Unclassified, Lactose-Fermenting, Urease-Producing Member of the Family *Enterobacteriaceae* Resembling *Escherichia coli*

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Eight strains of an unclassified, oxidase-negative, lactose-fermenting, urease-producing, gram-negative bacillus were isolated from clinical material. With the exception of urease production, the biochemical characteristics of these organisms resembled those of *Escherichia coli*.

Urease activity is typical in species of *Proteus* and *Klebsiella* and variable in other members of the tribe *Klebsiellae* and in *Citrobacter* and *Yersinia*. Although the intensity of urease activity is known to vary according to the media and techniques used (5), its presence is not at all characteristic of *Escherichia coli*.

Since 1970 our laboratory has isolated eight strains of an unclassified, oxidase-negative, lactose-fermenting, urease-producing member of the family *Enterobacteriaceae* from clinical specimens. In every respect other than urease production, these strains resembled *E. coli*.

These organisms were initially recognized in the initial set of tests used in this laboratory for identification of gram-negative bacilli (6): triple sugar-iron agar, lysine-iron agar, Simmons citrate agar, Christensen urea agar, ornithine motility medium, and indole test broth. Additional tests were those described by Edwards and Ewing (2). Antimicrobial susceptibilities were determined at the time of initial isolation by the agar dilution technique routinely used in this laboratory (6).

The eight patients from whom the unclassified, gram-negative bacilli were recovered ranged in age from 13 to 68 years (mean, 37 years). Seven of the eight strains were isolated from the urinary tract. From two paraplegic, hospitalized patients with chronic indwelling urethral catheters, colony counts of at least 100,000/ml were obtained concurrently with or shortly after isolation of *Proteus mirabilis* or *P. rettgeri* in significant numbers. From two patients with histories of chronic urinary tract infection, small numbers of the organism were isolated from single urine cultures only; in neither case was there history of infection with urease-producing organisms. A mixed infection with group D streptococci occurred in another

patient who required insertion of an indwelling urethral catheter for postoperative urinary retention. The organism was isolated in large numbers, concurrently with *P. mirabilis* and group D streptococci, from a patient with an infected urethral diverticulum. It was isolated in small to moderate numbers from one patient without signs or symptoms of urinary tract infection. Finally, the organism was isolated in large numbers, concurrently with *E. coli*, from an infected postoperative wound abscess in a patient who had undergone laparotomy with total abdominal hysterectomy, left salpingo-oophorectomy, and partial sigmoid resection 5 days previously for removal of a large tubo-ovarian abscess from which *Bacteroides fragilis* and *Peptostreptococcus* had been recovered.

On blood agar these organisms grew as grayish white, glistening, convex colonies with rough edges. Hemolysis was produced by four of the strains. On eosin-methylene blue agar they characteristically had dark centers and occasionally exhibited a green metallic sheen. Four of the strains yielded an alkaline/acid triple sugar-iron agar reaction, and four yielded an acid/acid triple sugar-iron agar reaction. All strains alkalized the slant and the upper third to one-half of the butt of the Christensen urea agar within 24 h. The remainder of their biochemical reactions are listed in Table 1. For purposes of comparison, the predicted percentages of positive reactions, according to Edwards and Ewing (2), are listed for *E. coli*. With the exception of the urease reaction, the reactions of the two groups of organisms do not differ significantly. Serological studies were not performed.

The antimicrobial susceptibilities of the eight strains are listed in Table 2. They do not differ significantly from those observed in our labora-

TABLE 1. Comparison of biochemical reactions of unclassified organisms with predicted^a reactions of *E. coli*

Test or substrate	Positive in 1-2 days		% Positive predicted for <i>E. coli</i>
	No.	% ^b	
Hydrogen sulfide	0	0	0
Urease (Christensen)	8	100	0
Indole	8	100	99
Methyl red	8	100	99
Voges-Proskauer	0	0	0
Citrate (Simmons)	0	0	0
KCN	0	0	3
Motility	6	75	69
Gelatin, 22 C	0	0	0
Lysine decarboxylase	8	100	88
Arginine dihydrolase	5	63	17
Ornithine decarboxylase	6	75	63
Phenylalanine deaminase	0	0	0
Malonate	0	0	0
Glucose	8	100	100
Lactose	8	100	90
Sucrose	2	25	51
Mannitol	8	100	96
Dulcitol	4	50	38
Salicin	7	100	37
Adonitol	1	13	5
Inositol	0	0	1
Sorbitol	8	100	93
Arabinose	8	100	100
Raffinose	1	13	54
Rhamnose	8	100	74
Maltose	8	100	86
Xylose	8	100	70
Trehalose	4	100	98
Nitrate to nitrite	8	100	99
Esculin	4	57	31
Sodium acetate	8	100	84

^a Based on classification by Edwards and Ewing (2).

^b Eight strains tested in all entries except: salicin, seven; trehalose, four; esculin, seven.

tory with typical isolates of *E. coli*.

Urease activity has been described (3) recently in *Salmonella cubana*; however, naturally occurring urease-producing strains of *E. coli* have not been described to the best of our knowledge. Lewis and Rosen (Abstr. Annu. Meet. Am. Soc. Microbiol. 1973, G218, p. 62) did report a naturally occurring *P. rettgeri* (*lac* +) that transferred genes for urease production

TABLE 2. Antimicrobial susceptibilities of unclassified organisms of Enterobacteriaceae

Antimicrobial	Cumulative no. inhibited at increasing concn (μg/ml) ^a					
	1	5	10	20	50	100
Cephalothin		4		5		7
Ampicillin		5	7			
Carbenicillin					4	
Tetracycline	2	5	5			
Kanamycin	1	7				
Gentamicin	7					
Chloramphenicol		4	4	4		
Nalidixic acid			6			
Nitrofurantoin					6	

^a Seven strains tested except: carbenicillin, four; nalidixic acid and nitrofurantoin, six.

and lactose fermentation to *E. coli*, *Salmonella typhi*, and *S. typhimurium*. This transfer to heterologous strains suggested that these genes were on a plasmid. That *Proteae* can participate in various forms of genetic transfer has been discussed by Coetsee (1).

It is of interest that three of the patients from whom these urease-producing organisms were isolated had antecedent or concurrent infection with either *P. rettgeri* or *P. mirabilis*. Although antecedent or concurrent infection with other recognized urease-producing organisms was not documented in the other patients, it appears to be likely that urease production, like hydrogen sulfide production (4), is a plasmid-mediated biochemical characteristic that must be recognized as an as yet rare occurrence in clinical isolates of *E. coli*.

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