

became bactericidal and retained this property for as long as three months. The possibility of hypersensitivity of an occasional individual to bromide drugs should be borne in mind when exposing large groups to treated garments or blankets.⁷

No simple method for disinfecting droplet-nuclei has yet been devised. Under favorable laboratory conditions, propylene glycol in concentrations of 0.07 to 0.14 milligrams per liter, and triethylene glycol in a concentration of 0.0045 milligrams per liter were highly germicidal for most airborne bacteria in clean air when the relative humidity was between 40 and 60 per cent.^{8, 9, 10} A humidity of 50 per cent, without the use of glycol vapor, has been reported as destructive to some bacteria. Apparatus for the production of glycol vapor, and an independent duct system for carrying this vapor and diluting air for large rooms or spaces, and unit type vaporizers for small spaces, have been described recently.¹¹ There is also available a device for the automatic regulation of glycol vapor in the air called the glycostat. This instrument has been calibrated to measure the degrees of saturation of the air with glycol vapor by direct reading of the variations in the intensity of light reflected from the glycol condensing surface of the wheel of the instrument.¹² Under practical conditions, however, particularly in the presence of dust in the air, glycol effectiveness is much reduced. The use of other chemical aerosols that have been tried is limited by their toxicity, odor, or destructiveness to fabrics and metals. A recently reported controlled experiment in the offices of the Metropolitan Life Insurance Company showed that under ordinary working conditions triethylene glycol vapor failed to reduce the number of airborne bacteria and the incidence rate of minor respiratory infections.¹³

Ultraviolet radiation of floors and upper air has been studied extensively at the Naval Training Center, Sampson, N. Y. In barracks housing naval recruits, hospital admissions for respiratory infections (mostly *catarrhal fever*) were 25 per cent lower in a group of men exposed to ultraviolet radiation—(2537 Angstrom Units, 1 to 7 ergs per (cm²) (sec) at bed level)—than they were in adjacent control barracks without ultraviolet radiation.¹⁴

A controlled study over a six-year period on the evaluation of ultraviolet radiation of sleeping quarters as a supplement of accepted methods of respiratory disease control was recently reported.¹⁵ The amount of radiation over the last two years of the period was about five times that recommended commercially. No significant effect in the incidence of disease could be detected in about 400 inmates during the six-year period. The data imply that air layers were not sufficiently mixed. However, more efficient mixing would have been obtained at the expense of increased circulation of dust and lint. Sources of ultraviolet radiation should be so situated as to protect the eyes of the occupants of the room from direct or reflected rays. A combination of ultraviolet radiation and dust control measures is believed to be more effective than either one of the two used alone, but the proof for this has yet to come.

The present status (1947) is admirably reviewed by the Committee on Sanitary Engineering of the *National Research Council*,¹⁶ and by a subcommittee of the *American Public Health Association*.¹⁷ Both committees feel that the problem of air disinfection is still in the experimental stage. Knowledge concerning the effectiveness of glycol vapors has not kept pace with the development of vaporizing devices, and there is real danger that commercial exploitation of the various devices may discredit

the method and discourage careful research in this important field.¹⁸ More experimentation is needed for arriving at a definite conclusion concerning its use in industry and public buildings.

VALUE OF AIR COOLING UNDER TROPICAL CONDITIONS

The commissioning of a class of naval hospital ships with all wards, laboratories and living spaces air cooled is a notable achievement to provide better treatment of patients, especially those suffering from extensive burns, by control of environmental factors. Although statistics are not at hand to indicate the deaths or retarded recoveries of patients due to lack of air cooling in ships operating in tropical waters, it is generally agreed among competent observers that high temperature and humidity are major factors in prolonging disability and increasing mortality of the sick and injured. Physiologic data obtained on healthy men, moreover, show the large loss of body fluids and the stress on the cardiovascular system in terms of increased pulse rate when these men are continuously subjected to high temperatures. Even at rest about 50 cc of fluid per hour are lost as sweat¹⁹ through intact skin. In burn patients the difficulty, encountered in temperate climates, of maintaining fluid and electrolyte balance is tremendously augmented by the additional evaporative fluid loss in hot environments.

Patients who have such varied conditions as heart disease, thyrotoxicosis, shock from any cause, severe hemorrhage, or those who have had an anesthetic, will invariably store heat when subjected to a hot, humid environment. The gradient between the body surface temperature and the environmental temperature is such that loss by radiation is slight. The heat loss by evaporation in a warm, humid environment is low whether the patient does or does not perspire. The heat regulatory center may be temporarily deranged following an anesthetic, brain injury, or after an overdose of barbiturate. Loss of fluids and electrolytes is another influencing factor. Cooling the body is the answer to this problem, and this can best be done in a cool room of low relative humidity where conditions for heat loss are ideal. This measure is also valuable in controlling temperature height of patients with various acute febrile diseases.²⁰

Frequently from 50 to 75 per cent of personnel aboard naval vessels operating in tropical waters are afflicted with heat rash to a degree that interferes with rest and sleep. In carefully controlled experiments¹⁹ it was possible to produce a fulminating type of rash in all men living continuously at an effective temperature of 85 (90 F dry-bulb and 83 F wet-bulb). In the control group, 12 out of 24 hr were spent in a relatively cool atmosphere of 75 ET (80 F dry-bulb, and 70 F wet-bulb). These men either remained free from heat rash, or occasionally developed a mild form. Thus, intermittent cooling to a degree which prevented sweating in men at rest eliminated a serious handicap to good performance of duty.

In both laboratory tests and aboard hospital ships a relatively cool living environment of 76 to 78 ET provided an atmosphere conducive to rest and sleep without excessive sweating. Berthing spaces tended to have extremely low odor levels. Motivation, initiative and alertness, in contrast to the usual irritability and lack of incentive incident to residence in tropical climate, were maintained.²¹

Little has been done, however, to obtain practical methods for application of air conditioning under heavy heat loads and on the enormous scale that would be needed to modify life in the tropics. It is not improbable that cooled houses in a tropical climate, if used consistently for one generation, might modify the whole character of a population. The obvious advan-