] Newton Henry Black and Harvey Nathaniel Davis, op. cit., p. 326.

> The unit of electromotive force is called the volt, after volta, the scientist who discovered the chemical means for producing electric current. A volt may be defined as the electromotive force needed to drive a current of one ampere through a resistance of one ohm.
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> . . . . . .
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> Electromotive force (abbreviated e.m.f.) is sometimes called voltage or difference of potential. All these terms refer to the same thing--namely, the "push" that moves or tends to move electricity.

(-) 44. Camels carry water in their humps. There are numerous beliefs about camels that are not true. One common belief is that camels have an extra compartment in their humps for storing water.

> The hump consists almost entirely of fat, which serves as a reserve food supply. Water can be consumed in large quantities, stored in cells in the paunch and used little by little as needed, hence camels can travel several days without drinking, and for several weeks if juicy plants are available.[57]

(-) 45. Bats are blind. "To be 'as blind as a bat' is not to be blind at all, but rather to possess powers of vision that are uncommonly good in semi-darkness, or at night, and fairly good even in the broad light of day."[58]

(-) 46. Ostriches, when pursued, hide their heads in the sand. "Ostriches live on dry, sandy, waste land; they may lie flat on the ground to conceal themselves, but never bury their heads in the sand to escape observation, as so often

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[57] Robert Hegner, Parade of the Animal Kingdom (New York: Macmillan Co., 1936), p. 587.

[58] William T. Hornaday, The American Natural History (New York: Charles Scribner's Sons, 1904) p. 60.

stated."[59]

(-) 47. A small house fly if it lives will grow larger. The common house-fly, Musca domestica, is the disease-carrying fly and is the only species which is very abundant in dining-rooms. Many people get the mistaken notion that some of the smaller flies of different species grow up to be house flies.

Lutz[60] has this to say concerning a close relative of Musca domestica:

> Homalomyia canicularis. Especially in May and June this, at first sight, small edition of Musca domestica is sometimes abundant in houses. Those who do not know that insects do not grow after getting functional wings believe them to be the young of the larger and more common insect. However, all the veins run without sharp bends to the margins of the wings. The early spring adults have probably been hibernating in the house. The larva of the Lesser House-fly live in waste vegetable matter, in the manure of different animals, and especially in human excrement.

(-) 48. Making a noise with a frying pan, kettle, or warming pan, will cause a swarm of bees to settle. Lutz[61] has the following comment to make concerning the swarming of bees:

> The swarming of the honey-bee brings about an increase in the number of colonies but it is the queen of the old colony, and not one of her daughters, which goes out to form the new colony. The stimulus to the act of swarming is not understood; since a swarm sometimes starts without a queen, she can not be the instigator. In fact, if she

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[59] Robert Hegner, op. cit., p. 369.

[60] Frank E. Lutz, op. cit., pp. 363-64.

[61] Ibid., p. 454.

is detained by a trap or in some other way, the bees may destroy her and swarm with a virgin queen.

The swarming bees usually cluster on a branch or some other support before going to a cavity, such as a hollow tree, in which to start a new colony. The old-fashioned idea that ringing bells or beating tin pans will hasten this clustering is a mistaken one. If there be a delay in finding a suitable cavity, unprotected comb will be made on the branch where the bees have clustered.

(-) 49. It often rains frogs. This belief probably dates back to the time when people believed in spontaneous generation.

Some centuries ago it was believed that new things just happened out of dead stuff. Spontaneous generation, the theory was called. Frogs and toads that were found in mud puddles of the road were supposed just to have rained down out of the sky, and to have come from the very rain drops.

* *

But as men began to look at things more closely it was found that the frogs had come originally from eggs, and that the adult animals had been hiding in the woods until the rain made puddles in the roads.[62]

(-) 50. A scorpion surrounded by fire will commit suicide by stinging itself to death.

Scorpions are not affected by their own poison, hence never commit suicide by stinging themselves.[63]

Most animals are immune to their own poisons. The scorpion when confronted with fire curls the tail over the body and may give the appearance of stinging itself, but if it dies in a situation of this sort the fire or some other cause is to blame.[64]

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[62] Alfred C. Kinsey, An Introduction to Biology (Chicago: J. B. Lippincott Co., 1926), p. 106.

[63] Robert Hegner, op. cit., p. 114.

[64] A. S. E. Ackermann, op. cit., p. 316.

*(+) 51. Steam may be used for power. "Another source of energy, which we use in many machines, is steam. Steam is made by heating water."[65] Water placed in a boiler and heated is subjected to great pressure because of expanding steam. As a result the temperature is raised considerably above that temperature which is possible at atmospheric pressure. More and more pressure is exerted by the expanding steam and finally its pressure is increased to such an extent that useful power may be generated by allowing it to expand within a cylinder or against a turbine.

*(+) 52. Filtering is a method of purifying water. Filtering is a method of purifying water. Bruce[66] makes this statement concerning filtration:

> Filtration consists in general of passing liquids through porous materials which remove matter in suspension. The best natural filters are soils containing considerable sand and gravel. As the water percolates through the soil, suspended particles cling to the sand and gravel. In the laboratory liquids are filtered through filter paper and porous cups.

(-) 53. A poisonous snake stings with its tongue.

> The tongue of a snake is not capable of inflicting a wound, nor of conveying poison into the blood of another creature.[67]

All snakes, non-venomous and venomous, from the most

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[65] Charles John Pieper and William Lee Beauchamp, op. cit., p. 340.

[66] George Howard Bruce, op. cit., p. 49.

[67] William T. Hornaday, op. cit., pp. 339-40.

diminutive species to the largest pythons have a forked tongue, which is in frequent use as an investigating organ when the reptile is in motion or particularly alert. This quivering member, swept through a vertical plane, with tips expanded, imparts a sinister effect to the snake in the eyes of the misinformed. Thus the tongue is sometimes thought to be a stinging organ. It is in no way connected with the venom apparatus of poisonous species.[68]

(-) 54. Live toads are found in solid rocks. Toads are long-lived among the members of the lower animals; one specimen is known to have reached an age of 36 years.

That toads can live for hundreds of years embedded in rocks or trees is certainly a fable, since this is physiologically impossible. Those who report the discovery of these ancient toads believe what they say, but are unfortunately not critical, scientific observers.[69]

*(+) 55. All living things are made of cells. All living things are made of cells. An aggregate of cells of similar structure forms a tissue. Thus the bones, skin, nerves and muscles of animals are tissues. An organ is an aggregate of tissues that performs a special function such as the heart or lungs of man. Cells may be defined as the units of living matter.

A brick wall is constructed from bricks. . . . . In a similar fashion, all forms of life are composed of cells. Plants and animals are both constructed of cells. They may vary in shape, size, color and activity, but nevertheless, they are to be considered as the units of structure.[70]

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[68] Raymond L. Ditmars, Snakes of the World (New York: Macmillan Co., 1931), pp. 21-22.

[69] Robert Hegner, op. cit., p. 302.

[70] Jesse Feiring Williams, Healthful Living, op. cit., p. 1.

(+) 56. A snake, cut and hack as you please, will never die until sunset. Snakes continue to have muscular contractions for hours after they are dead, and their hearts will continue to beat for hours if removed from the body and placed in a dish of water. However, the dying of snakes has nothing to do with the setting of the sun.

> The superstition that if a snake is killed, its tail will live until sundown, is general and has but slender foundation in the fact that snakes, being lower in their nerve-organization than mammals, the process of death is a slow one.[71]

(-) 57. Sponges are plants. Sponges belong to a group of invertebrate animals known as porifera.[72]

> The porifera, or sponges, are animals with cylindrical bodies, one end of which is attached to some object, the other being open. The body contains many pores connected with a central body cavity by canals. The body is supported by a skeleton or frame made of limy or glass-like spicules or horny fibers.[73]

*(+) 58. A barometer measures air pressure. A barometer is used to measure air pressure.[74] Air at the level of the ocean will exert more pressure than on the top of a mountain because a longer column of air is exerting pressure on the barometer. The U. S. Weather Bureau makes use of the

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[71] Anna Botsford Comstock, Handbook of Nature Study (Ithaca, New York: Comstock Publishing Co., 1935), p. 200.

[72] George W. Hunter, op. cit., p. 223.

[73] Arthur O. Baker and Lewis H. Mills, op. cit., p. 346.

[74] George W. Hunter and Walter G. Whitman, op. cit., p. 55.

barometer in predicting weather.

(-) 59. Snakes fascinate their prey before killing it. "Snakes do not chase people nor deliberately attack them but will run away if possible. They do not fascinate nor hypnotize people or other animals, although animals may be frightened to a standstill."[75] Probably both men and animals when confronted with something terrible are panic-stricken and incapable of motion for the moment; but there is no evidence that snakes have the power to fascinate or hypnotize.

(-) 60. The bite of a boa-constrictor is poisonous. Boas and pythons have no poisonous fangs, and are harmless so far as poisonous bites are concerned.[76] The boa constrictors catch and squeeze to death their prey by contracting coils of their body about it.

(+) 61. A spider is not an insect. Spiders have eight legs and belong to a group of animals called arachnids.[77] Insects have but six legs. Spiders may have two, four, six or eight eyes; depending on the species. Some spiders trap their victims in silken nets while other species leap upon their prey from hiding.

Many not-yet-acquainted consider spiders to be insects and for that reason they are mentioned here--but briefly

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[75] Robert Hegner, op. cit., p. 331.

[76] A. S. E. Ackermann, op. cit., p. 333.

[77] Arthur C. Baker and Lewis H. Mills, op. cit., p. 369.

because they have no more claim to be considered insects than have lobsters, except that they approach insects in the matter of interesting habits: home building, prey catching, mating, care of offsprings, devices to escape their enemies, and the like. Among other important differences, they have four pairs of legs; also the head and thorax are merged in one piece (cephalothorax).[78]

(-) 62. Wheat taken from Egyptian tombs will grow.

Many seeds, especially those of weeds and some garden seeds, such as radish, cabbage, carrot, cauliflower, cucumber and turnip, may live for as long as ten years before being germinated, but the average age that a seed lives is much less than this. The stories of germinating of wheat found in the tombs of the Pharaohs may be disbelieved, although recently some lotus seed believed to be at least four hundred years old, were taken from a dried lake bed in the Gobi Desert, and were successfully germinated. But the reason that these seeds retained their vitality was because they were protected from decay by the peat bog in which they were embedded.[79]

(-) 63. Gold is the most valuable metal. Brownlee, Fuller and others[80] make this statement concerning platinum which disproves the statement that gold is the most valuable metal: "On account of its cost, which is now much more than that of gold, it is used only to a limited extent in chemical manufactures." Gold is less expensive than platinum, thorium, cerium, osmium and many other metals as shown by Ackerman.[81]

(-) 64. "Shooting stars" are falling stars as their

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78 Frank E. Lutz, op. cit., pp. 32-35.

79 George W. Hunter, op. cit., p. 115.

80 Raymond B. Brownlee, Robert W. Fuller, William J. Hancock, Michael D. Sohon and Jesse E. Whitsit, First Principles of Chemistry (Chicago: Alyn and Bacon, 1951), p. 626.

81 A. S. E. Ackermann, op. cit., p. 369.

name implies. "The meteors, or "shooting stars," often to be seen at night, are not real stars, but small bodies which fall from space into the air covering of the earth."[82] As meteors pass through the air they become very hot because of air resistance. Sometimes they burn up and fall to the earth as dust and sometimes they fall to the earth and are found to vary greatly in size. Some weigh only a fraction of an ounce and others weigh several tons.

(-) 65. The earth is nearest the sun in summer.

When you go nearer to a fire you feel its heat more, hence, as it is warmer in the Northern latitudes in Summer than in Winter, it is thought the Earth must be nearer to the sun then. Almost exactly the reverse is true, for the Earth is farthest (94½ millions of miles) from the sun on July 1, and nearest to it Dec. 31 when the distance is 91 millions of miles.[83]

(-) 66. Stars may be seen by the unaided eye in daylight from the bottom of a deep well or tall chimney.

It is a well known popular belief that the stars can be seen in daylight from the bottom of a deep well, shaft, or tall chimney. Like many other popular beliefs, it survives only because no one has ever taken the trouble to investigate it.[84]

(-) 67. Red haired people have fiery tempers.

This is certainly one of the more popular of "Popular Fallacies," but this does not make it easier to deal with. . . . .

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[82] Charles John Pieper and Wilbur Lee Beauchamp, op. cit., pp. 5-6.

[83] A. S. E. Ackermann, op. cit., p. 381.

[84] Ibid., p. 385.

The author has failed to find any satisfactory evidence either for or against the idea, but it should be clearly understood in all such cases that it is the duty of those who propound such theories to support them by reliable facts and experiments which may be checked by others. It is not for such people to give vent to loose statements and then expect others to disprove them, and to claim that their statements are true because nobody has disproved them.[85]

(-) 68. People tend to marry persons having opposite characteristics.

The statement "you usually marry your opposite" is commonly heard, but the investigations of Sir Francis Galton, F. R. S., do not bear this out. They are recorded in his English Men of Science, Their Nature and Nurture (1874),[86] . . .

In fact he finds quite the opposite to be true and harmony prevails over contrast in the proportion of about five to one.

(-) 69. Warm water freezes sooner than cold water.

Even the illustrous Sir Francis Bacon fell for this mistake. See his Novum Organum p. 307 (Pickering, 1850).

On asking a well-read man, who believed the above statement to be true, to explain why the warm water should freeze first he said, because the difference in temperature between the warm water and the air was the greater, hence the rate of loss of heat would be greater and hence the warm water would freeze sooner than the cold!

At 10:15 P. M. on Dec. 20, 1909, two saucers of water were placed on an outside window-sill. One of these contained water at a temperature of 105° F., and the other water at 60° F. At 11:50 P. M. the latter was partly frozen while the other showed no signs of freezing, and it was not till 0.03 A. M. that the latter began to freeze. At 0.18 A. M. that which had been originally

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[85] Ibid., p. 411.

[86] Ibid., p. 414.

60° F. was still more frozen than the other.[87] . . . .
. . . . . .

(-) 70. A compass needle points to the geographic North Pole. A compass needle points towards the magnetic North pole and not towards the geographic North pole.

> The magnetic poles of the earth do not coincide with the geographic poles. The magnetic pole of the North, for example, is more than 1000 miles from the geographic pole.[88]
>
> Without doubt the ancients believed that the compass pointed to true north, but in most places on the earth's surface it really points several degrees to the right or left of true north.[89]

(-) 71. An animal is sucked into quicksand. Quicksand is: "A mass of loose sand mixed with water to such an extent that it is incapable of supporting a heavy body. The grains of sand, which have smooth, rounded surfaces, do not cling together to form a compact mass."[90]

Ackermann[91] says concerning quicksand: quicksand gives way under the weight of a person and when he tries to move the sand does not flow readily into the void, so that in trying to lift a leg a partial vacuum is formed which tends to hold

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[87] Ibid., pp. 812-13.

[88] William D. Henderson, The New Physics of Everyday Life (Chicago: Lyons and Carnahan, 1936), p. 377.

[89] Charles John Pieper and Wilbur Lee Beauchamp, op. cit., p. 497.

[90] "Quicksand," World Book Encyclopedia, 1937 edition, XIV, p. 5921.

[91] A. S. E. Ackermann, op. cit., pp. 831-32.

the individual at that place while the weight of the individual causes him to sink deeper. An animal is not sucked into quicksand but sinks because of his own weight.

(-) 72. Lightning never strikes twice in the same place. In thunderstorms lightning is more apt to strike high objects like steeples or trees. The safest place in a storm is at some distance from high objects. Fireplaces, stoves, telephones, radios and plumbing are good things to keep away from during electrical storms. "The common belief that lightning does not strike twice in the same place is incorrect."[92]

(-) 73. Dew falls as rain does.

> The atmosphere at all times contains water vapor; the warmer the air becomes, the more vapor it may contain. When the atmosphere cools, some of the vapor is condensed and forms water. This is what happens when a pitcher of ice water is set in a warm room; the moisture that collects on the outside of the pitcher is taken from the air that comes in contact with it. Dew is formed in the same way. At night, the earth gives back to the atmosphere some of the heat that is absorbed from the sun during the day. Much of this heat passes off through the blades of grass and the leaves of plants, which become cooler than the surrounding air, and they therefore condense the moisture in the same way that the pitcher does.[93]

(+) 74. The elements of which combustible materials are made are not destroyed by fire.

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[92] George L. Bush, Theodore W. Ptacek and John Kovats, op. cit., p. 242.

[93] "Dew", World Book Encyclopedia, 1937 edition IV, p. 1925.

Matter can be neither created or destroyed.[94]

> Our ordinary fuels, wood, coal, and oil, contain carbon and hydrogen. When these substances are burned, the new substances formed are carbon dioxide and steam. These are gasses and pass away unseen. Any ashes left are largely composed of material which does not burn.[95]

In other words these elements of which combustible materials are made are not destroyed but remain as ash or combine with oxygen to form new compounds, but in no sense are they destroyed.

(+) 75. A burned substance really gains in weight because of the union with oxygen. When material burns the products formed are largely carbon dioxide and water. This is a form of oxidation. That is, when a substance burns it unites with oxygen. "The products of any type of oxidation are always heavier than the substance oxidized."[96]

(-) 76. Water in a stream is purified after flowing several hundred feet over stones. Water is not entirely purified by flowing over stones or being exposed to air in a stream. Absolute self-purification of running waters has not been conclusively demonstrated, though partial purification is effected.[97] Typhoid germs and others will live several

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94 William Howard Bruce, op. cit., p. 5.

95 Raymond B. Brownlee, Robert W. Fuller, William J. Hancock, Michael D. Sohon and Jesse E. Whitsit, op. cit., p. 8.

96 William Howard Bruce, op. cit., p. 22.

97 "Water Supply," The Encyclopedia Americana, 1928, edition, XXIX p. 45.

days in running water and will actually multiply if there is waste material available on which to feed.

(-) 77. When we look at an object light goes from the eye to the object.

> When we see an object, it is because that object is sending light to our eyes. The light from the sun, an electric light, or some other light-giving body may come directly to the eye or be reflected from some object.[98]

*(-) 78. In a hot air furnace the air that goes into the room is separated from the smoke that goes up the chimney by means of filters. "If you examine a hot-air furnace, you see that it is simply a large stove surrounded by an air chamber. Leading away from this chamber are several pipes or ducts."[99]

(-) 79. One may take for granted that the claims made for patent medicines on labels and in advertising are essentially true.

> There have been many exposures of the frauds perpetrated by the "patent medicine business."[100]
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> One of the reasons why people buy patent medicines is because they read the glowing testimonials written by people who say they have been cured by patent medicines. Investigation of such letters often shows that they have

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[98] Charles John Pieper and Wilbur Lee Beauchamp, op. cit., p. 163.

[99] Ibid., p. 266.

[100] Jesse Feiring Williams, Personal Hygiene Applied, op. cit., p. 110.

been written by people who were paid for writing them.[101]

Patent medicines rarely cure anyone and they take large amounts of money from people who cannot afford to spend it. These drugs in many cases are habit forming and there is real danger from poisons present in patent medicines which are not covered by law.

*(+) 80. Compressed air is used for drilling through stone. Concerning compressed air Pieper and Beauchamp[102] state: compressed air is used in doing work such as operating pavement drills, sand blasts and spraying machines for killing insects and painting.

(-) 81. When talking over a telephone a person's voice travels along the wire. To answer the question of how a telephone operates we must take into consideration the transmitter into which we speak and the receiver which reproduces at the other end of the line the speaker's words. Electricity must be supplied through the two instruments and the line connecting them.

> The transmitter is a little box filled with carbon granules which form a part of an electric circuit, but offer a rather high resistance to the flow of current. If the carbon particles are pressed close together, resistance is decreased and more current flows. When

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101 George W. Hunter, op. cit., p. 356.

102 George W. Hunter and Walter G. Whitman, op. cit., p. 60.

> they separate, less current flows through them. If we were to compress and release the walls of the box alternately, a variable current increasing with pressure and decreasing with absence of pressure would pass through the circuit. One wall of this carbon box is attached to a thin diaphragm just inside the mouthpiece of the transmitter. Sound waves are vibrations, the air becoming first more, and then less dense in rapid succession. Each compression pushes the diaphragm forward and presses the carbon particles closer together. As the air becomes less dense the diaphragm springs back to its natural position and the carbon particles separate. In this way, a pulsating current is made to pass through the wire. The number of pulsations and their intensity correspond to the number of vibrations and the intensity of the sound produced in the mouthpiece of the transmitter.[103]

The current set up travels over the line wire to the receiver where an electromagnet causes an iron diaphragm to vibrate in unison with the transmitter diaphragm.

> The vibrating diaphragm of the receiver sets up sound waves in the air which are duplicates of those given to the transmitter. Thus it is that speech is reproduced at the other end of a telephone line with no sound waves, but only pulsations of electric current being transmitted over the wire.[104]

(-) 82. Fortunes can be readily told from the stars and the signs of the zodiac. Astrology is not a science and fortunes cannot be told by the stars. Astrology is practiced by ignorant people all over the earth that believe the stars control destinies.

The belief in fortune-telling has largely disappeared

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[103] George W. Hunter and Walter G. Whitman, op. cit., p. 460-61.

[104] Ibid., p. 463.

among educated people.[105]

> Astrology is the "so-called science" which claims to foretell future events, especially of men, from the stars. This science flourished during the Middle Ages and it is yet a means of livelihood to many persons who prey upon ignorant classes in all countries.[106]

(-) 83. Peoples in China are forced to have their heads downward all the time. People in China are not forced to have their heads downward because: "When we say down we mean towards the center of the earth and when we say up we mean the opposite direction."[107] Down to the Chinese means towards the center of the earth just as down to us means towards the same center.

(-) 84. The clouds consist of smoke.

> As air moves over the earth's surface and absorbs heat, it also increases its load of water vapor. Both the increased warmth and addition of water vapor make the air lighter and cause it to rise.
>
> As the moist air rises, it expands, and when it expands it becomes cooler. Cooling reduces the capacity of the air to hold moisture. As a result, at some height, conditions are such that the moisture in the air is condensed into little drops of water, forming clouds.[108]

(-) 85. Excessive firing of explosives will cause rainfall. Ackermann[109] cites numerous examples to disprove

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105 "Fortune Telling." The Encyclopedia Americana, 1926 edition, XI, p. 525.

106 "Astrology." Ibid., II, pp. 452-53.

107 Charles John Pieper and Wilbur Lee Beauchamp, op. cit., p. 46.

108 George W. Hunter and Walter G. Whitman, op. cit., p. 536.

109 A. S. E. Ackermann, op. cit., pp. 936-38.

this theory. So wide spread has this fallacy been that in the past many attempts have been made to produce rain by firing explosives. Many educated people believe the fallacy that heavy rains follow great battles.

(-) 86. Fat people are always more jolly than other people. "Excessive accumulation of fat is a discomfort to many persons"[110]. . . . According to The Literary Digest:[111] These are days of discomfort in many respects for persons who are currently classed as overweight. It is the style to be slim and the life insurance companies class the fat individual as a poor risk. There is more danger from disease such as diabetes when a person is overweight so, take it all in all, the fat people are mighty uncomfortable.

*(+) 87. Green plants make their own food. Baker and Mills[112] describe the process of food manufacture thus: Green plants carry on a process known as photosynthesis which consists of taking carbon dioxide from the air and water from the soil and combining the two, by chemical means, in such a way that food materials are formed. Plants not only manufacture fats, carbohydrates and proteins for their own use but they supply

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110 "Fat". World Book Encyclopedia, 1937 edition, VI, p. 2378.

111 "Worries of Overweight." Literary Digest, January 7, 1928, p. 22.

112 Arthur O. Baker and Lewis H. Mills, op. cit., pp. 216-19.

the animals of the world with their food either directly or indirectly, since animals are unable to manufacture any food of their own.

(+) 88. The onion belongs to the lily family.

> Such beautiful plants as tulips, hyacinths, trilliums, lilies, and lilies-of-the-valley are representative of the lily family. In addition to these ornamental plants, however, the family includes many food plants, such as onions, leeks, and asparagus.[113]

(+) 89. Irish potatoes are thickened underground stems. Baker and Mills[114] say this about the Irish potato: Irish potatoes are thickened, underground stems. The enlargement comes from the presence of stored food. Over its surface are a number of eyes or buds which under favorable conditions will send out a shoot producing a new plant.

(-) 90. The bat is a bird.

> Bats are the only members of the order of winged mammals. . . . . upon close inspection it somewhat resembles a mouse with wings. Its wings, however, are not real wings but broad pieces of leathery membrane stretched backward from the forearms to the feet and tail.[115]

(+) 91. It is not a sign of sickness when a dog eats grass. "What the dog needs to find now and then on his diet list is grass--just common grass. He often goes in search of

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[113] Ibid., p. 337.

[114] Ibid., p. 579.

[115] Ibid., pp. 394-395.

it himself and eats it like a famished cow."[116] It is true dogs need grass in their diet but it is not a sign of sickness when they do eat it.

(-) 92. Milk snakes suck milk from cows.

> This is the snake which is said to milk cows, a most absurd belief; it would not milk a cow if it could, and it could not if it would. It has never yet been induced to drink milk when in captivity; and if it were very thirsty, it could not drink more than two teaspoonfuls of milk at most; thus in any case, its depredations upon the milk supply need not be feared. Its object, in frequenting milk houses and stables, is for other than the milking of cows, for it is an inveterate hunter of rats and mice and is thus a great benefit to the farmer. It is a constrictor, and squeezes its prey to death in its coils.[117]

(+) 93. There is no lead in a lead pencil. There is no lead in a lead pencil. The black substance that makes the mark is graphite, a form of carbon. "Graphite is used for the so-called "lead" pencil. It is mixed with clay to give it different degrees of hardness, and then forced through dies."[118]

*(+) 94. The toad is a good insect destroyer.

> The toad is of great economic importance to man because of its diet. No less than eighty-three species of insects, mostly injurious, have been proved to enter into the toad's diet. A toad has been observed to snap up 128 flies in half an hour.[119]

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[116] Charles William Burkett, Editor, Our Domestic Animals (Boston: Ginn and Company Publishers, 1907), p. 48.

[117] Anna Botsford Comstock, op. cit., p. 204.

[118] George Howard Bruce, op. cit., p. 96.

[119] George W. Hunter, op. cit., p. 543.

(-) 95. Storage batteries store electricity. Storage batteries do not store electricity. These batteries are made of lead plates surrounded by sulphuric acid. When the battery is "charged" one set of plates consists of metallic lead and the other electrode is coated over with lead oxide. "A storage battery does not, as is sometimes supposed, store up electricity; a storage battery is merely a device for storing up energy."[120]

> Some people think of a storage battery as a sort of condenser where electricity is stored; but it is not that. In the storage battery, as in any other battery, the electrical energy comes from the chemical energy in the cells.[121]

(+) 96. Horse hairs change into snakes.

> Snake disputes between truthful persons are due either to deceptions to the eye (an organ easily deceived!), a misinterpretation of things seen, or imperfect observations.
>
> For example, men of the highest truthfulness have been deceived into the belief that they have "seen" horse-hairs turn into worms.[122]

(+) 97. There is no difference between cane sugar and beet sugar. Beet sugar and cane sugar are chemically the same. The prejudices against beet sugar probably arose in early days when it was poorly refined.

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120 William D. Henderson, op. cit., p. 439.

121 Newton Henry Black and Harvey Nathaniel Davis, op. cit., p. 369.

122 William T. Hornaday. The American Natural History, vol. IV (New York: Charles Scribner's Sons, 1914), p. 73.

A number of plants, besides producing starch, are able also to convert carbon dioxide and water into sucrose $C_{12}H_{22}O_{11}$. The sugar-cane and the beet produce exceptionally large amounts of this sugar, which is the one commonly used as table sugar.[123]

The World Book says concerning beet sugar: "When it is highly refined, it cannot be distinguished from cane sugar."[124]

(-) 98. Sugar is the sweetest substance known. Sugar is not the sweetest substance known.

Saccharin, a white, odorless powder, a product of coal tar, which, when pure, is several hundred times sweeter than cane sugar. . . . . It is sold usually in tablet form. Saccharin dissolves very little in cold water, somewhat more in hot, and is thoroughly soluble in alcohol. A half grain takes the place of the average amount of sugar used in sweetening a cup of coffee. Although saccharin is so much sweeter than sugar, it is in no sense a sugar substitute, because it has no food value. When used in a food for sweetening purposes, it replaces a definite amount of sugar, and correspondingly reduces the nutritive value of the product.[125]

(+) 99. Children are no better able than adults to learn something new.

We have shown that the decline from the acme of ability to learn (located probably at some point between twenty and twenty-five) to about forty-two is only about 13 to 15 per cent for a representative group of abilities; and that ages 25 to 45 are superior to childhood, and equal or superior to early adolescence (14 to 18), in

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123 Alexander Smith, Intermediate Text Book of Chemistry (New York: Century Co., 1920), pp. 221-22.

124 "Sugar". World Book Encyclopedia, 1937 edition, vol. XV, p. 6907.

125 Ibid., pp. 6292-93.

general ability to learn.[126]

*(+) 100. Tuberculosis may be a lung disease.

Tuberculosis is an infection acused by the Bacillus tuberculosis. The bacterium may attack almost any organ in the body. There may be tuberculosis of the lungs liver, spleen, intestines, kidney, bones, brain, and other structures. In children it is more commonly seen in bone and gland infection; in adults it is more frequent in the lungs.[127]

(+) 101. German silver is not silver. Bruce[128] has this to say about German silver: German silver is a strong, hard alloy which is composed of copper, zinc and nickel. It is used to make cheap jewelry, bric-a-brac and wire.

*(-) 102. Bright children are less healthy than others. A popular idea has grown that "bright" children are usually physical weaklings. I believe that physical examinations of school children would fail to support such a belief.

*(+) 103. A receding chin is not a sign of weak character. There is no connection between the shape of a person's chin and his or her character. Some of the world's great leaders have had receding chins.

(-) 104. Owls, prairie dogs and rattlesnakes live in the same holes. Owls, prairie dogs and rattle snakes do not

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[126] Edward L. Thorndike and others, Adult Learning (New York: The Macmillan Co., 1928), p. 147.

[127] Jesse Feiring Williams, op. cit., p. 242.

[128] George Howard Bruce, op. cit., p. 479.

live in the same holes. Rattlesnakes feed on prairie dogs and owls. It is quite unlikely that they would live together in harmony. Owls have been known to feed on small prairie dogs so that makes the owls and prairie dogs enemies.

> A curious thing about the snake and the dog is that each is mortally afraid of the other. The dog is afraid of being eaten by the snake, and the snake is afraid of being entombed by the dog. If the mother of the young dogs, on a return to the home hole, finds that a snake has intruded, she at once sets up a peculiar cry or bark, to which all the citizens of the town at once respond. They gather about the hole, and in a moment all set at work filling it up. When the hole is filled they butt and pack the dirt in the mouth of the hole till it is almost as hard as the prairie adjacent. There is no chance for an escape of the invader. He is sealed up in his tomb. . . . .
>
> There are other enemies also, such as cougars or mountain lions, bobcats, eagles, hawks, and owls, but most of them are not sufficiently abundant on the Great Plains to be regarded as important factors in holding the prairie dog in check. Still, in some localities, hawks and owls kill large numbers of the young.[129]

*(-) 105. A high forehead indicates intelligence.

Scientists have found that the height of the forehead does not prove the intelligence of the individual. Many people of low intelligence have high foreheads and some people with great intelligence have sloping foreheads. The idea regarding personality traits, intelligence, special abilities, etc. as related to the shape of the head has been discarded by the scientific world.

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[129] Merriam C. Hart, "The Prairie Dog of the Great Plains." United States Department of Agriculture Yearbook for 1901 (Washington: Government Printing Office, 1902), pp. 862-63.

(+) 106. Rattlesnakes cannot spring through the air. A rattlesnake cannot even leap off of the ground; coiled and ready to strike it is unable to dart out more than about three-fourths of its own length.

Comstock[130] writes:

> Some people firmly believe that snakes spring or jump from the ground to seize their prey, which is quite false since no snake jumps clear of the ground as it strikes, nor does it spring from a perfect coil.

*(+) 107. Heat and cold are not two separate things.

> Heat may be defined as a form of energy due to the molecular motion of a body.[131]

> Heat is a form of energy which manifests itself in the motion of molecules of matter. If a condition could be reached where there was no molecular motion, there would be no heat.[132]

Cold is the absence of heat.

*(+) 108. Dry ice is not ice. There is no ice in dry ice. This substance is carbon dioxide in solid form. It passes from the solid directly into the gaseous state. This material is very useful for refrigeration because when it changes to a gas no liquid is left.

> One of the latest developments in refrigeration is the use of "dry ice" which is solid carbon dioxide. This has the advantage of being about 140° F. Colder than ice itself and hence a small cube of it will do the work of

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130 Anna Botsford Comstock, op. cit., p. 200.

131 William D. Henderson, op. cit., p. 271.

132 William H. Snyder, General Science (Chicago: Allyn and Bacon, 1935), p. 83.

a much larger piece of ice. In addition, dry ice lasts longer than ordinary ice. A forty-pound piece uncovered in a store window during the summer would last about twenty-four hours. Dry ice evaporates slowly without leaving any liquid behind to rust or corrode the container.[133]

(-) 109. Death usually occurs during the early morning hours. In proving this a fallacy Ackermann[134] by referring to several instances where records have been kept shows that the number of deaths for each hour of the day is very evenly proportioned.

(-) 110. Groundhogs come out on groundhog's day and indicate by their actions the coming of spring.

Who is not acquainted with the superstition about "ground-hog day"? It is said that the ground hog comes out of his burrough on the second day of February, looks about him, and if he sees his shadow, decides that spring is still six weeks off. He thereupon crawls back into bed to finish his winter's nap. Though the tradition has no basis of fact, the details of the story suggest some of the habits of this little animal. He hibernates in winter and he lives in a burrow.[135]

(-) 111. Metal objects are colder than wool materials in the same room on a cold day.

When surrounding objects are cooler than the body, good conductors feel colder than poor conductors, because the good conductors quickly convey the heat away from the body. . . . . When objects in our surroundings are warmer

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[133] George W. Hunter and Walter G. Whitman, op. cit., p. 114.

[134] A. S. E. Ackermann, op. cit., p. 897.

[135] "Ground hog". World Book Encyclopedia, 1957 edition, VII, p. 2968.

than the body, good conductors feel hotter than poor conductors because the good conductors convey their heat to the body so rapidly.[136]

Objects in a room for some time have the temperature of the room, yet the temperature of different objects may seem different to the touch, there is in reality no difference.

*(+) 112. The sun is the source of the earth's energy.

Every day, every year--we do not know how many--the sun has been giving heat and light to the earth. Even the wood, the gas, and the coal which we get from the earth possess energy that was originally brought to the earth from the sun. Our day and night, change of seasons, weather, all the principal activities on the earth, we trace back to the energy of the sun. Without it, no living thing could exist upon the earth.[137]

*(-) 113. Vegetables should be planted at certain times of the moon. When vegetables are planted, it does not matter what time it is by the moon, if there is plenty of good soil, moisture and sunshine and if the soil is the correct temperature. However, many people have this misconception.

*(-) 114. Absence makes the heart grow fonder. I do not believe that absence makes the heart grow fonder because companionship and fondness are built on much association. Friendships grow by experiences shared with another.

*(-) 115. What you don't know won't hurt you. The

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136 William H. Snyder, op. cit., p. 180.

137 George W. Hunter and Walter G. Whitman, op. cit., p. 488.

expression, "what you don't know won't hurt you" is an error. If a thing is harmful its effect upon you is just as great whether you know it or not. People died of infections long before they knew of such things as germs and people die of gunshot wounds from the gun they didn't know was loaded.

*(-) 116. Snakes are always cold to the touch. Snakes are not necessarily cold to the touch. A snake assumes the temperature of its surroundings. On a warm day it is as warm as the earth where it is found and on a cold day of course its temperature would be much lower.

*(-) 117. Rubbing one eye will aid in getting a cinder out of the other eye. I have read many first aid manuals on removing foreign particles from the eye, but I have never seen this one recommended. However, I have often heard of this being used as a remedy by people who are uninformed.

*(+) 118. Practice does not necessarily make perfect. Many people are doing things today just as poorly as they did years ago and yet they have practiced every day. We become established in our errors and fail to improve through practice. The right kind of practice tends to improve one but even then perfection is an elusive thing.

(-) 119. When cousins marry the children of this couple will be defective. When cousins marry they need not have defective children.

Cousin marriages, in which the blood of the grandparents is again combined in the children, although producing a

high percentage of defects, do not necessarily produce undesirable traits. They simply bring out latent or recessive characters for the reason that under these conditions similar defect may meet similar defect instead of the opposite allelomorphic normal condition which would dominate the defect and cause it not to appear.[138]

*(-) 120. Weather can be forecast by some people because of feelings in their joints and muscles. ". . . . it is a great fallacy to suppose that there is such a thing as a weather prophet."[139]

*( ) 121. There is such a thing as witching for water. Ackermann[140] has this to say concerning the divining-rod: "A special committee of the Royal Sanitary Institute have made a number of experiments with dowsers which leave no doubt that their claims are without foundation."

Witching for water is possible but it is impossible to locate water by witching. In other words many people practice witching for water and many others believe it is possible to get water in this way but such practices are not supported by scientific fact.

(-) 122. Tin cans are mostly made of tin. If tin cans were made entirely of tin they would be so expensive that most of us could not afford to buy them. Pure tin is an expensive

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138 Hubert Eugene Walter, op. cit., pp. 201-02.

139 A. S. E. Ackermann, op. cit., p. 929.

140 Ibid., p. 760.

metal. Tin cans are made of sheet iron which is covered with a thin coat of tin to prevent rusting.

"Tin is used chiefly to make tin plate, which is sheet iron or sheet steel dipped in molten tin in order to protect the iron from rust. Ordinary tinware and tin cans are tin plate."[141]

(-) 123. The sun stands still. The sun is in constant motion, not only turning upon its axis but traveling through space. The sun is a star and all the stars relative to one another are in motion.

> Nevertheless, when the positions of the stars are measured with the help of a powerful telescope, their apparent arrangement is found to be continually changing. The changes are of two distinct kinds. As the sun is continually forging ahead through the stars, and dragging us with it, the stellar scenery changes in the way in which terrestrial scenery changes when we drive through a forest.[142]

(-) 124. A quick learner is a quick forgetter.

> Popularly, it is believed that there is a law of compensation in learning in that, if one learns slowly, one also forgets slowly. . . . . later experiments indicate that the quick learner is more effective in every respect.[143]

(-) 125. Thunderstorms cause milk to sour. Thunderstorms do not cause milk to sour. Hygeia[144] has this to say

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141 George Howard Bruce, op. cit., p. 468.

142 Sir James Jeans, Through Space and Time (New York: The Macmillan Co., 1934), pp. 174-175.

143 W. B. Pillsbury, The Fundamentals of Psychology (New York: The Macmillan Co., 1934), p. 580.

144 "Health Superstitions." Hygeia, (June, 1935), p. 492.

in this regard:

> There is an idea that a thunderstorm makes milk sour. A thunderstorm has nothing to do with the souring of milk, for this condition is brought about by the development of germs within the milk.

(-) 126. The respiration of plants is the reverse of that in animals. Plants require oxygen as do animals and they take in oxygen and give off carbon dioxide every minute of the day and night. However, they also have an added function called "photosynthesis" which takes place in the presence of "chlorophyll". In this process oxygen is given off and carbon dioxide is used to manufacture food. A plant may release more oxygen than it consumes, but it still requires oxygen for respiration just as animals do.

> All animals and plants require energy in order to live. When oxygen unites with the protoplasm of the cells, energy in the form of heat is produced. Two waste products result, carbon dioxide and water. Respiration is the introduction of oxygen into the cells, the production of heat, and the giving off of carbon dioxide.[145]

(-) 127. Mice grow up to be rats. Mice are always mice and rats are always rats. They belong to a group of gnawing mammals called "rodents."

> Mice belong to the same family as rats, from which they are distinguished by smaller size. . . . .
> The mouse family is called Muridae by scientists. The house mouse is Mus musculus; the wood mouse M. sylvaticus;

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[145] W. M. Smallwood, Ida L. Reveley and Guy A. Bailey, New Biology (Chicago: Allyn and Bacon, 1934), p. 17.

the meadow mouse, Microtus pennsylvanicus.[146]

"Rats belong to the family Muridae. The black rat is Rattus rattus; the brown, R. norvegicus."[147]

(-) 128. Benjamin Franklin discovered electricity.

"The Greeks, 2600 years ago, knew something of magnetism and of electricity caused by friction."[148]

"About the middle of the eighteenth century, Benjamin Franklin proved by his notable kite experiment that lightning was simply an electrical discharge between the clouds and the earth, or between different clouds."[149]

Benjamin Franklin did not discover electricity as it is commonly believed, but proved that lightning is an electrical discharge.

(+) 129. The seventeen-year locust is not a locust.

"The cicada is wrongly called a locust. It does not even belong to the same order as locusts. Grasshoppers are locusts."[150]

The cicadas are a family of insects belonging to the

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146 "Mouse." The World Book Encyclopedia, 1937 edition, XI, pp. 4701-02.

147 "Rat." Ibid., XIV, p. 6000.

148 George W. Hunter and Walter G. Whitman, op. cit., p. 341.

149 William H. Snyder, op. cit., p. 1201.

150 Arthur O. Baker and Lewis H. Mills, op. cit., p. 175.

same sub-order as scale insects and plant lice. The most interesting species, often miscalled seventeen-year locust, has a life history extending over a period of seventeen years.[151]

*(-) 130. Old men have more wisdom than young men. Probably training and environment have more to do with wisdom than age.

*(-) 131. Musicians have more hair than other people. I don't believe the hair has a thing to do with musical ability or music ability with the hair.

*(-) 132. Goats will eat tin cans and rubber tires. The goat is not dainty; it will eat with satisfaction what other animals reject, such as bark of trees, bushes, wild fruits, tobacco, etc.[152] However, it is doubtful that they will eat tin cans or rubber tires.

(-) 133. Corals are plants. "The coelenterates are a large group of animals, practically all of which are found in salt water. They include the beautiful sea anemones, jellyfish and corals."[153]

The coral secretes a stony support about its base, inside of which is the soft body of the animal. This stony material built up by thousands of animals make up the coral

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151 "Cicada," The World Book Encyclopedia, 1937 edition, III, pp. 1422-23.

152 Charles William Burkett, op. cit., p. 192.

153 George W. Hunter, op. cit., p. 224.

islands to be found in the Pacific. The fact that corals remain attached during most of their lives contributes to the current belief that they are plants.

(-) 134. Flies live for only three days.

> Most flies live only a few weeks, and towards the end of the season they die with great rapidity, becoming infested with reddish mites, which suck their juices or with fatal fungus diseases. In warm houses a few may survive the winter, but as a rule the adult flies die in the fall.[154] . . .

(-) 135. The elephant is the largest living thing. The elephant is not the largest living thing. "The whale is the largest of existing animals, sometimes attaining a size even larger than that of any prehistoric animal of which we have knowledge."[155]

(-) 136. Aluminum cooking vessels may poison food cooked in them. When aluminum was first used for cooking vessels people feared that food cooked in them would be poisoned. This was especially believed about acid foods.

"It is one of the best materials for cooking utensils, as it is light and durable, does not rust like tinware nor chip like granite, and is harmless in any action upon foods."[156]

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154 "Flies." The Encyclopedia Americana, 1932 edition, XI, p. 353.

155 "Whale." World Book Encyclopedia, 1937 edition, XVIII, p. 7726.

156 "Aluminum." World Book Encyclopedia, 1937 edition, I, p. 239.

*( ) 137. A man falling from an airplane does not continue to fall faster and faster until he strikes the ground.

(+) 138. Hair is a dead substance. Hair is a dead substance and it contains no nerves or blood vessels. It is produced by the skin and is dead as soon as it is pushed up out of the skin. The root of the hair is under the skin.

> The hair grows from follicles in the skin. At the follicle the hair cells are alive, the growth occurs in the follicle, and the hair is pushed out. The ends of the hair are dead and resemble the outer layers of skin in this respect.[157]

*(+) 139. Some wild animals should be conserved.

> The wild mammals still furnish us with our furs, some food, leather and oil. The importance of this group of animals is so great that regulations governing them during breeding season have been made, as well as special efforts to destroy the predatory ones.[158]

Buttons are manufactured from clams and we derive a great amount of food from ocean fish. There are many wild animals which are beneficial to us and they must be protected and conserved for future use.

(+) 140. Air has weight.

> The mass, and therefore the weight, of a unit volume of air depends upon the density of the atmosphere, which varies from day to day and from point to point on the earth's surface. Under standard conditions, that is at sea level and zero degrees centigrade (0°C), the freezing

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157 Jesse Feiring Williams, op. cit., p. 305.

158 W. M. Smallwood, Ida L. Reveley and Guy A. Bailey, op. cit., p. 210.

point of water, the mass per unit volume is
1 cubic centimeter of air = 0.00129 grams
1 cubic foot of air = 0.08 pounds.[159]

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[159] William D. Henderson, op. cit., pp. 80-81.

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159 William D. Henderson, op. cit., pp. 80-81.

CHAPTER III

PRESENTATION OF RESULTS

Participants

In the study made a total of 280 freshmen were selected for comparison. The test or questionnaire was given two different times to a total number of about five hundred high school students. The tests given to the 280 freshmen were used because (1) each of the two tests were available, (2) the personal data regarding the participant seemed to be reliable and (3) the appearance of the paper indicated that the person understood the directions. A total of 145 girls and 135 boys were included in the study, 46 of whom were not taking general science and the remainder of 234 were taking it. Nineteen boys and twenty-seven girls were not taking general science and 116 boys and 118 girls were taking it.

Coefficient of Reliability of the Fallacy Test

The reliability of a test is determined by the consistency with which it measures the capacity of those taking it. One method of measuring reliability of a test is to correlate the scores made on one-half of the test with the scores made on the other half of the test. This is a method of self-correlation; and the correlation so found is a "reliability coefficient."

When the coefficient is 1.00 the test is absolutely an

accurate measure of the capacity it tests, and when the reliability coefficient is .00 the test has no reliability.

> Most makers of general intelligence tests demand a reliability of at least .90 between duplicate forms of their tests for unselected groups of the same chronological age. To be a reliable measure of capacity, a mental or physical test should--generally speaking--have a minimum reliability coefficient of at least .80.[1]

The reliability of the fallacy test was computed in correlating the odd statements used in the test with the even statements used in the same test by use of the "Otis Correlation Chart." This method of self correlation yielded a coefficient of .74. To this coefficient Spearman's "prophecy" formula was applied according to Garrett.[2] This gave a final reliability coefficient of .85 which is considered quite reliable. This coefficient indicates that the test is .85 reliable in measuring the participants beliefs in popular fallacies. The probable error of this coefficient of correlation was calculated according to Garrett[3] and was found to be .02. To be reasonably sure that there is some correlation present an obtained correlation should be at least four times the probable error.[4] It will be observed that there is a high degree of correlation present.

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[1] Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, green and Co., 1935), p. 269.

[2] Loc. cit.

[3] Ibid., p. 170.

[4] Loc. cit.

Comparison of the Groups on Various Statistical Measures

A comparison of the groups on various statistical measures are presented in Table II. As a measure of central tendency the averages of the various groups are presented. It will be noted that those boys taking general science on the first and second tests have higher mean scores than any other group with scores of 53.49 in the first test and 57.54 on the second test. The girls taking general science made a score of 53.31 on the second test which was their high score for the two tests. This high score on the second test failed to equal either score made by the boys taking general science. This would seem to indicate that the boys taking general science were superior to the girls taking general science, since the girls, their improvement considered, have an average below the low average made by the boys. The girls not taking general science made the lowest average with a score of 47.32 on the first test. Their score of 51.57 on the second test was low for the second test but this score exceeded all scores on the first test except that made by the boys taking general science. It will be observed in comparing mean scores that each group improved in the second test. The mean of the girls taking general science on the first test exceeded the mean of both boys and girls not taking general science on the first test. This would indicate a group of girls taking general science

TABLE II

FREQUENCY DISTRIBUTION, AVERAGE, STANDARD DEVIATION AND STANDARD ERROR

	FIRST TEST						SECOND TEST					
	Those Taking General Science			Those Not Taking General Science			Those Taking General Science			Those Not Taking General Science		
Scores	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
85-89	0	0	0	0	0	0	2	0	2	0	0	0
80-84	0	0	0	0	0	0	1	1	2	0	0	0
75-79	5	1	6	0	0	0	5	2	7	0	0	0
70-74	5	1	6	0	0	0	13	7	20	0	1	1
65-69	9	11	20	0	1	1	12	8	20	1	0	1
60-64	11	14	25	3	3	6	16	20	36	4	8	12
55-59	21	12	33	3	1	4	15	16	31	4	1	5
50-54	18	16	34	3	5	8	20	19	39	2	5	7
45-49	20	21	41	4	6	10	14	12	26	3	5	8
40-44	15	20	35	2	4	6	9	18	27	2	3	5
35-39	7	10	17	1	4	5	7	8	15	2	2	4
30-34	4	8	12	1	3	4	1	3	4	1	1	2
25-29	1	3	4	2	0	2	0	3	3	0	1	1
20-24	0	1	1	0	0	0	1	1	2	0	0	0
Average	53.49	49.91	51.67	48.29	47.32	47.72	57.54	53.31	55.41	51.97	51.57	51.74
SD	11.17	11.32	11.39	10.79	9.57	10.11	12.29	11.98	12.32	9.85	10.72	10.37
N	116	118	234	19	27	46	116	118	234	19	27	46
Standard Error	1.04	1.04	.77	2.48	1.84	1.49	1.14	1.10	.81	2.26	2.06	1.53

Read Table Thus: The scores are indicated at the left, those participating at the top, the tabulation totals are found in the table in their respective columns and the averages, standard deviations, N's and Standard errors in their respective columns below.

which were superior to the boys and girls not taking general science.

Comparison of the Groups on Standard Deviations

Table II also presents the standard deviations for the various groups. The boys taking general science on the second test show the greatest "spread" of any single group of boys or girls with an SD of 12.29. The low SD, 9.57, was made by the girls not taking general science on the first test. However, the SD of the combined group taking general science was 12.32 on the second test. For the combined groups not taking general science the SD on the first test was 10.11 and on the second test 10.37. As a whole the general science groups show a slightly wider "spread" than those not taking general science. The standard deviation indicates the "spread" of points above and below the mean to include the middle 68.26 per cent (roughly the middle two-thirds) of the distribution.

The Reliability of the Mean

In determining the reliability of the averages the standard errors have been calculated and are also presented in Table II. It will be observed that in no case does the sigma average deviate more than 2.48 points from the true average which is the standard error of those boys not taking general science on the first test. The least deviation is .77 points

which is that of the general science group on the first test. The sigma average refers to the possible deviation of the obtained average from the true average. In other words in sixty-eight chances in one hundred the obtained average does not diverge from the true average by more than 2.48 points. In the case of the least deviation there are sixty-eight chances in one hundred that the obtained average does not deviate from the true average by more than .77 points. We can also be practically certain that the true mean lies within the limits of the obtained average plus or minus three times the sigma average.

The Reliability of the Difference Between Averages

The reliability of the difference in averages, or the sigma difference, is presented in Table III. The sigma difference in no case exceeds 3.35 which is found in comparing the first and second tests of boys not taking general science and the low limit of the sigma difference, 1.12, is found in comparing boys and girls taking general science on the first and second tests.

The sigma difference means that the chances are sixty-eight in one hundred that the obtained difference does not deviate from the true difference by more than plus or minus the sigma difference and that the chances are ninety-nine in

TABLE III

THE RELIABILITY OF THE DIFFERENCE BETWEEN AVERAGES

COMPARISONS MADE	1 sigma (diff.)	2 D	3 $\frac{D}{\text{sigma (diff.)}}$	4 chances in 100
The first test of boys taking general science with those boys not taking general science.	2.68	5.20	1.94	*97
The first test of girls taking general science with those girls not taking general science.	2.12	2.60	1.23	*88
The first test of boys and girls taking general science with those boys and girls not taking general science.	1.68	3.95	2.25	*99
The second test of boys taking general science with those boys not taking general science.	2.53	5.57	2.20	*99
The second test of girls taking general science with those girls not taking general science.	2.34	1.73	.74	*77
The second test of boys and girls taking general science with those boys and girls not taking general science.	1.73	3.67	2.12	*98
The first and second tests of boys taking general science.	1.54	-4.05	2.63	*99.5
The first and second tests of girls taking general science.	1.52	-3.39	2.24	*98.6
The first and second tests of boys and girls taking general science.	1.12	-3.74	.35	*99.9

Read Table Thus: The comparisons made are listed at the left, the sigma (diff.) in column 1, D in column 2, critical ratio in column 3 and the number of chances in one hundred of a true difference greater than zero in column 4. *All of the numbers in column 4 are positive indicating that the second group mentioned in each case was superior to or improved over the first group.

TABLE III (continued)

THE RELIABILITY OF THE DIFFERENCE BETWEEN AVERAGES

COMPARISONS MADE	1 sigma (diff.)	2 D	3 $\frac{D}{\text{sigma (diff.)}}$	4 chances in 100
The first and second tests of boys not taking general science.	3.35	-3.68	1.10	*85
The first and second tests of girls not taking general science.	2.77	-4.26	1.54	*93
The first and second tests of boys and girls not taking general science.	2.14	-4.02	1.88	*97

one hundred that the obtained difference does not vary from the true difference by more than three times plus or minus the sigma difference.

The differences between the average scores are also presented in Table III. The limits of the differences presented in this table are 1.73 where a comparison on the second test of girls taking general science is made with those girls not taking general science and 5.57 where a comparison on the second test of the boys taking general science is made with those boys not taking general science.

The critical ratio is a number which indicates the relationship between the difference, D, of the average scores and the sigma difference. To indicate this relationship the difference of the average scores, D, is divided by the sigma difference.

The critical ratios have been computed and are presented in the third column of Table III and from these critical ratios the number of chances in one hundred of a true difference greater than zero have been determined and are to be found in the fourth column of the same table. These chances in one hundred are taken from a statistical table by Garrett.[5] A 50 reading in column 4 would indicate equality between the items compared. However, the lowest reading in column 4 is 77 in

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[5] Ibid., p. 134.

the case of girls taking general science on the second test being compared with those girls not taking general science. In seventy-seven cases out of one hundred the difference between these two groups will be greater than zero, and as indicated by this comparison, the girls taking general science will in seventy-seven cases out of one hundred have a higher average than those not taking general science.

In every case, as indicated by the study, those individuals taking general science have an advantage over those not taking general science and every group improved in the second test as compared with the first test. As an example on the first test of boys taking general science compared with those boys not taking general science in ninety-seven chances in one hundred the boys taking general science had a higher average than the boys not taking general science. It is difficult to account for this but there are several reasons why one group might be superior at the outset. It is entirely possible that (1) those individuals of superior intellectual qualities chose to take general science, (2) it might be that the group interested in fallacies or with more scientific minds chose to take general science, or (3) those students enrolled in general science that came from homes where the parents, because of higher training, have given the children correct notions of popular misconceptions.

The girls taking general science also show at the

outset a superiority to those girls not taking it. In eighty-eight chances out of one hundred the girls taking general science were superior to those who were not taking it. Also on the second test the students taking general science were superior to the others.

In 99.9 times out of one hundred the boys and girls taking general science improved on the second test, while with those not taking general science the improvement was 97 in one hundred.

The improvement of pupils in the second test over the first might be accounted for in these ways: (1) through instruction which they received in the classroom, (2) through interest aroused in this particular test and consequent improvement through conversation with parents or classmates, (3) through influences outside school such as the radio, motion picture, and newspaper.

Number and Per Cent of Statements Answered Correctly and the Amount of Increase

Results relative to the individual items of the one hundred statements used in the test are presented in Table IV, from a sampling of fifty boys and fifty girls. The number of points of each item correct on the first and second test are shown for both boys and girls together with the total results and the number of points increase of the second test

TABLE IV

THE NUMBER AND PER CENT OF STATEMENTS ANSWERED CORRECTLY AND THE AMOUNT OF INCREASE

No. of statement in test used as a Fallacy	Number and percent right on first test						Number and percent right on second test						Number of points increase*		
	BOYS		GIRLS		TOTAL		BOYS		GIRLS		TOTAL		BOYS	GIRLS	TOTAL
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	No.
5	19	38	20	40	39	39	22	44	23	46	45	45	3	3	6
6	15	30	18	36	33	33	14	28	18	36	32	32	-1	0	-1
7	33	66	28	56	61	61	42	84	36	72	78	78	9	8	17
8	39	78	42	84	81	81	39	78	37	74	76	76	0	-5	-5
9	17	34	7	14	24	24	22	44	15	30	37	37	5	8	13
11	25	50	32	64	57	57	35	70	30	60	65	65	10	-2	8
12	7	14	10	20	17	17	14	28	15	30	29	29	7	5	12
14	11	22	15	30	26	26	16	32	9	18	25	25	5	-6	-1
15	38	76	38	76	76	76	42	84	40	80	82	82	4	2	6
16	36	72	26	52	62	62	41	82	35	70	76	76	5	9	14
17	32	64	36	72	68	68	35	70	28	56	63	63	3	-8	-5
19	30	60	26	52	56	56	30	60	29	58	59	59	0	3	3
20	34	68	38	76	72	72	33	66	36	72	69	69	-1	-2	-3
22	16	32	13	26	29	29	20	40	12	24	32	32	4	-1	3
23	43	86	33	66	76	76	41	82	41	82	82	82	-2	8	6
24	40	80	25	50	65	65	36	72	28	56	64	64	-4	3	-1

Read Table Thus: The numbers of the statements as used in the test (See Table I.) are presented in the left hand column and the number and per cent correct on the first and second test together with the number of points increase are presented in the table. *The number of points difference between the first and second test sometimes showed a decrease and those decreases have been indicated by a minus sign (-). N = 100--50 boys and 50 girls.

TABLE IV (continued)

THE NUMBER AND PER CENT OF STATEMENTS ANSWERED CORRECTLY AND THE AMOUNT OF INCREASE

No. of statement in test used as a Fallacy	Number and percent right on first test						Number and percent right on second test						Number of points increase*		
	BOYS		GIRLS		TOTAL		BOYS		GIRLS		TOTAL		BOYS	GIRLS	TOTAL
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	No.
25	36	72	29	58	65	65	40	80	34	68	74	74	4	5	9
26	24	48	28	56	52	52	25	50	26	52	51	51	1	-2	-1
27	28	56	20	40	48	48	23	46	31	62	54	54	-5	11	6
28	13	26	24	48	37	37	19	38	23	46	42	42	6	-1	5
29	18	36	14	28	32	32	28	56	18	36	46	46	10	4	14
30	37	74	38	76	75	75	43	86	41	82	84	84	6	3	9
32	37	74	35	70	72	72	36	72	35	70	71	71	-1	0	-1
33	30	60	32	64	62	62	36	72	40	80	76	76	6	8	14
34	30	60	26	52	56	56	29	58	28	56	57	57	-1	2	1
35	15	30	3	6	18	18	18	36	8	16	26	26	3	5	8
36	31	62	30	60	61	61	32	64	29	58	61	61	1	-1	0
37	23	46	26	52	49	49	27	54	26	52	53	53	4	0	4
39	26	52	21	42	47	47	29	58	28	56	57	57	3	7	10
40	16	32	12	24	28	28	27	54	14	28	41	41	11	2	13
42	18	36	11	22	29	29	21	42	19	38	40	40	3	8	11
44	15	30	20	40	35	35	16	32	17	34	33	33	1	-3	-2
45	29	58	14	28	43	43	35	70	18	36	53	53	6	4	10
46	20	40	17	34	37	37	23	46	19	38	42	42	3	2	5
47	26	52	22	44	48	48	30	60	29	58	59	59	4	7	11
48	34	68	30	60	64	64	35	70	33	66	68	68	1	3	4
49	42	84	42	84	84	84	46	92	47	94	93	93	4	5	9
50	21	42	16	32	37	37	24	48	17	34	41	41	3	1	4
53	42	84	21	42	63	63	44	88	30	60	74	74	2	9	11

TABLE IV (continued)

THE NUMBER AND PER CENT OF STATEMENTS ANSWERED CORRECTLY AND THE AMOUNT OF INCREASE

No. of statement in test used as a Fallacy	Number and per cent right on first test						Number and per cent right on second test						Number of points increase*		
	BOYS		GIRLS		TOTAL		BOYS		GIRLS		TOTAL		BOYS	GIRLS	TOTAL
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	No.
54	36	72	43	86	79	79	29	58	43	86	72	72	-7	0	-7
56	37	74	29	58	66	66	45	90	35	70	80	80	8	6	14
57	13	26	21	42	34	34	15	30	17	34	32	32	2	-4	-2
59	18	36	23	46	41	41	22	44	24	48	46	46	4	1	5
60	29	58	22	44	51	51	29	58	18	36	47	47	0	-4	-4
61	18	36	18	36	36	36	21	42	16	32	37	37	3	-2	1
62	19	38	20	40	39	39	14	28	24	48	38	38	-5	4	-1
63	33	66	18	36	51	51	38	76	29	58	67	67	5	11	16
64	23	46	12	24	35	35	19	38	15	30	34	34	-4	3	-1
65	20	40	18	36	38	38	30	60	20	40	50	50	10	2	12
66	26	52	21	42	47	47	20	40	26	52	46	46	-6	5	-1
67	39	78	35	70	74	74	40	80	39	78	79	79	1	4	5
68	28	56	30	60	58	58	34	68	32	64	66	66	6	2	8
69	25	50	32	64	57	57	30	60	31	62	61	61	5	-1	4
70	14	28	18	36	32	32	16	32	10	20	26	26	2	-8	-6
71	14	28	14	28	28	28	15	30	17	34	32	32	1	3	4
72	28	56	28	56	56	56	39	78	32	64	71	71	11	4	15
73	31	62	29	58	60	60	34	68	32	64	66	66	3	3	6
74	27	54	29	58	56	56	28	56	21	42	49	49	1	-8	-7
75	23	46	20	40	43	43	23	46	25	50	48	48	0	5	5
76	20	40	16	32	36	36	17	34	15	30	32	32	-3	-1	-4
77	28	56	18	36	46	46	34	68	22	44	56	56	6	4	10
79	26	52	30	60	56	56	33	66	37	74	70	70	7	7	14

TABLE IV (continued)

THE NUMBER AND PER CENT OF STATEMENTS ANSWERED CORRECTLY AND THE AMOUNT OF INCREASE

No. of statement in test used as a Fallacy	Number and percent right on first test						Number and percent right on second test						Number of points increase*		
	BOYS		GIRLS		TOTAL		BOYS		GIRLS		TOTAL		BOYS	GIRLS	TOTAL
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	No.
81	21	42	20	40	41	41	38	76	27	54	65	65	17	7	24
82	36	72	32	64	68	68	45	90	36	72	81	81	9	4	13
83	45	90	43	86	88	88	42	84	45	90	87	87	-3	2	-1
84	37	74	29	58	66	66	41	82	34	68	75	75	4	5	9
85	32	64	41	82	73	73	31	62	42	84	73	73	-1	1	0
86	37	74	39	78	76	76	38	76	38	76	76	76	1	-1	0
88	24	48	17	34	41	41	32	64	25	50	57	57	8	8	16
89	30	60	38	76	68	68	31	62	26	52	57	57	1	-12	-11
90	26	52	21	42	47	47	28	56	22	44	50	50	2	1	3
91	39	78	30	60	69	69	39	78	28	56	67	67	0	-2	-2
92	38	76	32	64	70	70	43	86	34	68	77	77	5	2	7
93	31	62	23	46	54	54	33	66	30	60	63	63	2	7	9
95	20	40	16	32	36	36	29	58	29	58	58	58	9	13	22
96	45	90	50	100	95	95	49	98	48	96	97	97	4	-2	2
97	3	6	6	12	9	9	9	18	12	24	21	21	6	6	12
98	28	56	30	60	58	58	39	78	32	64	71	71	11	2	13
99	25	50	28	56	53	53	26	52	28	56	54	54	1	0	1
101	23	46	23	46	46	46	25	50	29	58	54	54	2	6	8
104	17	34	30	60	47	47	16	32	26	52	42	42	-1	-4	-5
106	19	38	18	36	37	37	22	44	21	42	43	43	3	3	6
109	36	72	37	74	73	73	36	72	33	66	69	69	0	-4	-4
110	30	60	23	46	53	53	33	66	34	68	67	67	3	11	14
111	12	24	6	12	18	18	15	30	11	22	26	26	3	5	8

TABLE IV (continued)

THE NUMBER AND PERCENT OF STATEMENTS ANSWERED CORRECTLY AND THE AMOUNT OF INCREASE

No. of statement in test used as a Fallacy	Number and percent right on first test						Number and percent right on second test						Number of points increase*		
	BOYS		GIRLS		TOTAL		BOYS		GIRLS		TOTAL		BOYS	GIRLS	TOTAL
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	No.	No.
119	26	52	29	58	55	55	34	68	32	64	66	66	8	3	11
122	26	52	22	44	48	48	35	70	26	52	61	61	9	4	13
123	10	20	18	36	28	28	6	12	15	30	21	21	-4	-3	-7
124	37	74	38	76	75	75	34	68	35	70	69	69	-3	-3	-6
125	38	76	27	54	65	65	31	62	33	66	64	64	-7	6	-1
126	13	26	22	44	35	35	21	42	24	48	45	45	8	2	10
127	47	94	37	74	84	84	47	94	39	78	86	86	0	2	2
128	15	30	22	44	37	37	16	32	21	42	37	37	1	-1	0
129	19	38	18	36	37	37	19	38	24	48	43	43	0	6	6
133	25	50	26	52	51	51	20	40	25	50	45	45	-5	-1	-6
134	39	78	40	80	79	79	33	66	39	78	72	72	-6	-1	-7
135	22	44	20	40	42	42	20	40	18	36	38	38	-2	-2	-4
136	35	70	27	54	62	62	28	56	32	64	60	60	-7	5	-2
138	5	10	6	12	11	11	10	20	10	20	20	20	5	4	9
140	44	88	34	68	78	78	45	90	39	78	84	84	1	5	6

over the first have also been presented. Those items of the test which showed a decrease rather than an increase have been indicated by a minus sign (-). The number of the statements as used in the test (See Table I.) are presented in the left hand column and the number and per cent correct on the first and second test together with the number of points increase are also presented in the table.

The boys missed items 12, 97, and 138 (See Table I.) more frequently on the first test than on the second test and items 97, 123 and 138 more frequently on the second test. Item 97 was missed most frequently on the first test and item 123 was missed most frequently on the second test. The boys increased more on items 40, 72, 81 and 98. They increased most on item 81. The items answered correctly more often by the boys were 83, 96 and 127 on the first test and items 49, 96 and 127 on the second test.

The girls missed items 9, 35, 97, 111 and 138 (See Table I.) more often on the first test and items 14 and 35 on the second test. Item 3 was missed most often on the first test and item 35 most often on the second test. The girls increased more on items 27, 63, 95 and 110. They increased most on item 95. The items answered more often correctly by the girls were 54, 83 and 96 on the first test and 49, and 96 on the second test.

Points Gained and Lost on the Test

Table V indicates the number of points gained or lost in the second test over the first test. That is, the number of points gained or lost on the second test were tabulated and are presented here on a frequency table. The points to be gained or lost are indicated in the left hand column and the frequencies are entered in their respective columns which are indicated across the top. The numbers participating (n) and the medians are indicated at the bottom of the table.

The boys taking general science had the highest median with a score of 4 and the boys not taking general science had the lowest median with a score of 2.5. The girls taking general science had the second highest median with a score of 3.56 while the girls not taking general science had a score of 3.40. The boys and girls taking general science had a score of 3.83 which was greater than the 3.14 score of the group not taking general science.

Comparisons of the Proportional Gains

In Table VI a comparison of the proportional gains is made of the various groups which took the fallacy test. The groups compared are presented in the column at the left and the comparisons made are found in the vertical columns of the table. X indicates the sigma gain of the first group and Y indicates the sigma gain of the second group. Sigma gain

TABLE V

NUMBER OF POINTS GAINED OR LOST ON THE TEST

	TAKING GENERAL SCIENCE			NOT TAKING GENERAL SCIENCE			
	Boys	Girls	Total	Boys	Girls	Total	Grand Total
32-33		1	1		1	1	2
30-31	1	0	1		1	1	2
28-29	1	0	1		0	0	1
26-27	0	1	1		1	1	2
24-25	2	1	3		0	0	3
22-23	2	0	2		0	0	2
20-21	1	5	6		0	0	6
18-19	0	1	1		1	1	2
16-17	3	0	3		0	0	3
14-15	5	7	12	2	0	2	14
12-13	4	6	10	1	2	3	13
10-11	6	6	12	1	1	2	14
8-9	8	12	20	0	2	2	22
6-7	9	6	15	3	0	3	18
4-5	16	11	27	1	3	4	31
2-3	14	9	23	2	5	7	30
0-1	15	15	30	5	3	8	38
-2--1*	7	7	14	0	2	2	16
-4--3	7	10	17	1	0	1	18
-6--5	6	5	11	0	1	1	12
-8--7	5	4	9	0	1	1	10
-10--9	2	5	7	2	0	2	9
-12--11	1	3	4	1	2	3	7
-14--13	0	3	3	0	0	0	3
-16--15	0	0	0	0	1	1	1
-18--17	0	0	0	0	0	0	0
-20--19	0	0	0	0	0	0	0
-22--21	0	0	0	0	0	0	0
-24--23	0	0	0	0	0	0	0
-26--25	0	0	0	0	0	0	0
-28--27	0	0	0	0	0	0	0

Read Table Thus: The points to be gained or lost are presented at the left and the frequencies are entered in their respective columns which are indicated across the top. The numbers participating (N) and the medians are indicated at the bottom of the test. *Those scores below zero are indicated by minus signs (-).

TABLE V (continued)

NUMBER OF POINTS GAINED OR LOST
ON THE TEST

	TAKING GENERAL SCIENCE			NOT TAKING GENERAL SCIENCE			
	Boys	Girls	Total	Boys	Girls	Total	Grand Total
-30--29	0	0	0	0	0	0	0
-32--31	0	0	0	0	0	0	0
-34--33	0	0	0	0	0	0	0
-36--35	0	0	0	0	0	0	0
-38--37	1	0	1	0	0	0	1
N	116	118	234	19	27	46	280
MEDIAN	4	3.56	3.83	2.5	3.40	3.14	3.67

TABLE VI

A COMPARISON OF THE PROPORTIONAL GAINS OF VARIOUS GROUPS TAKING THE TEST

Comparisons of the Proportional Gain	X			Y			$\frac{X}{Y}$
	D	SD	Sigma Gain D/SD	D	SD	Sigma Gain D/SD	
Boys who took general science and the boys who did not take general science.	4.05	11.17	.36	3.68	10.79	.34	1.06*
Girls who took general science and the girls who did not take general science.	3.39	11.32	.30	4.26	9.57	.44	.67*
Boys and girls who took general science and the boys and girls who did not take general science.	3.74	11.39	.33	4.02	10.11	.40	.82*
Boys who took general science and the girls who took general science.	4.05	11.17	.36	3.39	11.32	.30	1.21*
Boys who did not take general science and girls who did not take general science.	3.68	10.79	.34	4.26	9.57	.44	.77*

Read Table Thus: The groups compared are presented in the column at the left and the comparisons made are to be found in the vertical columns. X indicates the sigma gain of the first group and Y indicates the sigma gain of the second group. *A score of one in the X/Y column indicates equality, above one indicates a superiority of the first group and a score of less than one indicates the second group is superior. All scores in the X/Y column are reckoned from zero.

refers to the relationship existing between the difference, D, of the two means of the groups to be compared and the standard deviation, SD, of the first group compared. The quotient represents the true gain made by the group. After finding the true gain made by each group the gain made by the two groups may be represented by dividing the sigma gain of the first group by the sigma gain of the second group. This quotient gives the relationship existing between the true gains of the two groups. A score of one in the $\frac{X}{Y}$ column indicates equality of the two groups, above one indicates a superiority of the first group and below one indicates a superiority of the second group. All scores in the $\frac{X}{Y}$ column are reckoned from zero.

The boys who took general science showed a gain of .06 over the boys who did not take general science. However, the boys that took general science at the outset had a higher average (See Table II.) than the others. In their case at least the superior group profited more by a year in high school in dispelling their belief in fallacies. The boys who took general science also gained over the girls who took general science, the relationship being 1.81.

The girls who took general science made only .67 as great a gain as those girls who did not take it. The average (See Table II.) of the girls taking general science was greater at the outset than the girls not taking it.

The boys and girls who took general science gained

only .82 as much as the boys and girls not taking it.

The boys who did not take general science improved .77 as much as the girls who did not take general science. The average (See Table II.) of the boys was a little higher than the average of the girls at the outset in the group not taking general science.

CHAPTER IV

SUMMARY AND CONCLUSIONS

1. This is a study of one hundred popular fallacies as they relate to high school freshmen to show (1) if there is a relationship between a year in high school and the dispelling of "popular fallacies", (2) if there is a difference between boys and girls in their popular beliefs and, (3) if general science has an influence in correcting these beliefs.

The study was made of 280 high school freshmen, 145 girls and 135 boys, 46 of whom were not taking general science and 234 were taking it. Nineteen boys and twenty-seven girls were not taking general science and 116 boys and 118 girls were taking it.

2. The data available indicate that the groups taking general science were superior at the outset to those groups not taking general science. It is possible that (1) individuals of superior intellectual qualities chose a course in general science, (2) individuals with specialized interests in fallacies or with more scientific minds chose to take general science, or (3) those students enrolled in general science whose parents, because of higher training, gave their children a correct notion of popular misconceptions.

3. In every case the groups improved in the second test as compared with the first test. The boys who took

general science gained more than the girls taking general science or the boys not taking general science. The girls who did not take general science showed a gain over the girls who took general science and also a gain over the boys who did not take general science. As a whole the boys and girls who did not take general science made a greater gain than the boys and girls who took general science.

4. The evidence, although not commanding, indicates that pupils do profit by high school training in dispelling their false beliefs in fallacies.

5. There are no decided sex differences in beliefs in popular fallacies, but the girls are slightly more gullible than the boys if comparisons are limited to the respective groups of those taking general science and those not taking general science.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Ackermann, A. S. E., Popular Fallacies. Philadelphia: J. B. Lippincott Company, 1924. 984 pp.

Baker, Arthur O. and Mills, Lewis H., Dynamic Biology. Chicago: Rand McNally and Company, 1933. 722 pp.

Black, Newton Henry and Davis, Harvey Nathaniel, New Practical Physics. New York: Macmillan Company, 1932. 645 pp.

Brownlee, Raymond B; Fuller, Robert W.; Hancock, William J.; Schon, Michael D. and Whitsit, Jesse E.; First Principles of Chemistry. Chicago: Allyn and Bacon, 1931. 777 pp.

Bruce, George Howard, High School Chemistry. Chicago: World Book Company, 1933. 550 pp.

Burkett, Charles William, Editor, Our Domestic Animals. Boston: Ginn and Company Publishers, 1907. 297 pp.

Bush, George L., Ptacek, Theodore W. and Kovats, John, Senior Science. Chicago: American Book Company, 1937. 822 pp.

Comstock, Anna Botsford, Handbook of Nature Study. Ithaca, New York: Comstock Publishing Company, 1935. 942 pp.

Ditmars, Raymond L., Snakes of the World. New York: Macmillan Company, 1931. 207 pp.

Fall, Delos, Science For Beginners. Chicago: World Book Company, 1917. 382 pp.

Garrett, Henry E., Statistics in Psychology and Education. New York: Longmans, Green and Company, 1935. 317 pp.

Haggard, Howard W., The Science of Health and Disease. New York: Harper and Brothers Publishers, 1927. 538 pp.

Hegner, Robert, Parade of the Animal Kingdom. New York: Macmillan Company, 1936. 675 pp.

Henderson, William D., The New Physics of Everyday Life. Chicago: Lyons and Carnahan, 1935. 797 pp.

Hornaday, William T., The American Natural History. New York: Charles Scribner's Sons, 1904. 449 pp.

Hornaday, William T., The American Natural History, II and IV. New York: Charles Scribner's Sons, 1914. 349 pp.

Hunter, George W. and Whitman, Walter G., Problems in General Science. Chicago: American Book Company, 1934. 688 pp.

Hunter, George W., Problems in Biology. Chicago: American Book Company, 1931. 706 pp.

Jeans, Sir James, Through Space and Time. New York: The Macmillan Company, 1934. 224 pp.

Kilmer, Fred B., Editor, Johnson's Standard First Aid Manual. New Brunswick, N. J., U. S. A.: Johnson and Johnson, 1925. 144 pp.

Kinsey, Alfred C., An Introduction to Biology. Chicago: J. B. Lippincott Company, 1926. 558 pp.

Lindsey, Arthur Ward, Textbook of Evolution and Genetics. New York: The Macmillan Company, 1929. 459 pp.

Lutz, Frank E., Fieldbook of Insects. New York: G. P. Putnam's Sons, 1921. 562 pp.

Pieper, Charles John and Beauchamp, Wilbur Lee, Everyday Problems in Science. Chicago: Scott, Foresman and Company, 1925. 600 pp.

Pillsbury, W. B., The Fundamentals of Psychology. New York: The Macmillan Company, 1934. 663 pp.

Smallwood, W. M., Reveley, Ida L. and Bailey, Guy A., New Biology. Chicago: Allyn and Bacon, 1934. 604 pp.

Smith, Alexander, Intermediate Text Book of Chemistry. New York: The Century Company, 1920. 520 pp.

Snyder, William H., General Science. Chicago: Allyn and Bacon, 1925. 591 pp.

Thorndike, Edward L., Bregman, Elsie O., Tilton, J. Warren and Woodyard, Ella, Adult Learning. New York: The Macmillan Company, 1928. 335 pp.

Walter, Herbert Eugene. Genetics. New York: The Macmillan Company, 1930. 339 pp.

Williams, Jesse Feiring, Healthful Living. New York: Macmillan Company, 1922. 431 pp.

Williams, Jesse Feiring, Personal Hygiene Applied. Philadelphia: W. B. Saunders Company, 1938. 458 pp.

B. ENCYCLOPEDIA ARTICLES

"Cocoa." Encyclopedia Britannica, 14th edition, V, 945-948.

"Drowning." The World Book Encyclopedia, 1937, IV, 2038-39.

"Flies." The Encyclopedia Americana, 1932 edition, XI, p. 353.

"Phrenology." Encyclopedia Americana, 1928, XXII, 20-22.

C. GOVERNMENT PUBLICATIONS

"Clothes Moth." United States Department of Agriculture, Leaflet 145, 8 pp.

Hart, Merriam C., "The Prairie Dog of the Great Plains." United States Department of Agriculture Yearbook for 1901, pp. 257-70.

D. NEWSPAPERS

Emporia Daily Gazette, January 1, 1935-June 1, 1938.

E. PERIODICALS

Conklin, Edmund S., "Superstitious Belief and Practice among College Students." American Journal of Psychology, XXX (1919) 433.

Dudeha, George J., "The Superstitious Beliefs of College Students." The Journal of Abnormal and Social Psychology, XXVII, No. 4 (January, 1933), 457-64.

Dunlap, Knight, "The Reading of Character From External Signs." Scientific Monthly, XV (August, 1922), 153-165.

Hartner, Richard S., "The Effects of Training upon the Belief in Certain Popular Misconceptions." The Journal of Applied Psychology, XXI (February, 1937), 119-29.