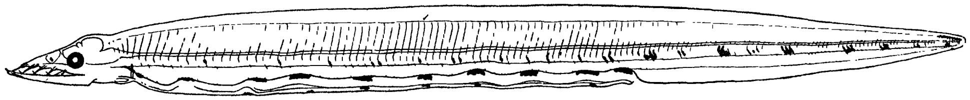
body and 82 or 83 for the caudal portion. The total number is, therefore, approximately equal to the total number found in the previous larvæ.



The coloration differs from that of the smaller larvæ in that additional spots have developed along the alimentary canal and along the sides. There are ten spots along the alimentary canal from the gill-openings to the anus. Most of these are duplicated above and below, the upper one being the larger. There are seven or eight spots along the tail, not counting the color at the tip, which is apparently much as in the younger larvæ. There is a marked spot near the tip of the lower jaw and another on the upper jaw. There are in addition to these spots, which had representatives in the younger larvæ, a number along the sides over the notochord. In the anterior part of the body, the abdominal portion, these spots consist largely of a single chromatophore between two protovertebræ. Their arrangement on one side is as follows: No. 1 between the seventeenth and eighteenth protovertebræ; No. 2 between 28 and 29; No. 3 between 35 and 36; No. 4 between 39 and 40; No. 5 between 45 and 46; No. 6 between 51 and 52; No. 7 between 55 and 56; No. 8 between 61 and 62; No. 9 between 70 and 71. Those of the other side have a slightly different arrangement.

The spots on the tail have migrated up from the lower margin of the body so that they form a continuous series with those of the middle of the sides instead of with those of the alimentary canal. The last one of the caudal spots is, however, still located at the lower margin. Below it on the margin of the fin fold is a small spot, and there is a black stripe along the upper margin of the body at the base of the dorsal membrane, from a little in front of the last caudal spot to the end of the tail.

The size of this specimen indicates that it is about a month older than those previously described. The breeding season of this eel would, therefore, extend from about the middle of June to the end of July.

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ION ACTION.

It has long been the view of the writers that the term ion action in the sense that it has been used in pharmacology and physiology, is not justifiable and throws no light on the nature of salt action. It seems to have been accepted by many physiologists that the differences observed in the action of a series of analogous salts possessing, for instance, a common anion are to be attributed to a specific action of the cations upon the tissue. Such a conclusion seems to be unwarranted. Recent work on the catalytic decomposition of hydrogen peroxide offers a good example to illustrate our views. In a recent number of the *American Journal of Physiology* there appeared an article by Neilson and Brown[*] entitled 'The Effect of Ions on the Decomposition of Hydrogen Peroxide by Platinum Black.' After a study of the effect of a series of sodium salts and also a series of chlorides on the rate of the catalytic decomposition these authors conclude: 'In the catalytic decomposition of hydrogen peroxide by platinum black the cation, in general, has an inhibiting or depressing effect, and the anion has an accelerating effect.' We have recently shown[†] that the inhibitory action of certain salts on the catalytic decomposition of hydrogen peroxide by various metals is due to the formation of a thin insoluble film over the surface of the metal by the action of the salt on the metal. Thus it was shown that the catalysis by a given metal is inhibited by those salts whose constituent acid yields an insoluble salt with the catalyzer. Thus the catalysis by silver is inhibited by soluble chlorides, brom-

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[*] *Amer. Jour. of Physiol.*, Vol. X., p. 225, 1904.

[†] *Amer. Chem. Jour.*, Vol. XXIX., p. 397, 1903.

ides and iodides, whereas fluorides do not inhibit the catalysis. It is to be observed that silver chloride, bromide and iodide are insoluble and that silver fluoride is soluble. This fact explains why chlorides, bromides and iodides inhibit the catalysis while fluorides do not, as in the latter case no insoluble coating can be formed. Silver cyanide is insoluble and hence hydrocyanic acid and the soluble cyanides inhibit the catalysis by silver. Thallium resembles silver in the solubility of its halogen salts, *i. e.*, the fluoride is soluble while the chloride and bromide are insoluble, and similarly soluble chlorides and bromides inhibit the catalysis by thallium while fluorides do not. Thallium differs from silver in that its cyanide is soluble and it was found that hydrocyanic acid has only a slight inhibitory action on the catalysis by thallium and this result is due to the fact that the metal is dissolved and hence the action of hydrocyanic acid on thallium is not at all comparable to its action on silver. Using freshly cut shavings of thallium the formation of the film on treatment with potassium bromide can be directly observed. On the other hand, hydrocyanic acid accelerates the catalysis by copper sulphate and ferrous oxide and also by finely divided copper and iron. It was found that if the salts of a given acid exert a retarding effect on the catalysis by a given metal the ammonium salt retards more than the corresponding sodium or potassium salt. This is also capable of simple explanation. Ammonium is a far weaker base than sodium or potassium, and is, therefore, more easily replaced by the catalyzer.

The ammonium salt thus lends itself more readily to the formation of a film. Thus the action of certain salts on the catalysis of hydrogen peroxide by metals is readily explained when we take into account the simple and well-understood chemistry of the substances with which we are dealing. It is true that the action of all inhibitors has not been explained as yet and in some instances undoubtedly other factors play a part, as has been found in the case of ammonium sulphocyanate. The action of accelerators is not as yet perfectly clear, but when the explanation is reached it will certainly take into consideration more the chemistry of each individual substance than the mere fact that they are in the ionic state. In general the sodium salts of the organic acids accelerate the catalysis. In our opinion the hydrolysis of these salts is to be taken into account as one factor in this acceleration, since the alkalies promote the decomposition of hydrogen peroxide and increase its instability. When we state that a thing is an anion or a cation we by no means exhaust the chemistry of the ion as seems to be sometimes inferred. An attempt to explain the action of inhibitors on the catalysis of hydrogen peroxide by metals in terms of the ionic theory as ordinarily employed in physiological work leads to conclusions that are entirely misleading. Thus ammonium chloride inhibits the catalysis by silver and thallium much more than sodium or potassium chlorides. To conclude from this that the ammonium ion is the inhibiting agent would be entirely erroneous. It is the chlorine in all cases that acts on the metal to form the film and the ammonium chloride inhibits the catalysis more strongly because the chlorine is less firmly held. To state from such facts that the cation retards the catalysis would neither be expressing a fact nor offering an explanation of the supposed fact. In a subsequent publication* Neilson and Brown make the following statement: 'In our work on the effect of ions on the decomposition of hydrogen peroxide by platinum black, we obtained results which may be explained by the assumption that in general the anions exert a stimulating action, and the cations a depressing action, so that the action of a given salt depends on whether the anion or cation is the more powerful.' The writers fail entirely to see the slightest suggestion of an explanation.

It seems to be true that most chemical reactions occur between substances in the ionic state, and the necessity of the presence of water for many chemical reactions has led some chemists to assume that chemical interaction only occurs between ions. This is still an open question. Even in so simple a case

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* *Amer. Jour. of Physiology*, Vol. X., p. 336, 1904.

as the hydrolysis of cane sugar by acids, an action which has been studied so carefully and been found to be proportional to the number of hydrogen ions, it is not proved that the hydrolysis is due to the hydrogen ion independently of the anion, and it seems most improbable to the writers that such is the case. The monatomic ions differ from atoms only in the possession of an electric charge. Hence ion action can only differ from atomic action in consequence of this charge. The writers have been unable to find any evidence in physiology or pharmacology that an ion ever effects a functional change in consequence of this charge. Such a demonstration would be heartily welcomed. The expression ion action in the sense in which it is so often used in physiological literature seems unwarranted.

It must be added that the brilliant results which have been attained in the field of salt action are in no way affected by whatever explanation they may ultimately receive.

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J. H. Kastle.

DEATH GULCH.

It is certain that nowhere within a like area can be found so many natural features of greatest interest as those to be seen in the Yellowstone National Park.

Not the least of these is Death Gulch, discovered in 1888 by Walter Harvey Weed, of the United States Geological Survey.

Mr. Weed's description of his discovery appears in Science, February 15, 1889, and contains information concerning geological features, comparisons with the Death Valley of Java and other matters of general interest.

At this time bodies of five bears, one elk, many small mammals in various stages of decomposition, and numerous insects were found. None of the animals showing signs of violence, Mr. Weed concluded death was caused by poisonous gas.

In 1897 Dr. T. A. Jaggar, Jr.,* visited the gulch, finding the carcasses of seven grizzlies and one cinnamon bear.

Tests made at various places along the bottom of the gulch failed to show sufficient gas to extinguish the flames of burning matches.

A year or two later Capt. H. M. Chittenden visited the gulch and found no animal remains nor any evidence of noxious gases.*

This experience caused him to express considerable doubt as to the authenticity of previous accounts.

As both Weed and Jaggar have indicated, the gulch is of such a nature, it is almost certain to be cleaned out periodically by freshets resulting from melting snow or heavy rains.

Quoting from the journal of the corporal in charge of the Soda Butte Station, the following extract needs no comment.

May 3, 1898.—Lt. Lindsley and Corpl. Herb left station for Cache (Creek). Followed trail to Death Gulch. Crossed Cache Creek at Death Gulch and patrolled two gulches to find the one in which supposed skeletons were to be found. Run into a bear track and in following it, came to Death Gulch. Corporal Herb went into it to the bottom and counted seven bear, brown silvertip and one grizzly. Part of gulch covered with snow. Signs of bear abundantly on both sides. The smell is that prevalent throughout the sulphur regions of the park. On being in the bottom of the gulch the sensation experienced was that of dizziness leaving a headache behind.

May 28, 1898.—Pvts. Root, McDonald and Edwards, mounted to Death Gulch. Counted carcasses of seven bear and one fox. Saw fresh signs of large bear on east side of gulch.

August 10, 1902.—Pvt. Wilson from station to Death Gulch, found carcass of bear having recently died, probably within twenty-four hours.

It has been my good fortune to visit Death Gulch, three different times. The first in 1900 when returning from Hoodoo Basin, our party camped near the mouth of Cache Creek and visited the gulch. We counted the carcasses of four large bears, and saw the remains of many other animals, represented mainly by bones with occasional tufts of hair. At this time the smell of sulphureted hydrogen was noticeable, and I determined then to learn, when possible, the composition of the gas of the gulch.

With this end in view, I went to the park in June of the past year, with apparatus for the analysis of gases.

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* *The Popular Science Monthly*, February, 1889.

* 'The Yellowstone National Park,' fourth edition, p. 335.