A COMPARISON OF VIBRIO CHOLERAE PACINI
AND VIBRIO ELTOR PRIBRAM

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SUMMARY. Fifty-seven characteristics of the proposed neotype strains of Vibrio cholerae Pacini 1854 and Vibrio eltor Pribram 1933 are compared. These organisms are so similar that they should be included in the same species under the name which has priority, Vibrio cholerae. Pribram (1933) appears to have been the first to publish validly the name V. eltor.

"A patient pursuit of facts, and cautious combination and comparison of them, is the drudgery to which man is subject by his Maker, if he wishes to attain sure knowledge."

--- Thomas Jefferson

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INTRODUCTION

Vibrio eltor, often called the El Tor vibrio, has been recognized for many years. Gotschlich isolated organisms resembling V. cholerae from 6 dead Mecca pilgrims at the El Tor quarantine station on the west coast of the Sinai Peninsula. The pilgrims did not have clinical cholera nor post mortem evidence of cholera. The organisms appeared morphologically, biochemically, and serologically like V. cholerae. Gotschlich (1906) did not describe these organisms to be haemolytic. Kraus and Pribram (1905, 1906) examined Gotschlich's strains and recorded their haemolytic activity. Kraus (1903) was familiar with haemolytic vibrios before he studied Gotschlich's strains.

Eisler (1909) appears to be the first to use an effectively published name for the organisms which Kraus and Pribram (1906) described but did not name. Eisler, who worked with Kraus and Pribram at the Staatlichen Seroterapeutischen Institut in Wien, studied the influence of salts on V. eltor and other schizomycetes. He used V. eltor strain V, one of Gotschlich's 6 isolates. Eisler did not describe V. eltor nor did he refer to an earlier description of it.

The name of a taxon is not validly published unless it is accompanied by a description of the taxon or by a reference to a previously and effectively published description of it (International Code of Nomenclature of Bacteria and Viruses, Rule 12a). V. eltor Eisler 1909 is not a validly published name because Eisler did not describe V. eltor strain V nor did he refer to the earlier publications of Kraus and Pribram or Gotschlich.

The name V. eltor should be attributed to Pribram 1933. Pribram referred to Gotschlich's strain V and gave earlier references for the distinctive description of the species. An earlier validly published name for this organism has not been found.

Hugh (1962, 1964) recommended that the National Collection of Type Cultures (NCTC) strain 8457 be recognized as the neotype strain of V. cholerae biotype El Tor (V. eltor Eisler). Since V. eltor Eisler is not a validly published name, it is recommended that strain 8457 be recognized as the neotype strain of V. eltor Pribram 1933. This strain conforms to the description of V. eltor as given by Kraus and Pribram (1906). This neotype strain is proposed in an attempt to fix the name, avoid ambiguity, confusion, and useless creation of new names. It can function as a reference strain in lieu of Gotschlich's strain. None of Gotschlich's haemolytic V. eltor strains, which were studied by Kraus and Pribram, are known to be available.

Strain 8457 was isolated in 1930 by W. Doorenbos from a pilgrim in the El Tor quarantine camp, and Doorenbos deposited this strain in NCTC in April 1951 (*vide* Doorenbos and Kop 1951). The Doorenbos strain number of this culture is not available from the curator of the NCTC. NCTC strain 8021 has been proposed by Hugh (1964) as the neotype strain for V. cholerae Pacini. The proposed neotype strains for V. cholerae and V. eltor carry the corresponding strain numbers given in Table 1.

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Table 1. Corresponding strain numbers of the proposed neotype strains of Vibrio cholerae and Vibrio eltor.

	<u>V. cholerae</u>	<u>V. eltor</u>
NCTC	8021	8457
ATCC	14035	14033
JMC	852	389
RH	1094	1092

Key:

NCTC	National Collection of Type Cultures, London, England
ATCC	American Type Culture Collection, Rockville, Maryland
JMC	The Jefferson Medical College of Philadelphia, Philadelphia, Penna.
RH	Culture Collection of Rudolph Hugh, The George Washington University School of Medicine, Department of Microbiology, Washington, D. C.

MATERIALS AND METHODS

The two vibrio strains were received from the NCTC in October 1960. The methods used to characterize these two strains were described by Hugh (1964, 1965).

RESULTS

The similar characteristics of the two proposed neotype strains are recorded in Table 2. The differences of the two strains are recorded in Table 3.

DISCUSSION

V. cholerae ferments glucose anaerobically and exclusively by the classical Embden-Meyerhof glycolytic pathway. The Entner-Doudoroff pathway and any other known hexose monophosphate pathways are not operative in V. cholerae (Unger 1961).

Table 2. The similar characteristics of the proposed neotype strains of Vibrio cholerae and Vibrio eltor.

ATCC strain number	<u>V. cholerae</u> 14035	<u>V. eltor</u> 14033
Gram-negative	+	+
Rod-shaped	+	+
Motility	+	+
Polar monotrichous	+	+
Adonitol	-	-
Aesculin	-	-
l-Arabinose	-	-
Cellobiose (sealed)	+	+
Dextrose	+	+
Dextrose gas	-	-
Dextrose (sealed)	+	+
Dulcitol (dulcitol)	-	-
d-Fructose	+	+
d-Galactose	+	+
l-Inositol	-	-
Inulin (from Dahlia)	-	-
Lactose	+ ₂	+ ₄
Maltose	+	+
d-Mannitol (mannite)	+	+
d-Mannitol gas	-	-
d-Mannose	+	+
Melezitose	-	-
Melibiose	-	-
Raffinose	-	-
Rhamnose	-	-
Salicin	-	-
d-Sorbitol	+	+
Sucrose	+	+
Trehalose	+ ₄	+
d-Xylose (sealed)	+	+
Indole	+	+
Methyl red (+ indicates orange color)	+	+
Acetylmethyl carbinol	wk +	+
Citrate - Christensen	+	+ ₂
Catalase	+	+
Indophenol oxidase	+	+
Gelatin-charcoal	+ ₃	+ ₃
Hydrogen sulfide - Kligler	-	-
Lysine decarboxylase - ninhydrin	+	+
Malonate	-	-
Nitrate to gas	-	-
Nitrate to nitrite	+	+
Phenylalanine deaminase	-	-
Growth in potassium cyanide broth	-	-
Urea - Christensen	-	-
l-Lysine decarboxylase	+	+
l-Arginine decarboxylase	-	-
l-Ornithine decarboxylase	+	+
Slide agglutination test - O Group I antiserum	+	+
% Guanine plus cytosine composition	46.6	46.8

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Table 3. Dissimilar characteristics of the proposed neo-type strains of Vibrio cholerae and Vibrio eltor.

ATCC strain number	<u>V. cholerae</u> 14035	<u>V. eltor</u> 14033
Citrate - Simmons	+	-
Tube haemolysis test - sheep erythrocytes	-	+
Subserotype (o forms)	Ogawa	Inaba
Sensitivity to Mukerjee bacteriophage	I + II + III + IV +	- - - -

Key:

- Negative

+ Positive test

Subscripts indicate the day on which reaction became positive.

DISCUSSION

The neotype strains of V. cholerae and V. eltor are alike in the 30 positive and the 20 negative characteristics recorded in Table 2. The two species are remarkably similar. V. eltor should be included in the species V. cholerae. Gallut (1962) considered El Tor vibrios as variants of V. cholerae. Felsenfeld (1963) suggested that El Tor vibrios be included under V. cholerae as V. cholerae variety El Tor.

Table 3 records 7 characteristics which distinguish the two strains. These characteristics are interpreted to be infrasubspecific differences. Rule 8 of the Bacteriological Code concerns infrasubspecific subdivisions or forms of species. These subdivisions of species (other than subspecies [varieties]) are regarded to be of lower rank than subspecies and the terms usually used to designate them are strain, biotype, serotype, phagotype, variant, etc. These terms are defined in Recommendations 8a, 8a(2), 8a(3), 8a(4), etc. of the Bacteriological Code.

Hugh (1965) reported that 37% of 258 strains of V. cholerae were citrate (Simmons) negative.

Various factors have been shown to influence the haemolytic activity of some V. eltor strains (Mukerjee and Roy 1962, Feeley and Pittman 1963). There is no agreement on a standard procedure for estimating the haemolytic activity of cholera-producing vibrios. Some strains are considered to be haemolytic (V. eltor) by some investigators, while others fail to detect haemolytic activity and assign the same strain to the species V. cholerae. The situation is further complicated by the fact that some serologic O group I vibrios are nonhaemolytic when isolated and are named V. cholerae. These same strains after continuous passage on laboratory media become haemolytic and are later renamed V. eltor (de Moor 1949, Mukerjee and Roy 1962, Finkelstein and Mukerjee 1963). The haemolysin test is not known to have a role in the pathogenesis of human cholera.

V. cholerae and V. eltor are subject to form variation (subserotypes or different O forms of one serotype). Kauffmann (1950) recognized only Inaba and Ogawa O forms which were differentiated by B antigen.

The above observations concerning the haemolytic activity of V. cholerae and V. eltor have prompted research workers to devise new procedures for the differentiation of serologic O group I vibrios. Some of these procedures include bacteriophage sensitivity (Newman 1960, Mukerjee 1963), chicken red cell agglutination (Finkelstein and Mukerjee 1963), production of acetylmethyl carbinol (de Moor 1938, Felsenfeld et al. 1951, Felsenfeld 1964), soda-serum agglutination and soda - sublimate precipitation (Tanamal 1948), and growth in trypsin broth and polymyxin B sensitivity (Gan and Tjia 1963). These and other "differentiating tests" are reviewed and briefly evaluated by Felsenfeld (1964). Phage sensitivity or resistance should not be the primary basis for distinguishing species of vibrios. It appears that these characteristics of V. cholerae may prove to be of epidemiological significance.

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