racts. These would effectually prevent transfer through the water itself. Furthermore, there is reason to believe that the transfer of water may have been nearly or quite completed before an actual surface valley connection was formed, since (as Lane has pointed out) leakage through the rocks from the higher to the lower level will go on for a long time, possibly increasing until all of the water from the higher level passes underground to the lower stream, leaving a dry channel for some distance below the point of capture in the upper valley. Under these circumstances it would be difficult to conceive of any transfer of faunas from the lower to the higher stream which was dependent upon direct fresh-water communication. On the other hand, there are so many means for the dispersal of fresh-water shells, and the evidence in other localities is so conclusive that they have been dispersed by such means, that we may reasonably suppose shells from either of the two systems might be transferred to the other independently of the capture. For this reason I do not believe that the distribution of the shells can be urged as a proof of capture, although the fact of capture is well attested by other lines of evidence.

The conclusion in favor of the theory of capture is further confirmed by the presence of old river gravels along the former southwestward course of the Chattooga. In view of the fact that the capture occurred at a remote period, we should not expect to find the former channel preserved, nor to find the gravels deposited by the river along that channel in their proper place. The stream dissection which we have already seen destroyed all traces of the former channel, would also wash the gravels down the slopes of the growing ravines and valleys, in many cases removing them altogether, but possibly leaving remnants in specially favored spots on the slopes and in the valleys. A careful search revealed the presence of these gravels, usually as scattered pebbles and boulders on the hillsides, but occasionally as considerable patches in the bottoms of small branch valleys. There was no mistaking their character. The present stream-borne material, even in the largest of these branches, is quite angular and evidently of local origin. The gravels are beautifully rounded quartz pebbles, cobbles, and boulders, somewhat roughened where exposed to the weather for a long time, but perfectly smooth where recently unearthed. In one place they were so abundant that a farmer had made numerous large piles of them in an ineffectual attempt to clear a small plot of ground for agricultural purposes. Their occurrence, together with the unequivocal topographic evidence, would seem to remove the question of capture from the realm of theory, and place it definitely in the realm of known facts.

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Reasons for Believing in an Ether

Many scientific men who are not physicists feel an ill-defined distrust of some of the more or less complex conceptions of modern physics. They feel that the physicist has, perhaps, allowed his imagination to carry him too far and has not stopped often enough to reexamine the foundations of his faith.

Perhaps the most fundamental conception exciting some such distrust from the outside is that of the æther which is assumed to fill all space. The non-physicist who has read of the oft-repeated but entirely unsuccessful attempts to detect the 'ether wind' due to the earth's movement through space, and of the negative results of all 'direct' experiments on the æther, begins to feel that the builders of physical theory are perhaps unreasonably tenacious of an idea which could, perhaps, best be dispensed with.

It may not be out of place, therefore, to state as briefly and clearly as possible several reasons for belief in an ether, reasons sufficient because based directly on observation or experiment.

The most important evidence is the simple fact that *the velocity of light does not depend on the velocity of the source.* This is shown by the normal apparent shape of the orbits of binary stars, which, it is easy to see, would otherwise appear distorted. For, if the orbital velocity of one member of a binary star

affected the velocity of its light, it would affect the time required for the light to reach us and would, therefore, change the apparent position of the star at any instant. The resulting distortion, which in some cases would be great, has been carefully looked for but has been found absent.

Thus it is a fact founded on observation that the velocity of light is independent of the source. The meaning of this fact can be made clear in the following way. Suppose an observer imprisoned in a windowless box which is thrown at random into space. Such an observer, meeting no experimental difficulties, could discover and accurately define his speed through space by simply measuring the velocity of light in various directions within his enclosure, and this, be it noted, without any reference whatever to any outside body. In general, he would find that light travels faster across his box in one direction than it does in another, for, as we have seen, the real velocity of light in space is not affected by the motion of the light source which he carries, and hence a change in his motion would change the apparent velocity of light within his box.

Thus space possesses what we might call a 'positional' property, by means of which the magnitude of any motion can be defined without reference to any body in the universe, and this motion is what physicists call 'motion with respect to the ether.'

There is an entirely different experimental truth which leads to the same conclusion as the above.

It is a generally accepted truth that two similarly charged bodies when moved side by side have, superimposed upon their mutual repulsion, an attraction which depends upon the fact that when moving they act like two parallel electric currents. This follows from Roland's classical experiment.

Now if the two charges, stationary with respect to each other, are considered alone in space, it is evident that they furnish our imprisoned experimenter another means of finding his motion relative to space, for the strength of the above-mentioned attraction depends only upon this absolute motion. This leads to the same conclusion as formerly, that space has a 'positional' property.

Other evidence of a similar kind might be given, but the above is sufficient to make it clear that at least so far as it represents this positional property of space the conception of an ether is thoroughly legitimate.

A being from a planet which possessed no atmosphere, if he came to earth, might first become conscious of our atmosphere through feeling it set in motion relatively to himself when he moved. In a somewhat similar way the ether manifests itself, since we know it through its motional property.

We are conscious of matter only as a collection of properties and one of these properties certainly is that it is capable of marking position. Therefore, the unknown reality, which exhibits this positional attribute in space as one of its properties, can be said to resemble matter to this limited extent at least, and upon this sure foundation can fitly be based the physicist's conception of an ether.

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NOTES ON ORGANIC CHEMISTRY

GLYOXAL

THE properties of the substance known as glyoxal, which is the simplest dialdehyde, certainly do not accord with its formula, OCHCHO. Some text-books try to evade this difficulty by describing it as 'a hydrate,' but this, to say the least, is hardly satisfactory. The matter has been cleared up very completely by a recent paper of Harries and Temme.[1] Glyoxal is found to exist in four forms: (1) Monomolecular glyoxal, OCHCHO, which is unstable and is described more fully below. (2) A trimolecular modification $(C_2H_2O_2)_3$, which is a colorless, pulverulent solid, readily soluble in water. It forms no characteristic derivatives, *i. e.*, reagents give with it only derivatives of (1). (3) Paraglyoxal $(C_2H_2O_2)_x$, a white powder, insoluble in water. (4) The ordinary form of glyoxal, now termed polyglyoxal $(C_2H_2O_2)_n$, which has been known during the past fifty years.

[1] *Ber. d. Chem. Ges.*, **40**, 165 (1907).