sonal fluctuations in wind direction. The division errors of the fixed circle of the new reversible transit instrument show on analysis a cyclic error, recurrent every $2\frac{1}{2}°$, which may reach 0.19″; thus emphasizing the need of determining the division error of each graduation.

The photoheliograph observations show that the expected decline in solar activity continues, though there have been four notable periods of resuscitated activity. Of the four big spot groups the area of which exceeded 1,000 millionths of the hemisphere, two exhibited bright eruptions in Hα light which were later followed by great magnetic storms on the earth. Assuming that the magnetic storms were caused by solar corpuscles emitted at the time of maximum intensity of the chromospheric eruptions, the mean time of travel of the particles is calculated as 20 hours.

The Nautical Almanac Office continues its essential work. Last year's report referred to the destruction by fire of the type and plates for most of its publications: during the early part of the year under review printing delays due to this circumstance and to a change of printing contract caused a dangerous accumulation of arrears. The Nautical Almanac for 1942 was in fact not published until November 3, less than two months before the date to which it refers, but the arrears are being wiped off so satisfactorily that the 1943 edition appeared on April 3. The failure of communications with many of the other ephemeris offices has led to a small increase of computational work; but duplication is avoided so far as possible by interchanging information with such of the offices as are still free to collaborate. The war has hastened a decision which would have been reached in any event, namely, to abandon the indiscriminate provision of occultation reduction elements. The observations for 1938 and 1939 show that the majority of the computed reduction elements are never in fact used, owing to the particular occultation not being observed; and of the remainder most are used once only. In the future the office will do the individual reductions for all observations actually made, provided that observers will do that portion of the reduction depending solely on their position and that of the star. A revision of the Air Almanac has recently been planned in conjunction with the Air Ministry: the effect will be to redistribute the data on the two pages allotted to each day, one of which now becomes a "night" page and the other a "day" page. The change should result in greater simplicity in use, at the expense of a slightly larger page. The present R.A.F. Star Charts are based on a recent investigation carried out by the office on the optimum method of identification of the stars used in aerial navigation.

The Magnetic Department of the observatory, in addition to the regular daily observations of the magnetic elements, is at present engaged in preparing charts for the Admiralty showing the iso-magnetic lines in declination, horizontal intensity, inclination and vertical intensity. The declination charts, of which the previous edition was published in 1937, are now ready; those for H and dip, for which the previous editions are dated 1922, are well advanced. Vertical-intensity charts are a novelty.

Features of the year's weather observed at Greenwich include a very wet August (4.146 in.) followed by an unprecedented lack of rain in September and October, during which only 1.41 in. fell. The winter was conspicuous for cloudiness, the sunshine recorded being only 55 per cent. of the average, and for consistently low temperatures in January and especially in February, which had a record number of days (twenty-six) on which temperatures below freezing were recorded.

Visitors to Greenwich Park will miss the famous 24-hour clock dial at the shattered main gates of the observatory, and the daily fall of the time ball; but the familiar domes are still there, though somewhat perforated, and the Wren building still stands guard over the all too characteristic bend in the river. Meanwhile, as the familiar, never-failing "six-pips" testify, the work of the Royal Observatory goes on.

SPECIAL ARTICLES

THE EFFECT OF HUMIDITY ON BETA STREPTOCOCCI (GROUP C) ATOMIZED INTO AIR

MICROORGANISMS in atomized droplets pass through a critical period in changing from an aqueous to an atmospheric state of suspension. The duration of this transient stage naturally depends upon air humidity. Sampling methods, adequate for studying subsequent mortality of residual organisms in static experimental atmospheres, may yet be too coarse for distinguishing such effects.

In the development of a dynamic method for study of disinfection of atomized air-suspended microorganisms, some eighty experiments in design of apparatus, development of techniques and exploration of bacterial behavior have been performed. An experiment consisted of two or more runs in altered atmospheres, each run involving six simultaneous volume and settling samples from two consecutive atmospheric exposures.

Confusion reigned until lethal effects of humidity changes in exposure chambers were evaluated. Their magnitude had not been suspected. High humidity

neutralized and low humidity masked the disinfecting action of propylene glycol vapor. Disinfection was most apparent at intermediate humidities.

Seven series of experiments representing comparable relative humidities, concentration of disinfectant and time of exposure have been tabulated (Table I). Normal room humidity existing during the late winter and early spring is represented by ±; added humidity by +; and deficiency due to dehumidification by − sign. The results are reported in terms of lethes —a lethe being equivalent to bacterial removal by one displacement of the atmosphere within the chamber. Air change is a ventilating term which simplifies expression of air disinfection.

TABLE I

LETHAL EXPOSURE

Series	Experiments	First Exposure: Time seconds	First Exposure: Glycol conc mg/l	First Exposure: Humidity	First Exposure: Lethes	Second Exposure: Time seconds	Second Exposure: Glycol conc mg/l	Second Exposure: Humidity	Second Exposure: Lethes
VII	3	60	.00	±	.10	60	.00	±	1.75
VII	"	"	.00	−	1.75	"	.00	−	1.26
I	5	10	.00	±	1.50	10	.00	±	.04
I	"	"	.05	±	4.27	"	.05	±	.07
II–IV	11	60	.00	+	.50	6	.00	±	1.07
II–IV	"	"	.30	+	1.50	"	.05	±	3.74
V–VI	5	60	.00	+	.55	6	.00	+	.14
V–VI	"	"	.30	+	1.20	"	.05	+	.18

Results on beta streptococci (Group C), averaging 3.6 lethes with and 1.27 lethes without glycol vapor, corroborate British results on aerosols of hexylresorcinal dissolved in propylene glycol[1] and American results on propylene glycol aerosols without hexylresorcinal[2] and later results on propylene glycol vapor.[3] Expressed in terms of lethes, these laboratory findings can readily be converted into sanitary ventilation equivalents.

Uniform dilutions of glycol vapor and humidity (Series I) were more lethal on first than on second exposure. Where first exposed to higher concentration of propylene glycol vapor and moisture (Series II–IV) lethes were higher on the second exposure. In humid air (Series V–VI) neither exposure showed marked lethal effect, but combined glycol vapor and humidity (second runs) seem to neutralize each other. Dehumidification with calcium chloride, on the other hand (Series VII), gave lethal results comparable to propylene glycol. Exposure in the apparatus following glycol experiments showed lethal lag, resulting perhaps from condensation or absorption on interior surfaces.

The possibility that results reported by English workers might be due less to toxic effect of hexylresorcinal aerosols, and those reported by American workers due less to the toxicity of glycol vapor than to desiccation produced by this hygroscopic substance, can not be overlooked. Disagreement among various workers[4] on the mode of disinfection, together with low toxicity of propylene glycol in aqueous solution, raises questions which await better understanding of relationship to humidity.[5] Retabulated on the assumption that the results are due to dehydration (Table II), they fall into alignment.

The decrease in effectiveness of a fumigant with increased humidity runs counter to accepted theory of fumigation; neither does disinfection rate (disregarded in Table II) conform to the normal law of equal proportionate bacterial decrease in equal time intervals. Mortality seems to occur at critical phases rather than to follow the normal logarithmic type of death rate.

TABLE II

LETHAL DEHYDRATION

Series	Experiments	Lethes with differing humidity: Humidified	Average humidity	Dehumidified
VII	3	..	1.85	** 3.00
I	5	..	1.54	* 4.34
II–IV	11	..	1.58	* 5.24
V–VI	5	.69	* 1.39	...
Average	24	.69	1.59	4.29

* Assuming desiccation by propylene glycol.
** By calcium chloride.

These results are preliminary to a more detailed description of the method and to a more thorough study of air disinfection.

W. F. WELLS
PETER ZAPPASODI

LABORATORIES FOR THE STUDY OF AIR-BORNE INFECTION,[6]
UNIVERSITY OF PENNSYLVANIA SCHOOL OF MEDICINE

[1] C. C. Twort, A. H. Baker, S. R. Finn and E. O. Powell, *Jour. Hygiene*, 40: 253, 1940.

[2] O. H. Robertson, E. Bigg, B. F. Miller and Z. Baker, SCIENCE, 93: 213, 1941.

[3] O. H. Robertson, C. G. Loosli, T. T. Puck, E. Bigg and B. F. Miller, SCIENCE, 94: 612, 1941.

[4] A. Trillat, *Rev. de path. comp.*, No. 510 (March): 292, 1939; R. J. V. Pulvertaft, G. C. Lemon and J. W. Walker, *Lancet*, 443, 1939; A. T. Masterman, *Jour. Hygiene*, 41: 44, 1941; A. E. Williamson and H. B. Gotaas, *Industrial Medicine*, 11: 40, 1942; O. H. Robertson, E. Bigg, B. F. Miller, Z. Baker and T. T. Puck, *Transactions of Assoc. of Amer. Physicians*, Vol. LVI, 1941.

[5] A. H. Baker and C. C. Twort, *Jour. Hygiene*, 41: 117, 1941.

[6] These laboratories are supported by a grant from the Commonwealth Fund to the University of Pennsylvania for studies in the prevention and control of air-borne infection. These experiments were conducted at the Henry Phipps Institute.