of the bat can similarly be used for the direct observation of melanocytes by transmitted light[9].

RICHARD S. SNELL

Section of Dermatology,
Department of Medicine,
Yale University School of Medicine,
New Haven, Connecticut.

ALENE F. SILVER
HERMAN B. CHASE

Division of Biological and Medical Sciences,
Brown University,
Providence, Rhode Island.

[1] Medawar, P. B., *Nature*, **148**, 783 (1941).
[2] Szabó, G., *J. Path. Bact.*, **70**, 545 (1955).
[3] Staricco, R. G., and Pinkus, H., *J. Invest. Dermatol.*, **28**, 33 (1957).
[4] Snell, R. S., *J. Invest. Dermatol.*, **42**, 337 (1964).
[5] Cruickshank, C. N. D., Cooper, J. R., and Hooper, C., *J. Invest. Dermatol.*, **34**, 339 (1960).
[6] Klaus, S. N., and Snell, R. S., *J. Invest. Dermatol.* (in preparation).
[7] Silver, A. F., and Chase, H. B., *Physiologist*, **7**, 255 (1964).
[8] Silver, A. F., and Chase, H. B., *J. Invest. Dermatol.* (in the press).
[9] McGuire, J. S., *Physiological Zoology* (in the press).

MICROBIOLOGY

Transduction in *Proteus morganii*

PHAGES capable of generalized transduction among strains of *Proteus mirabilis* have been described[1–3]. *Proteus morganii* differs in many respects from *P. mirabilis*[4] including a growth requirement for pantothenate and *l*-cystine in addition to the nicotinic acid requirement of the latter organism[5]. Several gene loci of these two species are being investigated in this laboratory. With *P. mirabilis* biochemical work is complemented with genetic (transductional) studies. In order to do the same with *P. morganii* it was decided to search for transducing phages active on this species.

The seventeen temperate *P. morganii* phages previously isolated[4] from an equal number of *P. morganii* strains[6] were investigated. The screening test used was the ability of phage to transduce a one-step marker (*str-r*) controlling resistance to 1 mg streptomycin/ml. from a mutant to the wild-type host. The materials and methods used for this part of the investigation were those previously used[1]. The minimal medium used was that of Porter and Meyers[5] solidified when necessary by the addition of 1·5 per cent agar. Under these conditions the growth factors *l*-cystine, calcium pantothenate and nicotinic acid were added to the agar at 47° C just before the plates were poured. Auxotrophic mutants of *P. morganii* strain N.C.T.C. 2815 were selected by the penicillin method after ultra-violet irradiation of washed suspensions of the organism to about 1 per cent survival. With transductions of prototrophy to auxotrophic mutants 0·05 ml. of the adsorption mixture (constituted as for streptomycin transductions) was plated on minimal medium 15 min after mixing. Colonies were scored after 4 days at 37° C.

One of the seventeen phages was capable of intra-strain transduction of the *str-r* marker. This phage (named *M*) was derived from *P. morganii* strain N.C.T.C. 10041 by ultra-violet induction of an overnight broth culture. Phage *M* is strictly inducible. No phage was detected in supernatants of an unirradiated broth culture tested at intervals for 10 days. The host of the phage is *P. morganii* strain N.C.T.C. 2815 on which it forms markedly turbid plaques. The transduction rate of the *str-r* marker from mutant 2815 *str-r* to wild-type 2815 is 6–9 × 10^{-6}/phage particle adsorbed. The transducing ability of phage *M* is completely abolished by prior addition of 0·1 ml. pure phage antiserum which reduces the phage titre from 7 × 10^9 plaque forming units/ml. to 8 × 10^4 P.F.U./ml., but it is unaffected by treatment of the lysate with deoxyribonuclease. A large number of strains of all the genera of the family Enterobacteriaceae were tested for susceptibility to the phage with negative results. The infectivity of phage *M* is Ca^{++} independent and undergoes 90 per cent inactivation at 60° C for 15 min and 99·9 per cent at 70° C for the same period of time. The structure of the phage was examined[7] before its transducing potential was recognized. It resembles the *Salmonella* transducing phage *P22* (ref. 8), but its overall dimensions are slightly smaller and it has a collar around the short neck.

Mutants of strain N.C.T.C. 2815 with individual growth requirements for histidine, tryptophan, isoleucine plus valine, ornithine and adenine were isolated. Phage lysates of the wild-strain transduced all the foregoing auxotrophs to prototrophy at rates similar to the *str-r* transductions. Phage *M* is thus capable of generalized transduction. Particular attention was given to the detection of abortive transductants, but none of the systems yielded any[2]. All prototrophic transductant clones examined so far are lysogenic and yield no *str-r* transductants when used as recipients for phage prepared on 2815 *str-r*.

This work was supported by a grant from the South African Council for Scientific and Industrial Research.

J. N. COETZEE

Department of Microbiology,
University of Pretoria,
South Africa.

[1] Coetzee, J. N., and Sacks, T. G., *J. Gen. Microbiol.*, **23**, 445 (1960).
[2] Coetzee, J. N., *J. Gen. Microbiol.*, **33**, 1 (1963).
[3] Böhme, H., *Biochem. Biophys. Res. Commun.*, **10**, 60 (1963).
[4] Coetzee, J. N., *Nature*, **199**, 827 (1963).
[5] Porter, J. R., and Meyers, F. P., *Arch. Biochem.*, **8**, 169 (1945).
[6] Coetzee, J. N., *J. Gen. Microbiol.*, **31**, 219 (1963).
[7] Prozesky, O. W., de Klerk, H. C., and Coetzee, J. N., *J. Gen. Microbiol.* (in the press).
[8] Anderson, T. F., *Proc. Eur. Reg. Conf. Electron Microscopy, Delft*, **2**, 1008 (1960).

Thermophilic Micro-organisms from Rotting Maize

TEMPERATURES of up to 58° C were observed within a 20-ton stack of maize which accidentally became wet in Ado-Ekiti, Western Nigeria.

Samples collected deep in the stack were plated out on Difco corn meal agar (for fungi) and on glucose-yeast extract agar[1] (for bacteria) and incubated at 55° C.

Three fungi, *Thermomyces lanuginosus* Tsiklinsky (I.M.I. 110803), *Mucor pussilus* Lindt (I.M.I. 110805) and a possibly new species of *Rhizomucor* (I.M.I. 110804), were regularly isolated. The last-mentioned isolate is at present being studied.

Three strains of spore-forming bacteria and one of an actinomycete were also obtained. The morphological and physiological properties of the bacteria (N.C.I.B. 9667–9669) suggest that they are strains of *Bacillus licheniformis* (Weighman) Chester *emend. Gibson*, while the actinomycete (N.C.I.B. 9670) belongs to the genus *Thermoactinomyces* and is probably *T. thermophilus* Krassilnikov.

Table 1 illustrates the temperature requirements of the isolates on the aforementioned media.

Table 1

	Minimum (° C)	Optimum (° C)	Maximum (° C)
Thermomyces lanuginosus	28–32	45–50	58–60
Mucor pussilus	21–23	40–45	50–53
Rhizomucor sp.	25–30	45–53	60–61
Bacillus licheniformis	27–30	38–45	58–59
Thermoactinomyces sp.	30–35	45–47	59–61

All the isolates hydrolysed starch; none 'cleared' chitin or cellulose agar[1]. The bacteria and the actinomycete visibly dissolved finely ground particles of maize incorporated with mineral salts into agar; the fungi did not.