The assumption that there is a drag of the ether by the earth involves a considerable readjustment of the theories of the ether, inasmuch as it requires a modification of the accepted explanation of aberration. In commenting on the preliminary report of this work presented to the National Academy of Sciences in April, 1925, Dr. L. Silberstein said: "From the point of view of an ether theory, this set of results, as well as all others previously discovered, are easily explicable by means of the Stokes ether concept, as modified by Planck and Lorentz, and discussed by the writer (Silberstein) in the *Philosophical Magazine.*"[6]

The theory of Stokes may be described by means of the following sentences selected from Sir Joseph Larmor's treatise on "Aether and Matter," pages 10, 13, 35 and 36:

As Sir George Stokes was not disposed to admit that the aether could pass freely through the interstices of material bodies in the manner required by Fresnel's views, and as any other theory of its motion which could be consistent with the fact of astronomical aberration required irrotational flow, an explanation of the limitation to that flow had, he considered, to be found. This chain of argument, that motion of bodies disturbs the aether, that aberration requires the disturbance to be differentially irrotational, that this can only be explained by the dispersion of incipient rotational disturbance by transverse waves, and further that radiation itself involves transverse undulation, he regards as mutually consistent and self supporting, and therefore, as forming distinct evidence in favor of this view of the constitution of the aether. . . . The question then arises how far this explanation will extend to the case in which the aether is entrained by the matter that is moving through it. Attention has already been drawn to Sir George Stokes's considerations which would make the luminiferous property itself prevent the initiation of any rotational motion in the aether. It is in fact not difficult to prove that the energy of strain of a rigid incompressible medium of the type of ordinary matter may be expressed as a volume integral involving only the differential rotation, together with surface integrals extended over boundaries; and it follows that any local beginnings of rotational motion in an aether of elastic-solid type would be immediately carried off and distributed by transverse waves, so that if the rigidity is great enough no trace of rotational motion of the medium in bulk can ever accumulate.

There are systematic differences in the so-called constant of aberration and in standard star places as determined at different observatories, which might be explained on the hypothesis of a variation in ether drift due to differences in the local coefficient of drag. The drag at any given station may depend more or less upon altitude, local contour and the distribution of large masses of land such as mountain ranges. The ether-drift experiments have never been made at sea-level, nor, in fact, at any place except Mount Wilson, with sufficient completeness to give accurate measures of the effects. The evidence now indicates that the drift at Mount Wilson does not differ greatly in magnitude from that at Cleveland and that at sea-level it would probably have about the same value.

The reduction of the indicated velocity of two hundred or more kilometers per second to the observed value of ten kilometers per second may be explained on the theory of the Lorentz-FitzGerald contraction without assuming a drag of the ether. This contraction may or may not depend upon the physical properties of the solid, and it may or may not be exactly proportional to the square of the relative velocities of the earth and the ether. A very slight departure of the contraction from the amount calculated by Lorentz would account for the observed effect. A reëxamination of the Morley-Miller experiments of 1902–1904 on the Lorentz-FitzGerald effect is now being made, with the indication that the interpretation may be modified when taken in connection with the large velocity of the solar system indicated by the observations of 1925.

It need hardly be said that the determination of the absolute motion of the solar system from such interferometer observations is one of considerable complexity. I am under obligation to Professor J. J. Nassau, of the Department of Mathematics and Astronomy of Case School of Applied Science, and to Dr. G. Strömberg, of the staff of the Mount Wilson Observatory, who have given very great assistance in the analysis and in the mathematical solutions of various parts of the problem.

Note.—Since this paper was prepared, a very complete series of observations involving 2,000 turns of the interferometer has been made at Mount Wilson, corresponding to the epoch February 8, 1926. The general indications are that the latest observations are entirely consistent with the report here made, though it is possible that there will be slight modifications in the numerical results when all observations are combined. A definitive numerical calculation will require several months of continuous work and is now in progress.

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[6] February, 1920, Vol. 39, page 161.

EXISTING PRACTICES OF POLLUTING PUBLIC WATER COURSES

Is civilization in danger of "being stewed in its own juice," or even as a preliminary smothered in a film of oil, (cold, not hot!) after an introductory sensory torture by the numerous and abundant waste products of human activity? This does not hark back

to the period of the Inquisition, or even to the days of witchcraft, but applies even to our own to-day as well as to posterity's to-morrow.

Where can you turn for an answer to any of the following questions? What agencies have been set up, what have these accomplished, what are they doing at this moment to prevent biologic wastage from bringing us, as a nation, to biologic bankruptcy?

To what extent are we piling up waste substances, ranging from denatured flivvers to denatured water and air, concentrated in quantities beyond the capacity of nature to convert such raw materials back again into her special brands of products?

How broadly, efficiently, and cooperatively are those who should be the engineers of civilization to-day working with nature to make the world safe under the rule of democracy?

What dangers are already in evidence or readily predictable?

Can these dangers be mitigated? How, when and where?

Where lies the responsibility for regulating whatever source of pollution may be amenable to regulation?

Has there been developed a general working plan, conforming to nature's laws and man's specifications? Do our minor projects, federal, state and individual, fit into this or any plan?

Reasonably complete information, general or detailed, on these points is not readily accessible. That conditions which lead to the dangerous pollution of public waters are not under adequate control is all too obvious.

Detailed discussion here is not practicable because most of the facts surrounding such pollutions are too prosaic, sufficiently obvious and yet too complicated. Some of the financial and political causes are sufficiently patent, and many of the details of destructive effects of existing practices and tendencies are known; others are reasonably predictable. But the crux of the situation which requires emphasis is that the public does not yet realize that our civilization is producing wastage and dollars faster than nature can take up the slack. Those of our methods which lead to excessive concentration of wastes actually clog and ultimately break down nature's machinery for converting wastes into renewed and useful products. The purpose here is to call attention to two facts, each of fundamental importance, but, working together as they do, are likely to become catastrophic.

Though it has now become a biological commonplace, biologists, within relatively recent years, have learned that abundant free oxygen and water are for living organisms basal factors of existence. Water and air make possible the continuously necessary cycle of matter in the world. Soluble minerals become built up into plants, plants into animals, and in due time, the bodies, both plant and animal, go back into mineral substances, to complete the cycle of "dust to dust."

Still more recently biologists have learned that to-day, as in the beginning, the condition of the waters of the earth determines not only the health and wealth of the aquatic inhabitants, but as well even the continued existence of mankind, through the primary food supply (the Plankton) and the humidity of the air.

As individuals and as a nation we have made some progress in starting the consideration of some of the questions involved in making wise use of the land, and some of the terrestrial resources. Is it not now time to consider more widely and carefully than ever before how we must treat the biologic aspects of our public waters and of our aquatic resources? Let us glance rapidly at some outstanding existing conditions. Conservatively speaking, the concentrated raw sewage and factory wastes of twenty-five million people are cast directly into the public water courses of the coastal and middle west of this continent. As a result of such wholesale concentration we choke the broad biologic process of metabolism, *i. e.*, the progressive conversion of dead organic material into its elements and the rebuilding of these elements into higher forms, including man. As a direct consequence, to-day, in many places, our rivers and shores frankly are regarded as sewers, shorn of original vegetation and devoid of useful fishes and shellfishes; moreover, with a constantly diminishing value as a source of healthful, even necessary, recreation; of peculiarly valuable types of food and of general public health.

Our best efforts at the "cheap" methods of dilution and dispersal by water result ultimately in sorrow to the eye, threats to the nostrils, a direct menace to our bodies and a ball and chain to our economic activities.

In spite of much notably successful and devotedly altruistic work by the several federal departments, by state and local health officials and civic associations, our public water courses are going from bad to worse, soon to become an economic handicap, a public menace rather than a public asset.

Scientific foresight, moreover, shows two conspicuously ominous conditions relatively near as quick results of our present practices of dumping into public waters waste materials, of which oily substances are a prominent feature.

First, the progressive curtailment of the exchange of free oxygen from the air to practically all organisms living in the water.

Second, the checking of evaporation from the surface of the waters.

It may be difficult for some of us to realize that a "free country" will be of little avail if we do not pro-

vide "free oxygen" to our public waters. This supply of oxygen comes to them in largest measure by mechanical mixture from air to water. The peasant or the wine merchant who desires to shut out the air from wine, under certain conditions, puts a thin layer of olive oil on the surface of the wine in the container. Unwittingly, on a huge scale and to a seriously large degree in the aggregate we are doing a similar thing when we permit the escape of mineral oils, anywhere, and even in small quantities. The result is twofold; we steal from the aquatic organisms the oxygen necessary for their growth, and then for good measure slowly poison them. A casual glance at many of our rivers and harbors indicates the places where ultimately the oil puts in its "dirty work." These heavy mineral tarry oils, unlike those more directly from organic sources (*i.e.*, fish and vegetable oils) are relatively resistant to change, dissolve and dissociate very slowly, and hence may persist even for years, spreading over a constantly widening area. As these oils "break up" various constituents separate out. Among these are some of the deadly chemical substances most frequently used for preventing organic growth (phenols, napthalenes, *et al.*, sold and used under various special trade and chemical names). The non-floating residue of the heavy, tarry, oily substance settles down to ultimately convert the land under the water into a sort of bitulithic pavement, obviously not conducive to the existence of many types of organisms. Here are some of the important causes of the decline of our fisheries and shellfish industries. The food supply of these is poisoned at its source, and in addition the supply of oxygen from the air is being shut off. The oxygen already dissolved in the water is diverted from its normal use, by being compelled to oxidize sewage, garbage and other waste substances, which should not be permitted to come into excessive, harmful competition with the aquatic organisms in the struggle for oxygen and for existence.

Further, the mineral oils, in addition to poisoning the organisms which compose the basal food supply for higher forms of animals, including man, equally destroy the bacteria whose function is to break up dead organic matter and thereby speed up the processes of oxidation and nitrification. But most serious of all is the fact that oils have another peculiar property, that of rapidly spreading over an ever increasing surface. Thus it is not only the quantities which may accumulate in eddies and currents, borne by wind and tide, sufficient to be a fire menace to shipping, a nuisance to bathers, but the infinitely thin layer of oil on the surface, even invisible to the unaided eye, may be sufficient to check or even to inhibit the fundamentally essential interchange of oxygen, of carbon dioxide, etc., between the air and the water. The net result is that our present practices of careless wastage of oils compels nature to carry on less efficiently her fundamentally important function of conserving energy and material, for the reason that we compel her to substitute putrefaction in place of oxidation and nitrification as major processes in nature's metabolism. In other words, our present practices of disposal of various waste substances have enormously increased in nature the amount of putrefaction, and seriously impaired the constructive processes of oxidation and nitrification. This we do by neglecting to follow nature's plan, of conducting on land some considerable proportion of the primary processes in the metabolism of waste products; but instead we cast prematurely, and therefore wastefully, into the water substances which should have primary treatment on land. So much for the ultimate effects of some pollutants on the waters. What are the predictable effects of this upon general land conditions? And the second prediction is like unto the first.

One may reasonably assume as an agreed fact that evaporation from the surface of ocean, swamp, lake and river is an important source of that air-humidity essential to terrestrial plant and animal life. The existence and constantly increasing extent of oily matter on the surface of the water will limit the quantity of water which goes into the air by evaporation from that surface. Hence it is safe inference that oil on the waters is certain to limit the water content of the air and consequently to unfavorably affect climate. The United States is notably one of the regions of the earth where aridity is at present extending or is likely to extend. Is it not a proper assumption that appreciable limitation of evaporation will appear in decreased precipitation? The facility with which we permit the escape of waste oils appears certain to become an important factor in restraining not only waste of oil but also the waste of climate and other favorable conditions of life. The sources of these oils have been studied by the U. S. Bureau of Mines. A catalogue would be long, ranging from oil well and transporting and distributing devices and practices to the careless wastage of small quantities by Mr. and Mrs. John Citizen, of Rabbit Hole, Nevada. It is the capacity of small, even minute quantities of oil to "get together" for teamwork which causes all the trouble.

What has been done and what more should be done to improve conditions which now exist or may threaten? The various federal departments have made numerous contributions on important aspects. Their wise and altruistic labors have done much to ameliorate conditions. Similarly, state legislatures, executive and judicial officers and the press have contributed in varying degrees to postpone the evil day of reckoning. At last the public is beginning to realize that human individual responsibilities competently and faithfully met are the true measures of personal and national wealth, and this *dollar economy* should

not be permitted to come into destructive competition with nature. It has become obvious that neither legislation, the courts, science, executive officials, or civilians working alone can meet the situation, and define, or allocate responsibilities and remedies remedially efficient. Cooperation, both broad and intimate, is essential if we are to overtake and conquer the economic menace arising from aquatic pollution.

Should not some of the dollars which originated in "economical methods," of waste disposal, not then even perhaps suspected of being in violation of nature's laws, be now made available for helping nature "back to normalcy," and to avoid further biologic blunders in the disposal of our waste products? In this belief, the executive committee of the National Conference on Outdoor Recreation has voted to seek the financial support necessary for initiating a non-political, authoritative, adequate disinterested survey of existing facts and factors involved in the present polluted conditions of our public water courses, assisting and cooperating to the utmost practicable degree with the existing federal and state agencies, with a view to the establishment of basic economic facts for future remedial procedure, upon which legislators, manufacturers and the public may rely, in constructive action which will at once define and defend private rights through safeguarding the public rights. This committee will aim to secure a coordination of pure science, applied science, political, economic and business science, carried on in the spirit of altruism, controlled and guided by "common sense," free from prejudice, sectional and personal interest and control: safeguarding the public, but making possible the utmost personal latitude of action within the limits of biological safety.

GEORGE WILTON FIELD

WASHINGTON, D. C.

AWARDS OF THE JOHN SIMON GUGGENHEIM MEMORIAL FELLOWSHIPS

THE appropriation of $100,000 for the assistance of young American scholars and artists during the year 1926–27 has been announced by Henry Allen Moe, secretary of the John Simon Guggenheim Memorial Foundation. This foundation was established a year ago with a fund of $3,000,000 by former United States Senator and Mrs. Simon Guggenheim, as a memorial to a son who died on April 26, 1922.

Thirty-seven new Fellows have been appointed from 18 states, ranging from Georgia to Washington. The list includes five women. Three artists are appointed for creative work in painting, three musicians for creative work in musical composition, and the research appointments are for work in a wide range of subjects. Among the fellows for 1926–27 are members of the faculties of 22 colleges and universities. Harvard University leads with four fellows; the University of Chicago has three; the University of Cincinnati, three; the University of Wisconsin, two; and Yale University, two. Seven of the fellows for 1926–27 are not at present affiliated with any educational institution.

The Guggenheim Foundation offers to the young productive scholars and artists of the country opportunities to carry on research and creative work, chiefly abroad. Applicants are required to present definite projects for research in a given field of knowledge, or projects for creative work in some one of the fine arts.

The fellowships are tenable anywhere in the world, for any period, long or short. The stipend is usually $2,500 for a period of twelve months, but in every case is adjusted to the needs of the individual appointed. The fellowships are open on equal terms to men and women, being citizens of, or permanent residents in, the United States, of every race and creed. The normal age limits of fellows are twenty-five and thirty-five years.

The appointments to fellowships just announced were made on the recommendation of the committee of selection of the foundation, consisting of: President Frank Aydelotte, Swarthmore College, *chairman*; President Frederick C. Ferry, Hamilton College; Dean Virginia C. Gildersleeve, Barnard College; Professor Charles Homer Haskins, Harvard University; and Dean Carl E. Seashore, The State University of Iowa.

Among the thirty-seven fellowships awarded are the following in the natural and exact sciences:

Dr. Wallace Reed Brode, research chemist, Bureau of Standards, Washington, D. C.—appointed for research on the absorption spectra of simple azo dyes, principally with Professor Arthur Hantzsch at the University of Leipzig, Germany. This involves a continuance of research carried on by Dr. Brode for his doctor's degree at the University of Illinois, and other researches, in a field in which he has published a number of papers in the past five years.

Dr. Royal Norton Chapman, professor of entomology, University of Minnesota—appointed to make an investigation of the problem of the relation of the abundance of insects, particularly destructive insects, to changing environmental conditions, principally at the European Parasite Laboratory, Le Mont Fenouillet, Hyeres, France, and the Rothamsted Experiment Station, England. Dr. Chapman has made and published studies of importance to the milling and cold storage industries, notably his "Insects in Relation to Wheat Flour and Wheat Flour Substitutes," "Observations on Mites infesting Flour