seems probable that integers were used before the common fractions were employed, but the fact that in our modern languages the number one-half has a name which is independent of the name for two points to the very early use of common fractions. The scale downwards from unity was probably almost as important in the early steps towards civilization as the scale upwards, but such questions can obviously never be decided from historical evidences.

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CROSS REFERENCES IN SCIENTIFIC LITERATURE

THE effective compilation of data is almost inevitably complicated by the necessity of a suitable means of indicating cross references. Since the secretarial work involved often becomes burdensome, the following system is suggested:

References are taken on standard size index cards, the six by four inch cards being very satisfactory. These are filed alphabetically according to the name of the author. The subject being investigated is divided into appropriate topics and a key card is prepared. The top margin of the key card is divided into vertical spaces about one fourth inch apart, and a topic assigned to each space so provided. If, for example, the first topic selected is "the reaction of the culture media," all cards treating this subject will be marked on the upper margin one fourth inch from the left margin. If "culture characteristics" is the next topic, all references concerning this subject will be marked one half inch from the left margin. "Scotch tape" in various colors, red, blue and green can be used to mark the upper margin of each card. If a reference card contains information concerning more than one of the topics suggested it may be marked in as many places as necessary on the upper margin. The use of various colors makes it possible to divide the upper margin into more spaces than would otherwise be possible. If three colors are used there will be a repetition of one color every three fourths of an inch. Brass paper clips were previously used but the top margin of the cards was so thickened that the index became unwieldy. In addition to the variety of colors, the "Scotch tape" has the advantages of being thin and its use on the card does not cause the upper margins to become unduly thick. The number of cross references is limited by the size of the index card, but the simplicity makes an effective system possible with a minimum amount of effort.

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OVEREXERTION AS CAUSE OF DEATH OF CAPTURED FISH

MOST kinds of fishes die very quickly when removed from the water. As an example, herring on being taken out of the water flop about very vigorously and die in a few minutes with the symptoms of asphyxia. Some kinds, however, remain alive for a considerable time under such conditions. The eel (*Anguilla*) may remain alive for days out of water in moist situations, and the same is true for the catfish (*Ameiurus*). Since the obvious changes in the dying fish are those associated with suffocation in air-breathing vertebrates, such as mammals and birds, and since the fish is out of its natural environment, water, for which its respiratory mechanism is suitable, it is natural to conclude that the death of the fish is due to interference with respiration. Nevertheless, proof has been lacking that in air the gills are less able to transmit oxygen to, and remove carbon dioxide from, the blood than when they are in water.

As a matter of fact, death occurs in many captured fish, such as herring, even when they are not removed from the water. Herring do not survive very long when caught in nets, whose meshes permit them to pass through as far as the dorsal fin, but no farther. Although the fish are said to be gilled since the gills prevent them from backing out, there is no interference with respiration, the net holding them by the middle of the body. Among sea fish that are taken regularly by baited hooks on set lines (the "long lines" of British fishermen and the "bultows" or "trawls" of fishermen on the western side of the North Atlantic), the haddock is one that dies very quickly whether removed from the water or merely caught and held. It may be maintained that, with a hook in its mouth, the haddock is unable to breathe properly, but I have failed to get evidence that this is true.

Ritchie,[1] in studying *rigor mortis* in fish, particularly members of the cod family (*Gadidae*), found captured haddock, cod and hake (*Urophycis*) to have 0.15, 0.08 and 0.05 per cent. respectively of lactic acid in their muscles, representing increases above the amount in resting muscle due to various degrees of fatigue. The differences in degree of fatigue between the three species was considered to correspond with differences in the "usual notion of their muscular activity." Macleod and Simpson[2] found that haddock captured on "trawls" and examined within 2½ hours after being hooked had practically no glycogen in the muscles, but those taken quickly on hand lines had from 0.04 to 0.22 per cent., the difference being attributed to more struggling when a long time on the "trawls." The absence of glycogen would be due to

[1] A. D. Ritchie, *Jour. Physiol.*, 60: 1–2, 1925.

[2] J. J. R. Macleod and W. W. Simpson, *Contr. Can. Biol. N. S.*, 3: 439–456, 1927.

its conversion into lactic acid, but since the amounts of lactic acid in the muscle of haddock taken on the "trawls" was little if any greater than those of haddock taken by hand lines, it is inferred that the lactic acid was being removed by the blood. Buddenbrock[3] finds that there is a high concentration of lactic acid in the blood of cod that have been captured and placed in an aquarium, and that, both directly and through its effect on the cell membrane and shape of the erythrocytes, lactic acid reduces the oxygen-carrying power of the blood. This causes a vicious circle, since the oxygen is required to remove the lactic acid, and its lack results in a further increase in the lactic acid.

It can now be readily understood why very nervous fish, such as herring and haddock, die so quickly when captured, and sluggish fish, such as the eel and the catfish, live so much longer under similar conditions. The rapidity of death seems definitely related to the degree of struggling or muscle activity on capture. It is evident that overexertion of the fish converts all the glycogen of the muscle into lactic acid, which passes into the blood and reduces the oxygen-carrying capacity of the latter. This results in asphyxiation of the cells of the nervous system, which undergo irreversible changes. At the Atlantic Biological Station, St. Andrews, New Brunswick, success was achieved in keeping herring and haddock alive in aquaria, when on capture their struggling was reduced to a minimum.

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SCIENTIFIC BOOKS

MEN OF MATHEMATICS

Men of Mathematics. By E. T. BELL. Simon and Schuster, New York, 1937. xxi + 592 pp. $5.00.

IF one thumbs the numerous cards for Eric Temple Bell in the Harvard College Library, one finds intermingled with those representing his mathematical work some endorsed "John Taine, pseud." and representing something else—"thrillers." Thus does a great library override the author's modest pseudonymity. The Jekyll-Hyde characteristics of the Bell-Taine contributions are both present in Bell's "Men of Mathematics," but what part of the work will be attributed to Jekyll and what to Hyde will vary with the reader. For that large number of the somewhat general public to which Simon and Schuster cater in some of their publications it will be Dr. Jekyll who writes the "heart-interest" material and the glittering generalities in an often loose style and it will be Mr. Hyde who tries to expound the theory of algebraic ideals or of transfinite numbers or of symbolic logic, whereas for the professional mathematician the attribution for these respective parts will be inverted. As the book has been widely read and perhaps not always discriminatingly reviewed, it may be permitted that I concentrate unduly upon some of the things on which I would raise questions.

Of Poincaré it is written (p. 546): "He had the misfortune to be in his prime just when physics had reached one of its recurrent periods of senility, and he was so thoroughly saturated with nineteenth century theories when physics began to recover its youth—after Planck, in 1900, and Einstein, in 1905, had performed the difficult and delicate operation of endowing the decrepit roué with its first pair of new glands—that he had barely time to digest the miracle before his death in 1912."

Passing over the use of "recurrent" with so progressive a condition as "senility," one may raise a question as to the jump from that to "roué," and the further question as to who were the women in the case—was the "queen of the sciences among them? Then with respect to the medical or surgical references, is it an accepted fact that the Steinach or similar operations do renew the youth of decrepit roué's? Or is this just "fine writing"? Furthermore, when was Poincaré in his prime and what was physics doing around that time? He was not thirty when Gibbs's thermodynamic papers, over which Maxwell was enthusiastic, were published. He was in his thirties when Arrhenius and Oswald were establishing important results in the same field, when Heaviside's best work on telephony was done and Hertz discovered his wireless waves. He was barely forty when x-rays, electrons and radioactivity came actively on the scene and Lorentz was making great contributions. The author does not seem to realize that it was such high activity and buoyant youth in physics which made Planck and Einstein possible as Faraday's work had made Maxwell possible.

On p. 168: "Without the science of chemistry soap is impossible." As my maternal grandmother used to say—I want to know! Page 24: "For penetrating subtlety of thought we shall not meet his (Zeno's) equal till we reach the twentieth century and encounter Brouwer." There were some pretty subtle thinkers in between. Page 108: "Mathematics, dynamics, and celestial mechanics were in fact—we may as well admit it—secondary interests with Newton. His heart was in his alchemy, his researches in chronology, and his theological studies." It is said that when a complaint was made to Lincoln that Grant drank whiskey, Lincoln asked that the brand be ascertained so that he could get some of the same for his other generals. Page 95: "For in Newton's day alchemy *was* chem-

[3] W. v. Buddenbrock, *Cons. Int. Explor. Mer. Rapp. Proc.-Verb.*, 101 (IV_2): 1–7, 1938.