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Corynebacterium parvum: a Synonym for *Propionibacterium acnes*?

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SUMMARY

Fifty-nine strains labelled *Corynebacterium parvum* were investigated by cell-wall agglutination tests using antisera to *Propionibacterium acnes* and *P. granulosum*. Fifty-two strains appeared to be serologically identical with *P. acnes* and three with *P. granulosum*; these identifications were confirmed by the results of fermentation and other metabolic tests. Of the remaining four strains, three were identified as *P. avidum* by fermentation tests, and by DNA/DNA homology determinations against reference strains of *P. avidum*, *P. acnes* and *P. granulosum*. One strain was identified as Actinomyces, probably *A. naeslundii*.

These results indicate that *C. parvum* should be regarded as a synonym of *P. acnes*.

INTRODUCTION

Corynebacterium parvum infectiosum was originally described by Mayer in 1926. Following the lead of Prévot (1940) the name generally used for the organism has been *Corynebacterium parvum*, although the *Index Bergeyana* (1966) states that *C. parvum* was validly published but is illegitimate under rule 24b of the Bacteriological Code. The original strain (Mayer, 1926) was isolated from a long-continued and ultimately fatal infection in a woman whose illness started after childbirth, and Mayer subsequently reported the isolation of the same bacterium in another 23 cases, mostly genital infection in females. The bacterium was described as being a very short, Gram-positive rod showing some degree of bipolar staining, generally more intense at one end than the other. However, the original description of the other properties of the strains is meagre and does not contain enough information to distinguish them from other small, Gram-positive coryneform organisms.

Recently there has been increased interest in strains labelled *Corynebacterium parvum*, because injection of killed suspensions has a marked stimulating effect on the reticulo-endothelial system and causes an increase in the rate of clearance of carbon particles from the blood of mice and rats (Halpern *et al.* 1963; Prévot *et al.* 1963). Killed suspensions also inhibit tumour growth under certain conditions (Halpern, Biozzi, Stiffel & Mouton, 1966; Smith & Woodruff, 1968; Fisher, Grace & Marmick, 1970). Strains designated as *Corynebacterium acnes* (*Propionibacterium acnes*) have also been shown to have a stimulating effect on the reticulo-endothelial system (Farber & Glasgow, 1972).

Johnson & Cummins (1972), using DNA/DNA homology tests coupled with investigations of cell wall antigens, indicated three broad groups among the anaerobic coryneforms; these were provisionally called *Propionibacterium acnes*, *P. granulosum* and *P. avidum*. During this work, three out of four strains labelled *Corynebacterium parvum* were found to be *P. acnes*, and the fourth *P. granulosum*. A more systematic examination of all the strains labelled *C. parvum* available to us was therefore made, to see if *C. parvum* existed as a separate entity.

It was proposed to identify serologically, and thus eliminate from consideration, strains which were either *Propionibacterium acnes* or *P. granulosum*, leaving a group of strains which might be considered to be *Corynebacterium parvum*. However, preliminary tests showed that out of 59 strains, 52 could be provisionally identified as *P. acnes* and three as *P. granulosum*, leaving only four strains unidentified. Therefore all 59 strains were examined in detail.

METHODS

Strains. The strains, and their sources where known, are listed in Table 1. The American Type Culture Collection (ATCC) strains 11829 and 12930 came to the ATCC from Professor H. Seeliger, Bonn, Germany, but were originally obtained from the Pasteur Institute. They may, therefore, be duplicates of cultures already in the Anaerobe Laboratory Collection, but we have not been able to trace the numbers they had when received in Bonn. ATCC 11829 is also held in the National Collection of Type Cultures, Colindale, England, as NCTC 10387, and the strains listed as *Corynebacterium parvum* A, B and C are three subcultures (different colony types) isolated from NCTC 10387 in the laboratories of Burroughs Wellcome, Beckenham, Kent. The original source of *C. parvum* NCTC 10390 is not known.

Chemical and serological methods. Methods for wall analysis, preparation and absorption of antisera, and wall-agglutination tests have been described (Johnson & Cummins, 1972).

Physiological tests. Media for fermentation tests, and methods for nitrate reduction, gelatin liquefaction and production of indole are described in the *Anaerobe Laboratory Manual* (1972). All media contained 0·1 % Tween 80 (polyoxythylene sorbitan-mono-oleate). The inoculum for the tests consisted of five drops of a 48 h culture in peptone–yeast extract–glucose (PYG), and the cultures were incubated, with shaking, at 35 to 36 °C for 4 days (gelatin 7 days).

DNA competition experiments. These were performed as described by Johnson & Cummins (1972).

RESULTS

The results of cell-wall analysis, serological tests and fermentation tests are given in Table 2.

Wall composition. All strains (except 6653) conformed to the general pattern of cell-wall components previously found in anaerobic coryneforms of the acnes group (Johnson & Cummins, 1972). The diamino acid of peptidoglycan was L-DAP except in two strains which had the *meso*-isomer, and the cell-wall sugars were galactose, glucose and mannose. In the case of the two strains with *meso*-DAP, one, 6574, was identified as *Propionibacterium acnes* serological type II, and the other, 6631, as *P. avidum*. In both of these groups, occasional strains with *meso*-DAP have previously been found (Johnson & Cummins, 1972).

Wall-agglutination tests. To conserve materials, only two serum dilutions, 1/20 and 1/200, were used. The sera for *Propionibacterium acnes* serological types I and II were prepared against strains 3706 (type I) and 0162 (type II), which were typical representatives of each type (Johnson & Cummins, 1972), and each serum was absorbed with walls of the other type. Most wall preparations were also tested with an unabsorbed serum to *Propionibacterium granulosum* 0507 at the same two dilutions.

The wall-agglutination results were quite clear-cut, in that all strains except four reacted with one, and only one, of the three sera used. In the case of the absorbed sera (3706 and 0162) there was generally 2+ or 3+ agglutination at a dilution of 1/20, although some strains showed a rather weaker reaction, recorded as 1+. The titres of these two sera (originally

Table 1. *Strains of Corynebacterium parvum*

VPI no.*	Other nos.*	Source (where known)
6572	Prévot 3239	Inguinal gland puncture
6573	Prévot 1421	Blood culture, subacute bacterial endocarditis
6574	Prévot 3195	Septicaemia
6575	Prévot 2721C	Pleural fluid
6578	Prévot 1594	Purulent arthritis, pus
6579	Prévot 1867	Osteomyelitis, pus
6580	Prévot 3231	Canaliculitis
6581	Prévot 2872	Inguinal abscess
6582	Prévot 1355	Subacute bacterial endocarditis, blood culture
6583	Prévot 476	Erythema nodosum, blood culture
6622	Prévot 3557	—
6623	Prévot 4182	Meningitis, blood culture
6624	Prévot 3806	Blood culture
6625	Prévot 3456	Septicaemia
6626	Prévot 3879	Vulvo-vaginitis
6627	Prévot 3607	Lymph gland puncture
6628	Prévot 3812	Multiple facial abscesses (beard area)
6629	Prévot 3894	Septicaemia
6630	Prévot 3594	Blood culture
6631	Prévot 3232D	Allergic rhinitis
6632	Prévot 2355A	Abscess of neck
6633	Prévot 2500	Blood culture
6635	Prévot Achard	Purulent pleurisy
6636	Prévot 2444	Blood culture
6637	Prévot 2508	Endocarditis, blood culture
6638	Prévot 2288	Lymph gland
6639	Prévot 2484C	—
6640	Prévot 3192	—
6641	Prévot 2738	—
6642	Prévot 2706	Blood culture
6643	Prévot 2075	Blood culture
6644	Prévot 3431	Septicaemia
6645	Prévot 2733	Cervico-facial lesion
6646	Prévot 2241	—
6647	Prévot 2472	—
6648	Prévot 2281	Lymph gland, Hodgkins disease
6649	Prévot 2501	Sinusitis
6651	Prévot 1571	—
6652	Prévot 1904	Septicaemia, blood culture
6653	Prévot 1562	Cervical gland enlargement, pus
6656	Prévot 1440	Polyarteritis, blood culture
6657	Prévot 1369	Splenomegaly, blood culture
6659	Prévot B2321	Received from Dr Beerens, Lille, France
6660	Prévot 1397	Malignant reticulosis, blood culture
6661	Prévot 1396	Acute myeloid leukaemia, blood culture
6663	Prévot 1432	Subacute bacterial endocarditis, bone marrow culture
6666	Prévot 1383	Acute lymphatic leukaemia, blood culture (1st lyophil)
0204	Prévot 329B	Dental abscess
0207	Prévot 1383	Acute lymphatic leukaemia, blood culture (2nd lyophil)
0208	Prévot 2683	—
6500	Prévot 3085	—
0210	ATCC 11829	Professor H. Seeliger, Bonn (originally from Institut Pasteur, Paris)
	ATCC 12930	Professor H. Seeliger, Bonn (originally from Institut Pasteur, Paris)
	C. parvum A	Dr Geoffrey O'Neill, Glasgow, Scotland
	C. parvum B	Dr Geoffrey O'Neill, Glasgow, Scotland
	C. parvum C	Dr Geoffrey O'Neill, Glasgow, Scotland
	NCTC 10387	Dr Geoffrey O'Neill, Glasgow, Scotland
	NCTC 10390	Dr Geoffrey O'Neill, Glasgow, Scotland

* VPI, Virginia Polytechnic Institute; ATCC, American Type Culture Collection; NCTC, National Collection of Type Cultures.

Table 2. *Characteristics of strains of Corynebacterium parvum*

Sugar fermentations (4 days): +, pH of less than 5·5; −, pH of more than 6·0. If the value in repeated tests was between 5·5 and 6·0, the lowest pH recorded is shown. Aesculin +, hydrolysis as shown by the ferric chloride test. *Indole production*: +, strongly positive; +^{w}, weakly positive; Tr, trace; ., no test.

	Cell wall components				Cell wall agglutinations against						Physiological tests							
			Sugars		Serum 3706 ABS 0162 CW		Serum 0162 ABS 3706 CW		Serum 0507 (not absorbed)									
Strain	DAP* isomer	Galactose	Glucose	Mannose	1:20	1:200	1:20	1:200	1:20	1:200	Glucose	Sorbitol	Maltose	Sucrose	Aesculin	Indole	Nitrate	Gelatin
					Identification: *Propionibacterium acnes* type I													
0207	L	+	+	±	2+	−	−	−	.	.								
0208	L	+	+	±	2+	−	−	−	.	.								
6572	L	+	+	±	3+	−	−	−	−	−	+	−	−	−	−	+	+	+
6573	L	+	+	±	2+	±	−	−	−	−	+	+	−	−	−	+	+	+
6575	L	+	+	±	3+	−	−	−	−	−	+	−	−	−	−	+^{w}	+^{w}	+
6578	L	+	+	±	2+	±	−	−	−	−	+	−	−	−	−	+	+	+
6579	L	+	+	±	3+	Tr	−	−	−	−	+	+	−	−	−	+	+	+
6580	L	+	+	±	2+	−	−	−	−	−	+	+	−	−	−	+	+	+
6582	L	+	+	±	3+	1+	−	−	−	−	+	+	−	−	−	+	+	+
6622	L	+	+	±	3+	−	−	−	−	−	+	+	−	−	−	+	+	+
6628	L	+	+	±	2+	−	−	−	−	−	+	−	−	−	−	+	+	+
6630	L	+	+	±	3+	−	−	−	−	−	+	−	−	−	−	+	+	+
6636	L	+	+	±	3+	−	−	−	−	−	+	+	−	−	−	+	+	+
6638	L	+	+	±	1+	−	−	−	.	.	+	5·6	−	−	−	+	+	+
6640	L	+	+	±	3+	−	−	−	−	−	+	+	−	−	−	+	+	+
6642	L	+	+	±	1+	−	−	−	.	.	+	+	−	−	−	+	+	+
6643	L	+	+	±	2+	−	−	−	.	.	+	−	−	−	−	+	+	+
6644	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
6645	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
6646	L	+	+	±	2+	−	−	−	−	−	+	+	−	−	−	+	+	+
6647	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
6651	L	+	+	±	1+	−	−	−	.	.	+	+	−	−	−	+	+	+
6656	L	+	+	±	2+	−	−	−	.	.	+	−	−	−	−	+	+	+
6659	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
6660	L	+	+	±	1+	−	−	−	.	.	+	+	−	−	−	+	+	+
6661	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
6663	L	+	+	±	2+	−	−	−	.	.	+	−	−	−	−	+	+	+
6666	L	+	+	±	2+	−	−	−	.	.	+	+	−	−	−	+	+	+
C. parvum A	L	+	+	+	3+	−	−	−	.	.	+	−	−	−	−	+	+	+

* Diaminopimelic acid.

Table 2 (*cont.*)

Strain	DAP* isomer	Sugars: Galactose	Sugars: Glucose	Sugars: Mannose	Serum 3706 ABS 0162 CW 1:20	Serum 3706 ABS 0162 CW 1:200	Serum 0162 ABS 3706 CW 1:20	Serum 0162 ABS 3706 CW 1:200	Serum 0507 (not absorbed) 1:20	Serum 0507 (not absorbed) 1:200	Glucose	Sorbitol	Maltose	Sucrose	Aesculin	Indole	Nitrate	Gelatin
		Cell wall components			Cell wall agglutinations against						Physiological tests							
					Identification: *P. acnes* type II													
0204	L	−	+	±	−	−	3+	3+	.	.	+	−	−	−	−	+	+	+
0210	L	−	+	±	−	−	2+	1+	−	−	+	−	−	−	−	+	+	+
6574	*meso*	−	+	±	−	−	2+	−	−	−	+	−	−	−	−	+	+	+
6583	L	−	+	±	−	−	3+	Tr	−	−	+	−	−	−	−	+[w]	+	+[w]
6623	L	−	+	±	−	−	2+	−	−	−	+	−	−	−	−	+	+	+
6624	L	−	+	±	−	−	2+	−	−	−	+	−	−	−	−	+	+	+
6625	L	−	+	±	−	−	2+	−	−	−	+	−	−	−	−	+	+	+
6626	L	−	+	±	−	−	2+	−	−	−	+	−	−	−	−	+	+	+
6629	L	−	+	±	−	−	2+	−	.	.	5·6	−	−	−	−	+	+	+
6632	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6633	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6635	L	−	+	±	−	−	3+	−	.	.	+	−	−	−	−	+	+	+
6637	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6639	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6641	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6648	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6649	L	−	+	±	−	−	3+	−	−	−	+	−	−	−	−	+	+	+
6652	L	−	+	±	−	−	2+	−	.	.	+	−	−	−	−	+	+	+
6657	L	−	+	±	−	−	4+	2+	.	.	+	−	−	−	−	+	+	+
ATCC 12930	L	−	±	±	−	−	3+	3+	.	.	+	−	−	−	−	+	+	+
C. parvum B	L	−	±	±	.	.	.	.	.	.	5·6	−	−	−	−	+	+	+
C. parvum 10390	L	−	+	±	−	−	2+	1+	.	.	+	−	−	−	−	+	+	+

* Diaminopimelic acid.

Table 2 (*cont.*)

Strain	Cell wall components: DAP* isomer	Sugars: Galactose	Sugars:	Sugars: Mannose	Cell wall agglutinations against: Serum 3706 ABS 0162 CW 1:20	Serum 3706 ABS 0162 CW 1:200	Serum 0162 ABS 3706 CW 1:20	Serum 0162 ABS 3706 CW 1:200	Serum 0507 (not absorbed) 1:20	Serum 0507 (not absorbed) 1:200	Physiological tests: Glucose	Sorbitol	Maltose	Sucrose	Aesculin	Indole	Nitrate	Gelatin
Identification: *P. granulosum*																		
6500	L	++	Tr	±	.	.	.	.	2+	3+	+	−	+	5·7	−	−	−	−
C. parvum C	L	+	Tr	±	−	−	−	−	3+	3+	+	−	5·8	+	−	?Tr	+[w]	+
C. parvum 10387	L	++	±	+	−	−	−	−	3+	1+	+	−	5·8	+	−	−	−	+
Identification: *P. avidum*																		
6627	L	+	+	+	−	−	−	−	−	−	+	−	+	−	+	−	−	+
6631	*meso*	−	+	+	−	−	−	−	−	−	+	−	+	+	+	−	−	++
6581	L	+	+	+	−	−	−	−	−	−	+	−	+	5·6	+	−	−	+
Identification: Actinomyces																		
6653	No DAP (also, fucose ±, rhamnose +)	Tr	±	Tr	−	−	−	−	−	−	+	−	+	−	−	−	−	−

* Diaminopimelic acid.

Table 3. *DNA homology results*

Strain	Homology (%) to DNA from 0389 (*Propionibacterium acnes*)	Homology (%) to DNA from 0575 (*Propionibacterium avidum*)
0389 (reference)	100	52
0575 (reference)	54	100
6627	39	90
6631	40	83
6581	44	90
6653	0	0

1/320 to 1/640) had been reduced by absorption, and only a few wall preparations reacted at the 1/200 dilution. The three strains reacting with the *P. granulosum* serum, which had not been absorbed, were subsequently tested in a full set of dilutions (1/20 to 1/1024) and all went to the titre of the serum (1/640).

The four strains which were negative with all three antisera were 6627, 6631, 6581 and 6653. The first three of these were subsequently shown by DNA homology tests to be *Propionibacterium avidum*, and the sugar fermentation and other metabolic tests confirmed this (see Tables 2 and 3). The other strain, 6653, is probably *Actinomyces naeslundii.*

Fermentation tests. Sugar fermentations were read by measuring the pH after 4 days' incubation (Table 2). In the case of aesculin, the pH never dropped below 6·0 and hydrolysis of the aesculin was shown by the ferric chloride test.

Almost all strains of *Propionibacterium acnes* gave a strongly positive indole test, and all except 6583 (serological type II) showed complete liquefaction of the gelatin so that the medium remained fluid even after having been cooled to 4 °C. In the case of 6583, gelatinase activity was very weak and after growth the gel was almost as stable as the control medium.

DNA homology tests. These were only done with the small group of strains which serological and metabolic tests indicated were neither *Propionibacterium acnes* nor *P. granulosum.* The results are given in Table 3, and confirm the identification of strains 6627, 6631 and 6581 as *P. avidum.* Strain 6653, identified as *Actinomyces naeslundii*, shows no homology with any of the reference strains.

DISCUSSION

As many as twelve named species of anaerobic coryneforms have been described (Prévot & Fredette 1966) but there has been disagreement in the literature as to their fermentative and other properties. Johnson & Cummins (1972), using cell-wall analysis and DNA/DNA homology studies, concluded that only three major groups, provisionally named *Propionibacterium acnes, P. granulosum* and *P. avidum*, could be clearly distinguished.

The primary separation of these groups was based on the degree of DNA base sequence similarity revealed in the homology tests, but the groups can also be distinguished serologically (Johnson & Cummins, 1972; C. S. Cummins, unpublished). An extensive series of fermentation tests performed in the Anaerobe Laboratory on anaerobic coryneforms (Moore & Holdeman, 1973) revealed that the groups can also be distinguished by the eight tests shown in Table 4. Essentially, *Propionibacterium acnes* produces indole, reduces nitrate to nitrite and liquefies gelatin, but does not ferment sucrose or maltose. *P. granulosum* is generally indole-, nitrate- and gelatine-negative, ferments sucrose and maltose, but does

Table 4. *Characters used to identify strains of Propionibacterium acnes, P. granulosum and P. avidum*

For abbreviations, see Table 2.

Group	Cell wall components: DAP isomer	Cell wall components: Sugars	Physiological tests*: Glucose	Sucrose	Maltose	Sorbitol	Aesculin hydrolysis	Indole	Nitrate	Gelatin
P. acnes type I	L	Galactose, glucose, mannose	+	−	−	+ or −	−	+	+	+
P. acnes type II	Generally L, occasional strain with *meso*	Glucose, mannose	+	−	−	−	−	+	+	+
P. granulosum	L	Galactose, mannose, trace glucose	+	+	+	−	−	− (occ. w^+)	−	− or w^+
P. avidum	Generally L, occasional strain with *meso*	(i) Galactose, glucose, mannose (ii) Glucose, mannose	+	+	+	−	+	−	−	+

* See text for interpretation of tests.

Table 5. *Comparison of the properties of various subcultures of Corynebacterium parvum* ATCC 11829

For abbreviations, see Table 2.

Strain	Cell-wall sugars: Galactose	Glucose	Mannose	Serological Identification
VPI0210*	−	+	±	*Propionibacterium acnes*, type II
NCTC 10387	++	±	+	*P. granulosum*
C. parvum A	+	+	+	*P. acnes*, type I
C. parvum B	−	+	+	*P. acnes*, type II
C. parvum C	+	Tr	±	*P. granulosum*

* Results for strain 0210 taken from Johnson & Cummins (1972).

not hydrolyse aesculin; while *P. avidum* is indole- and nitrate-negative, can liquefy gelatin, ferment sucrose and maltose and, characteristically, hydrolyse aesculin. The two serological types of *P. acnes* differ also with respect to sorbitol fermentation, since about 50 % of the type I strains can attack this carbohydrate, while none of the type II strains so far tested can do so. It should be emphasized that we have had much more consistent results in fermentation and other metabolic tests when Tween 80 is added to the medium. It has been known for a long time (Fleming, 1909) that oleic acid improves the growth of the acne bacillus, and it is assumed that Tween 80 acts by supplying this factor.

As far as *Propionibacterium acnes* is concerned, the pattern of reactions given here is the same as that found by Moss, Dowell, Lewis & Schekter (1967) except that only 65 % of their strains were indole-positive. They do not appear to have included in their investigation any strains corresponding to *P. granulosum* or *P. avidum* as described here. The distinction between *P. acnes* and *P. granulosum* also agrees with that made by Voss (1970) between his *Corynebacterium acnes* group I and *C. acnes* group II. His latter group corresponds to what we have called *P. granulosum*.

The 59 strains labelled *Corynebacterium parvum* were subjected to these eight tests and the results can be seen in the right-hand part of Table 2. There is clearly excellent agreement between the results of the fermentation tests and the serological results, and this agreement gives considerable confidence in the identification of the strains. The great majority of them (52 out of 59, or 88 %) are identical with *Propionibacterium acnes* and, of the other seven, three are *P. granulosum* and three *P. avidum*. Only one strain, 6653, does not belong in the *P. acnes* group and this strain can be identified tentatively as *Actinomyces naeslundii* on the basis of fermentative tests and cell-wall composition. Strain 6627 failed to produce acid from sucrose in repeated tests. Its reactions otherwise are typical of *P. avidum* and it shows 90 % homology with DNA from 0575 which is the reference strain of *P. avidum*. Its identity with *P. avidum* can therefore scarcely be in doubt.

These results suggest clearly that *Corynebacterium parvum* should be regarded as a synonym of *Propionibacterium acnes*.

Corynebacterium parvum ATCC 11829. This organism merits particular attention since we have examined five different subcultures of it in the course of this investigation. Strain 11829 came to the ATCC from Professor H. Seeliger, Bonn, Germany, who obtained it from the Pasteur Institute at Paris, but its original number is not known. The culture of 11829 held at the Anaerobe Laboratory (VPI0210) was obtained from the ATCC but was purified here by a single colony isolation before being freeze-dried. The culture we have used is therefore descended from a single colony isolate. Other subcultures of 11829 which we have investigated are NCTC 10387 and the three colonial variants of 10387 labelled *Corynebacterium parvum* A, *C. parvum* B and *C. parvum* C. A comparison of the results obtained with these five subcultures (Table 5) reveals that at some point the culture has become mixed. In fact, it seems possible that this may have happened more than once, since three different bacteria have been identified among the five cultures examined.

Werner & Mann (1968) also isolated two different colonial types from ATCC 11829, one of which fermented sucrose, trehalose and melezitose, but was indole-, nitrate- and gelatin-negative, while the other did not ferment sucrose or melezitose, fermented trehalose weakly and was indole- and gelatin-positive. It seems likely that the former was *Propionibacterium granulosum* and the latter *P. acnes*.

We have emphasized previously the problem of cross-contamination of anaerobic coryneforms (Johnson & Cummins, 1972) and it seems that ATCC 11829 is a particularly good example of the confusion that can arise in this way. Clearly, a culture which was assumed to

be pure, but which was in fact a mixture of *Propionibacterium acnes* and *P. granulosum*, would give confusing results in fermentation tests since it would probably ferment sucrose and maltose as well as being indole-, nitrate- and gelatin-positive. On the other hand, efforts to purify it in two different laboratories by single colony isolation could well result in the isolation of *P. acnes* in one and *P. granulosum* in the other.

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