Laboratory Preparation and Decontamination of Mustard

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In the preparation of mustard a hood with a good draft should be used. Dissolve 122.2 gm (1 mole) of Kromfax solvent in 978 gm of 36% hydrochloric acid in a 2-liter round-bottom flask and place under a reflux condenser. Heat this solution between 80° and 90° C for 1 hr. The liquid will become turbid, due to the separation of the mustard. Allow to cool and separate the lower layer by means of a separatory funnel. The mustard thus obtained may be freed from excess HCl by passing a stream of dry air through it. The weight of product should be about 149.5 gm, or 94% of theory, and the melting point about 13° C, which indicates a purity of 96%. Pure mustard has a melting point of 14.5° C.

The crude material can be dried by heating under vacuum at 50 mm, at a bath temperature of 100° C, for 1 hr. Purification can be obtained by distillation in vacuum from a round-bottom flask fitted with an air-bubbler tube and equipped with a short column (7″) packed with glass helices. Useful boiling points of mustard are 81°/5 mm, 93°/10 mm, and 107°/20 mm.[1]

In handling this material, it should be remembered that it acts as a blistering agent even at very low concentrations. The spent aqueous layer from the above reaction should be handled with care. It may be saturated with HCl gas and used again, or decontaminated with gaseous chlorine before disposal. It may also be decontaminated by means of bleaching powder paste, as described below.

Mustard should be used in a hood with a good draft. One should avoid breathing the vapor and should allow neither the liquid nor the vapor to contact any part of the body. Particular care should be taken not to expose the eyes to mustard vapor by working for prolonged periods with the head inside a hood containing it.

Rubber gloves should be used in handling mustard. If the gloves become contaminated, immerse them for 4 hrs in boiling water before the next use. Gloves made of rubber which is about 35 mils thick may be worn with safety for about an hour after they have been contaminated with liquid mustard. As an added precaution, wash hands frequently when working with mustard, especially if it is suspected that the hands have become contaminated. Mustard must be washed from the skin immediately after contact to eliminate danger of burns.

Decontaminate glassware by immersion in concentrated nitric acid at room temperature in a hood. In a short time a reaction will take place with evolution of brown fumes. The mustard reaction products are toxic but have a very low vapor pressure. After treatment with nitric acid, the glassware should be washed thoroughly with water and the sink thoroughly flushed. Bulk mustard should be added to nitric acid with caution (preferably dropwise), because the reaction is violent.

Should mustard be spilled on a laboratory bench or on the floor, don gas mask and rubber gloves and decontaminate promptly as follows:

(a) Soak up all liquid with rags and dispose of the latter by incineration.

(b) Scrub the contaminated surfaces with a paste of bleaching powder and water. Allow the bleach paste to remain in contact with the surface for 24 hrs, then remove paste and wash the surface with soap and water. Dry bleach must not be mixed with bulk mustard, because the reaction is violent and *flammatory.*

Small objects which cannot be placed in nitric acid may be decontaminated by immersion in either a carbon tetrachloride solution of chlorine or Dichloramine-T or a slurry prepared by mixing equal weights of bleaching powder and water. Mustard readily penetrates porous materials such as paint films or wood. Only the surface contamination is removed by a quick treatment of such materials with decontamination agents. A relatively long contact with bleaching powder or solutions containing active chlorine is required to decontaminate porous surfaces effectively.

Incineration is a convenient method of disposal of small quantities of contaminated material such as clothing, rags, or wood. Since some undecomposed mustard vapors may be given off, the incinerator stack should be so located that the toxic fumes will not constitute a hazard.

[1] For purification by crystallization, see *J. Amer. chem. Soc.*, 1947, **69**, 1808.

The Excystment of *Colpoda duodenaria*

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The formation of cysts by certain protozoa can be studied as a problem of cellular differentiation. The genus *Colpoda,* and specifically the species *C. duodenaria,* forms permanent or resting cysts when the medium is deficient in available food, provided that the concentration of the protozoa is not too low. As far as can be ascertained, there are no structural parts to the resting cyst, other than cytoplasm and nuclei contained in one or more membranes. Redifferentiation can be followed by staining the cyst at intervals after immersion in an excystment medium, such as hay infusion, yeast extract, etc.

Excystment induced by some carbon compounds of low molecular weight (*1*) and excystment induced by potassium phosphate with or without such carbon compounds (*2*) have been reported, but in no case has the medium been as efficient (measured by the time required for 50% of the cysts to emerge) as, for instance, the optimum concentration of yeast extract; the optimum concentration of the potassium phosphate was found to be around 0.01 M.

We can now report that ethyl alcohol in combination with potassium phosphate (pH 7) gives an excystment medium as potent as the optimal yeast extract, and that the concentration of potassium phosphate required in this case is 0.0001 molar, or 15 μg/ml. This quantity of the phosphate might well be present in complex excystment media, such as soil extract, urine, and organic infusions. Three-tenths M ethyl alcohol without phosphate kills most or all of the organisms as they emerge from the cyst membrane; 0.00001 M potassium phosphate completely protects them from injury.

In a medium composed of 0.3 M ethyl alcohol, and 0.0001 M potassium phosphate in distilled water, 50% of the organisms were fully differentiated and have emerged from the cyst membranes in 100 min at 24°C.

References

1. HAAGEN-SMIT, A. J., and THIMANN, K. V. *J. cell. comp. Physiol.*, 1938, **11**, 389.
2. STRICKLAND, A. G. R., and HAAGEN-SMIT, A. J. *J. cell. comp. Physiol.*, 1947, **30**, 381.

Book Reviews

General psychology. John E. Bentley. Philadelphia-London-Montreal: J. B. Lippincott, 1947. Pp. xvi + 389. (Illustrated.) $3.50.

This book is designed as a text for the beginning student in General Psychology, special consideration being given to the needs of the student nurse. The contents are presented in 5 major divisions: the organic basis of human psychology, sense activity and experience, learning, personality adjustment, and applications of psychology to nursing. This text places greater stress on sensory and perceptual processes than is found in many books now offered for the beginning student. The discussion of the nervous system and the senses together occupy one-fourth of the book; perception, memory, and reasoning also receive extensive treatment. While nearly all topics customarily found in textbooks of general psychology are considered here, some receive only the briefest mention, e.g. the conditioned response.

The diagrams are exceptionally fine and should prove of great value to students. A glossary and supplementary section, which provides a few lines of material about important people cited in the book, should also be of help. Much of the writing, however, is abstruse and so condensed as to require very close attention on the part of the beginner. General statements are offered without supporting evidence. Perhaps because the author was chiefly concerned with the student nurse, much attention is given to disorders and maladjustments, in addition to the normal functions and processes studied. Suggestions and advice are offered to the student on such matters as the improvement of memory, the relief of worry, etc. While such advice is designed to be helpful, it is presented so tersely that it fails to achieve its purpose.

Students should find the organization of this book rather easy to follow. Each of the 5 major sections and every chapter is introduced by an outline of its contents, designed to orient the student in his study. Each chapter has several major and numerous minor subdivisions, making this a textbook well designed for study purposes. Some sections, however, are broken up so fine as to contain little more than definitions. This text might well have been expanded to twice its size so that more concrete material could have been included. Some topics would benefit by more extended treatment and by inclusion of experimental supporting material.

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Radar aids to navigation. John S. Hall. (Ed.) (Massachusetts Institute of Technology Radiation Laboratory Series.) New York-London: McGraw-Hill, 1947. Pp. xiii + 389. (Illustrated.) $5.00.

Of the 28 publications planned in the Radiation Laboratory Series, this is No. 2; 33 authors have written parts of the volume. L. A. Turner was technical editor, R. A. Whitmer and R. G. Herb also helped with the editing, and many other persons had a share in assembling the material. The series bears the imprint of OSRD and NDRC, as well as of MIT, and evidently will involve as many contributors as an encyclopedia. This is understandable and necessary in a presentation of teamwork on the unprecedented scale of wartime radar development in the United States, Britain, and Dominions. There is a general Foreword by L. A. DuBridge, as well as the Preface by J. S. Hall, who regrets that "the authors have not always found it possible to present this information in nontechnical form." Description is facilitated by many photographs and diagrams. Throughout the book the editors have achieved a remarkable uniformity of style.

This highly authoritative book is invaluable for the navigational engineer, but necessarily is too inclusive and condensed to appeal to all ordinary navigators. There are four parts. Part I is a general introduction, discussing principles of radar and of other radio navigational methods, including radio ranges, Sonne, u-h-f aids, direction finders, and the various once-secret systems allied to loran, including Gee, "skywave-synchronized" loran, and Decca. Shoran is mentioned in a later chapter, under Radar Aids to Mapping. The short comment on celestial navigation lists its disadvantages but not the