

SUMMARY

From the above results it is concluded that the use of small quantities of 60 per cent perchloric acid considerably shortens the time of digestion in a Kjeldahl determination, without appreciably affecting the accuracy of the results, in the class of substances investigated, provided that the quantity of

the acid added does not cause the digestion to clear in less than 3 min. or fail to clear in 7 min.; that 1-g. samples treated with 25 cc. of concentrated sulfuric acid plus 1 g. of copper sulfate with 2 cc. of perchloric acid usually fulfil these requirements; and that all samples should be heated at least 15 min. after clearing.

LABORATORY AND PLANT

Constant Temperature Rooms^{1,2}

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Until comparatively recently the constant temperature room was considered an essential part of the equipment of a bacteriological laboratory, but not of a chemical laboratory. With the widening interest and activity in biochemistry, the chemist has come to consider such a room as a vital portion of his equipment. In many, indeed in most cases, a large amount of money has been spent in providing complicated heating devices and in insulating the rooms.

The incubator equipment of the Department of Agricultural Bacteriology of the University of Wisconsin has been gradually developed, as the need for increased space has arisen. The need has been met with limited resources. It is thought that a brief presentation of the essential portions of the equipment may prove of interest to others who wish to extend their facilities in this direction.

The laboratories are provided with four incubator rooms of varying sizes. In each instance a room originally used as a store room and opening off a laboratory has been adapted for incubator purposes. No money has been spent in insulating the walls, the lath and plaster of the original building forming the only insulation. False ceilings have been installed in order to diminish the height of the rooms and to avoid heating space that was inaccessible. Two of the rooms are provided with double doors, one swinging into the room, the other outward. The other rooms have single, light wood doors.

HEATING DEVICES

Three of the rooms are heated with gas. A bottomless box of galvanized iron (Fig. 1) about 16 in. \times 14 in. \times 17 in. high has been constructed with a door on one side. A row of holes near the bottom of the box permits the entrance of air. A rectangular galvanized iron pipe 12 by 6.5 in. in section is carried from the side of the box across one side of the room and then upward to the ceiling, where it joins a 6-in. round pipe which enters one of the ventilating flues of the building. A damper is installed in the round pipe to prevent the too rapid passage of air through the pipe and the consequent excessive loss of heat.

Gas is piped to the box and on the end of the supply pipe a rose-top Bunsen burner is connected with threaded joints. In the line of the supply pipe a Roux bimetallic regulator with a horseshoe shaped bar is installed with a bypass provided with a stopcock. The stopcock is for the purpose of allowing a small amount of gas to pass to the burner in case the regulator should not function. As far as our experience goes it is not an essential part of the equipment. As the heated gases pass through the pipe they are robbed of their heat by the extensive radiating surface of the pipe. The maximum use of the gas is thus obtained. One room has a content of 430 cu. ft. The radiating surface of the box and

pipe is approximately 52 sq. ft. The room is heated to a temperature of 35° C. by one burner. The records presented in Fig. 2 show the temperature variations of the room during a period when it was opened only a few times each day. The maximum temperature variation of the rooms surrounding the room in question during the period covered by the records was 15° C.

The fire hazard is nil, since the two possible sources of danger are excluded. Danger from a burner that strikes back is avoided by using only threaded joints and by not allowing the supply pipe to come in contact with wood for 3 or 4 ft. from the burner. The danger from an extinguished burner is avoided by the passage of the gas into the ventilating flue. One of the rooms is so situated that access to a

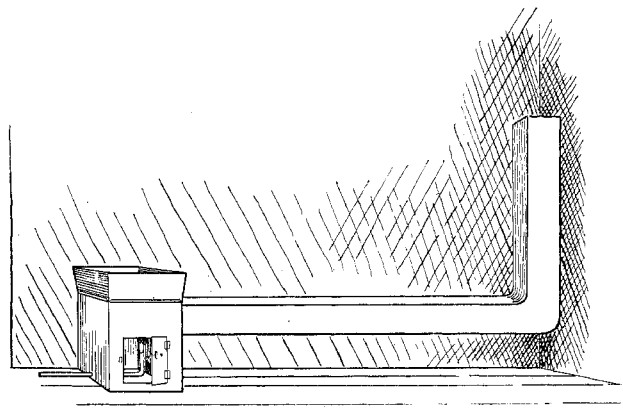


FIG. 1

ventilating flue could not be gained. The gases from the heating pipe are discharged into a hall, the cubical content of which is so great that an explosive mixture would not be obtained, unless the gas was allowed to escape for many hours. The absence of danger from fire was well shown by an incident of recent occurrence. One of the rooms is provided with two burners. During the summer one is sufficient to maintain the temperature at the desired point, but in the winter two are needed. The gas was turned off the building for the purpose of making repairs. When it was turned on again, one of the burners was lighted, but not the other, which was discharging gas. This unlighted burner was not discovered for 48 hrs. The gas from it did not catch fire, although the two burners were in the same box and not over 4 in. apart. The current of air through the box was sufficient to prevent the ignition of the gas and to carry it away so rapidly as to prevent an explosive mixture being reached in the box. No odor of gas could be noted in the room. The unlighted condition of the one burner was detected by the lowered temperature of the room.

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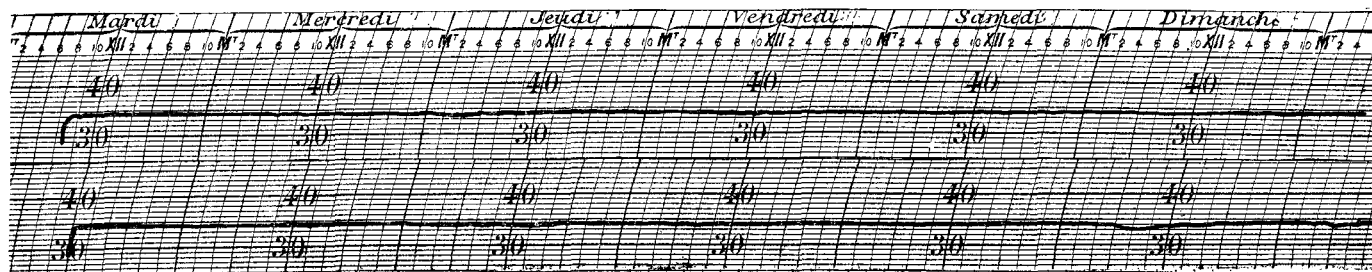


FIG. 2—THERMOGRAPH RECORDS OF A NONINSULATED CONSTANT TEMPERATURE ROOM HEATED WITH GAS CONTROLLED BY A ROUX BIMETALLIC REGULATOR

AVOIDANCE OF STRATIFICATION

One trouble encountered in incubator rooms is the stratification of the air. In the rooms heated by the method described, this is almost completely overcome by allowing air to enter the room at the top of the door. This cool air lowers the temperature at the top of the room, while the constant removal of the cold air at the floor through the heating device tends to prevent low temperatures near the floor. The temperature is sufficiently uniform so that cultures of *B. tuberculosis* grow well at any level in the incubator. The importance of this movement of air in equalizing temperature was not fully realized until another room was equipped with a different heating device.

The thermograph record of such a room will not present a straight line, but a line with uniform variations when the regulator is operating properly. In Fig. 3 thermograph records of this room are presented. It is to be noted that the temperature of this room has varied regularly over a space of about 2° C. During the past few months it has been used most successfully for the growing of *B. tuberculosis* in connection with the preparation of tuberculin. The regular variations in temperature noted in this room are of no importance in most lines of work.

There is a large reserve of heat, and the room has been kept at the desired temperature irrespective of variations in temperature of the rooms surrounding it, or out of doors.

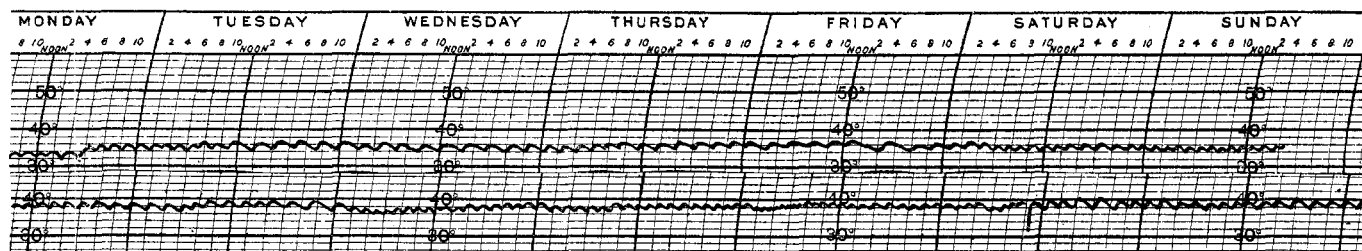


FIG. 3—THERMOGRAPH RECORDS OF A NONINSULATED CONSTANT TEMPERATURE ROOM, HEATED BY HIGH PRESSURE STEAM CONTROLLED BY A JOHNSON COMPRESSED AIR REGULATOR

It is possible to maintain a relatively high moisture content in the air of these rooms by having a pan of water resting directly on the box in which the flame is burning (Fig. 1).

One of the rooms equipped as described has been in constant use for 10 yrs. for all kinds of work. During this interval no money has been spent on repairs. The room has a content of 350 cu. ft. The pipe and box furnish about 30 sq. ft. of radiating surface.

The lack of insulation of the rooms has caused the use of more gas than would have been necessary with insulation. The interest charges and depreciation on insulated rooms would go far to offset the additional expense for gas, and probably would more than equal this charge. The amount of heat that one or two burners will supply is not sufficient to maintain the non-insulated rooms at the temperature desired if the temperature of that part of the building surrounding the rooms varies too widely.

During the past year a steam-heated room has been in use. The room is a basement one with concrete floor, one outside wall with window equipped with an inside shutter of wood. A single door is provided. The radiator that was in the room was connected to the high pressure steam pipes on which a pressure of 20 lbs. is carried throughout the year. The regulation is by means of a Johnson compressed air regulator, such as is used in many of the university buildings. By these regulators the steam is turned off and on; thus the heat supplied varies from zero to the maximum capacity of the radiator. The temperature of the room varies by such an extent as is necessary to cause the regulating device to

The stratification in this steam heated room is marked, since there is no exchange of air. In order to overcome this, an electric fan has been found essential. Without this aid to equalize the temperatures at different levels, *B. tuberculosis* would grow only when placed at a certain level in the room, the depth of this zone was not over 3 ft. With the fan, the cultures grew equally well at any level.

The total expense connected with the adaptation of these rooms for incubating purposes, including regulators and shelving, has been less than \$800. The total content of the four rooms is 2200 cu. ft.

One of the rooms is provided with racks which carry small metal drawers with bottoms of wire screen. These drawers are assigned to individual students, and may be carried to the working desk. The other rooms are provided with shelves of wire mesh supported on a frame work.

The plant of the Union Dye and Chemical Company at Kingsport, Tenn., was sold at auction on September 19, 1921, in accordance with the decree of the Chancery Court of Kingsport, arising from a suit against the company brought by the Equitable Trust Company of New York and Lyman Roades. The plant went into the hands of the receiver about January 1, 1921. The property, machinery, equipment, a tract of land and real estate of the corporation were sold for \$185,000 and chemicals on hand for \$15,000, making a total of \$200,000. The plant was bought by a New York attorney who is said to have been acting for a corporation which expects to operate it. Prior to the war the Union Dye plant was used for the manufacture of dyes, but was taken over by the Government for the manufacture of high explosives. At the close of the war the plant became inactive and several buildings are in need of immediate repair.