PROGRESS REPORT

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Systematic Description of Bacterial Isolants from Rigorous Environments

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DESCRIPTIVE CHARTS OF SAHARA DESERT ISOLANTS

To supplement Progress Report of March 15, 1966

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Supplement Progress Report - March 15, 1966

Of the 30 isolants from the Sahara Desert, six failed to grow. These six cultures were 294B, 294C, 296E, 297A, 297D, and 299A. Microscopic examination revealed branched mycelium representative of actinomycetes.

Three other isolants, 296C, 298B, and 299B, are also members of the actinomycetes group and await further characterization by Dr. K. C. Lu.

All the bacterial isolants are Gram positive, excluding one which is negative initially then turns positive after approximately 18 to 24 hours.

Of these Gram-positive isolants, four cultures, 293B, 293G, 295B, and 296D, are Micrococcus species.

Of the rods, eight isolants, 293A, 293F, 294F, 296A, 297B, 297C, 298A, and 298D, are Bacillus. Tentatively, 296A is Bacillus megaterium, and the remaining are Bacillus subtilis variations.

Five isolants, numbers 293C, 293E, 294A, 294E, and 296B, are soil diphtheroids typical of those described previously.

The remaining four cultures are awaiting further work. Two, 293D and 294D, are nonsporeforming plump rods with some diphtheroid characteristics. 298C is a peritrichously flagellated short plump rod--possibly a Brevibacterium. Isolant 297E is a long thin ellipsoidal rod. In young cultures it is Gram negative but after 24 hours changes to large Gram-positive ellipsoidal to coccoid forms, suggesting Azotobacter cysts. The change in Gram staining but not in morphology is characteristic of Arthrobacter. It cannot be assigned to any described species.

Summary tabulations are presented in Tables I and II attached.

TABLE I

I.	Actinomycetales	30%
II.	Eubacteriales	70%
	A. Cocci	13%
	B. Rods	57%
	1. *Bacillus*	27%
	2. Soil diphtheroids	17%
	3. Other	13%

a. 297E, Gram negative, ellipsoidal, to Gram positive coccoid and ellipsoidal.
b. 298C, Gram positive, rod, peritrichous, possibly *Brevibacterium*.
c. 293D and 294D, questionable whether cocci or rods.

TABLE II

293A	*Bacillus*	296B	Soil diphtheroid
293B	*Micrococcus*	296C	actinomycete
293C	Soil diphtheroid	296D	*Micrococcus*
293D	Soil diphtheroid?	296E	actinomycete
293E	Soil diphtheroid	297A	actinomycete
293F	*Bacillus*	297B	*Bacillus*
293G	*Micrococcus*	297C	*Bacillus*
294A	Soil diphtheroid	297D	actinomycete
294B	actinomycete	297E	*Arthrobacter*? *Azotobacter*?
294C	actinomycete	298A	*Bacillus*
294D	Soil diphtheroid?	298B	actinomycete
294E	Soil diphtheroid	298C	*Brevibacterium*?
294F	*Bacillus*	298D	*Bacillus*
295B	*Micrococcus*	299A	actinomycete
296A	*Bacillus*	299B	actinomycete

Descriptive charts for 19 bacterial isolants from the Sahara Desert are presented herewith. These charts are not quite complete, lacking results for size of Bacillus subtilis spores and of tests for alkaline pH tolerance, nitrate reduction, indol, and methyl red transformation. Results are pending clarification of anomalous reactions; these are not critical to identification of the bacteria concerned but will be completed to fulfill the record.

The identified isolants are as follows:

293A, 293F, 294F, 297B, 297C, 298A are Bacillus subtilis. Differences in color are the main variations. 298D is B. subtilis var aterrimus.

296A is Bacillus megaterium.

293B, 293G, 294A, 294E are soil diphtheroids. All are in the small group and are very similar except 294A which is longer and hydrolyzes starch but not gelatin.

298C apparently is a Brevibacterium, but cannot be identified with any described species.

293D and 294D are pleomorphic, appearing generally as coccoid rods; typical rods also are formed. The affinities are uncertain.

Of the 30 original isolants submitted, the remaining 11 include six that are dead, two show inadequate growth, and three are Actinomycetales, which have been entrusted to Dr. K. C. Lu for identification.

OREGON STATE UNIVERSITY
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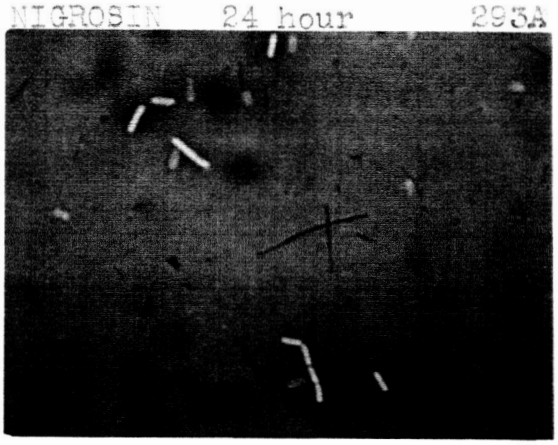
Descriptive Chart

293A (code number)	Trypticase Soy Agar (medium)	Sahara Desert (source)
Bacillus subtilis (name of organism)	28°C. (temperature)	Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS



MORPHOLOGY:
Form: rods, ends rounded, *filaments, cocci, spirals, branching* _____.
Size: *average* – 0.67 x 3.11μ
range – 0.59-0.81 x
Irregular forms: 206 -3.68μ

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

nigrosin - 24↑

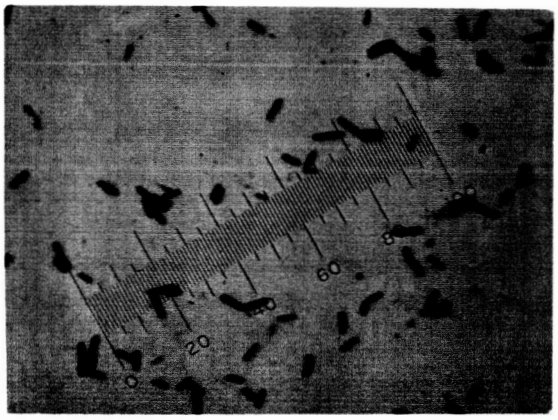
PASTEURIZATION SURVIVAL (85°C, 10 minutes): positive
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

spore -72 ↑

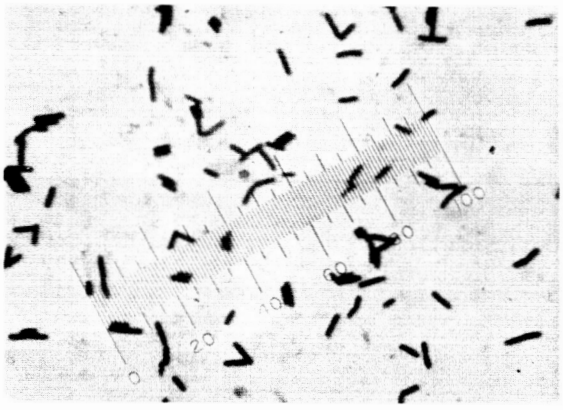
MOTILITY: + age 18 hr.
Flagella: peritrichous

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

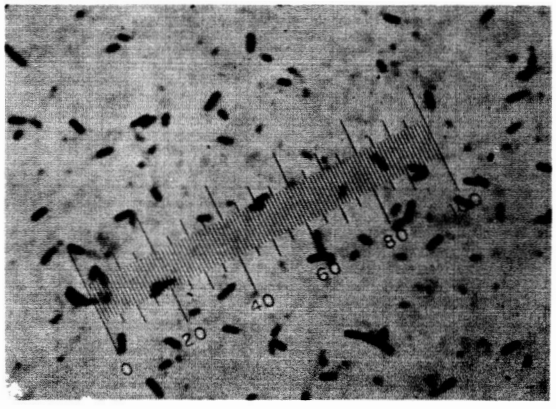
Gram - 18 →



24 ↓



48 →



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 HOUR

Amount of growth: abundant, moderate, scant.

Form: aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.

Consistency: adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.

AGAR COLONIES: age 1-7 DAYS

Macroscopic

Size: 2 mm.

Shape: filamentous, irregular, oval, puntiform, round.

Elevation: beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.

Topography: contoured, rough, smooth, striated, wrinkled.

Habit: compact, spreading.

Microscopic (100x)

Margin: Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.

Internal structure: amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.

Optical properties

Appearance by reflected light: dull, fluorescent, glistening, iridescent, opalescent.

Appearance by transmitted light: opaque, translucent, transparent.

Medium: blackened, blued, browned, grayed, greened, yellowed, unchanged.

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Bamboo	2fb
Potato slant	Dk. Brown	3nl
Fat agar:	Lt. Mustard Tan	2ie

NUTRIENT BROTH: age 24 HOUR

Amount of growth: abundant, moderate, scant.

Surface growth: none, flocculent, membranous, pellicle, ring.

Subsurface growth: none, granular, turbid.

Sediment: none, compact, flaky, flocculent, granular, viscid.

Odor: resembling Fecal.

GELATIN STAB: age 48 hr. - 4 da

Liquefaction: none, crateriform, infundibuliform, napiform, saccate, stratiform. ↑ (4da)

Rate: fast, moderate, slow.

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth: smooth: glistening.

Fat agar: abu: compact: glistening: 2ie

Glucose-nitrate agar: moderate; thin; growth.

Glucose-nutrient agar - growth better than on nutrient agar.

Potato Slant: potato browned; growth tight wrinkles; dull; abundant.

Tyrosine Agar - no pigment.

DNA

G:C _____

G+C _____ moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: aerobic, anaerobic, facultative (microaerophilic)

CATALASE: positive, negative.

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (50°C. +)

SOLE CARBON SOURCE: age _____

Glucose: positive, negative.	48 hr.
Sucrose: positive, negative.	
Xylose: positive, negative.	2 da.
Citrate: positive, negative.	3 da.
NH_4^+ AS SOLE NITROGEN SOURCE: positive, negative.	2 da.

REDUCTIONS:

Nitrate: NO_2^- ____, NH_4^+ ____, gas ____, negative.	
Methylene blue: positive, negative.	48 hr.
Selenite: positive, negative. slight	18 da.
Tellurite: positive, negative. slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: acid O&C, alkaline ____, neutral, gas.	24 hr.
Sucrose: acid ____, alkaline O, neutral, gas.	6 da.
Lactose: acid O&C alkaline ____, neutral, gas.	24 hr.
Xylose: acid O.C alkaline O neutral, gas. ac. C neut. O. 24 h. 48 h.	49 da.
Mannitol: acid O, alkaline, neutral, gas.	24 hr.

HYDROLYSIS:

Gelatin: positive, negative.	5 da
Casein: positive, negative.	24 hr.
Fat: positive, negative.	36 da.
Starch: positive, negative.	2 da.
Cellulose: positive, negative.	2 mo.
Urea: positive, negative.	37 da.

TOLERANCES:

Salt: 2%—positive, negative.	2 da
7%—positive, negative.	
10%—positive, negative.	
pH: acid 6.0, alkaline ____.	2 da

LITMUS MILK REACTIONS:

Reaction: acid, alkaline, neutral.	20 da.
Curd: acid, alkaline, absent, gas.	50 da.
Peptionization: positive, negative.	30 da.
Reduction: positive, negative.	9 da.

OTHER REACTIONS:

H_2S from Lead acetate: positive, negative.	8 da.
NH_4^+ from peptone: positive, negative.	5 da.
Acetylmethylcarbinol: positive, negative.	2 da.
Indol: positive, negative.	
Methyl red: positive, negative.	

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Descriptive Chart

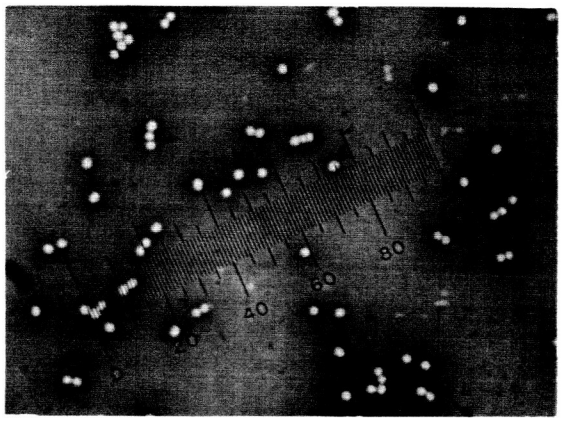
293 B (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Micrococcus roseus (name of organism) | 28°C (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGY:
Form: *rods, ends*_____,
filaments, cocci, spirals,
branching _____.
Size: *average* – 1.10 μ
range – 0.95 - 1.22 μ
Irregular forms:
staph

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 95% positive



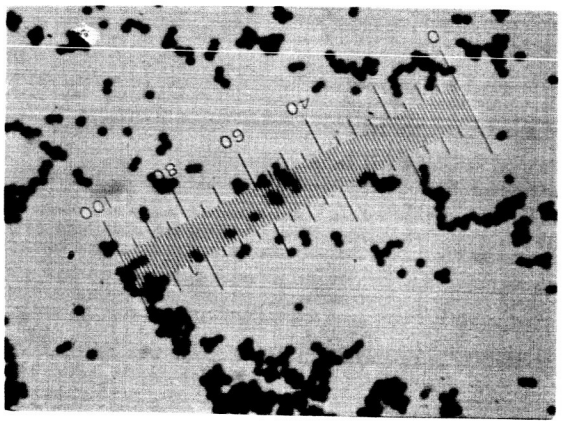
NIGROSIN - 24 ↑

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

MOTILITY: – age 18 - 48 hr.
Flagella: –

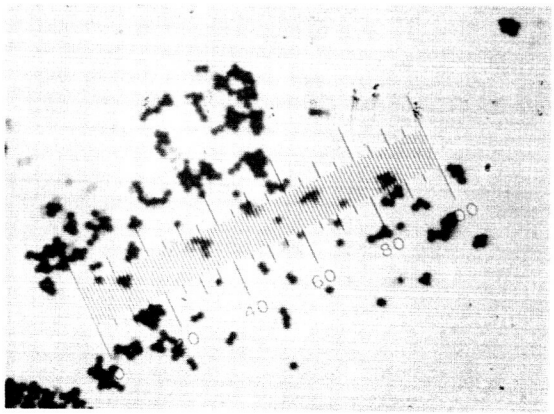
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

GRAM 18 →



24 ↓

48 →



II. *CULTURAL CHARACTERISTICS*

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Apricot	4ia
Potato slant Eat agar:	Orange	sla

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 28 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: very slight.

Fat agar: abu: compact: glistening: sla

Glucose-nitrate agar: growth scant, pearly white.

Glucose-nutrient agar: better growth than on nutrient agar.

DNA

G:C

G+C moles %

III. *PHYSIOLOGICAL CHARACTERISTICS*

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. ++, 20°C. +, 28°C. ++, 37° ++, 45°C. —, 55°C. —.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2 da
Citrate: *positive, negative.*	8 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	3 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, *gas* ___, *negative.*	51 da.
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	18 da.
Tellurite: *positive, negative.*	14 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da.
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*	6 da.
Lactose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da.
Xylose: *acid* O, *alkaline* ___, *neutral, gas.*	6 da.
Mannitol: *acid* O, *alkaline, neutral, gas.* sl.	49 da.

HYDROLYSIS:

Gelatin: *positive, negative.* slight	5 da
Casein: *positive, negative.*	24 da.
Fat: *positive, negative.*	36 da.
Starch: *positive, negative.*	20 da.
Cellulose: *positive, negative.*	60 da
Urea: *positive, negative.*	37 da.

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* ___.	2 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_3^+ from peptone: *positive, negative.*	5 da
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

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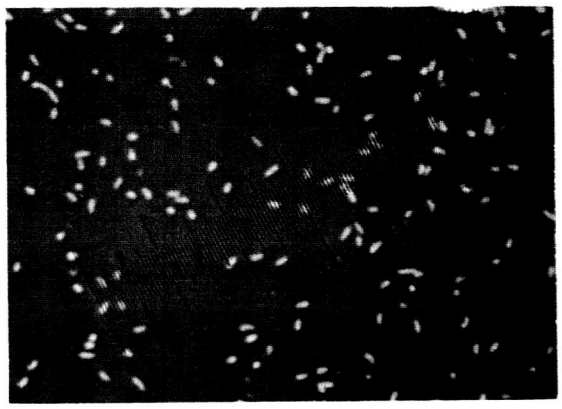
Descriptive Chart

293C (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

soil diphtheroid (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS



NIGROSIN - 24 ↑

MORPHOLOGY:

Form: ~~rods~~, ends pointed - RNdd
filaments, cocci, spirals,
branching _____.

Size: average – 0.50 × 1.21 μ
range – 0.40 - 0.69 × 0.49 - 2.58 μ

Irregular forms: wedges; coccoid; clubs (angular)

GRAM REACTION:

18 hrs: 50 % positive
24 hrs: 50 % positive
48 hrs: 50 % positive

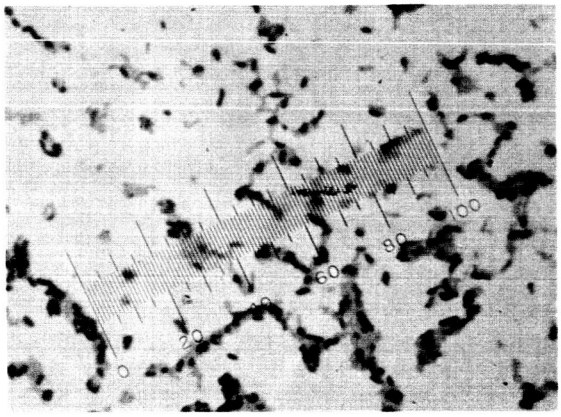
PASTEURIZATION SURVIVAL (85°C, 10 minutes): Negative

Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

MOTILITY: – age 18-48 hr.
Flagella: –

OTHER STAINS:

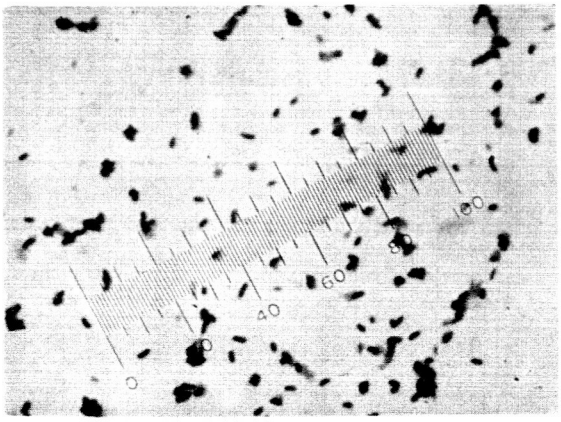
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:



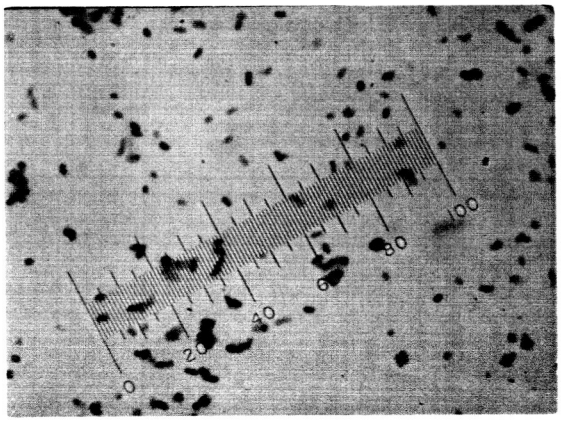
GRAM

18 →

24 ↓



48 →



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 0.5 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt. Wheat	2ca
Potato slant Eat Agar	Maize	2hb

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* Sl.

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling rotten cabbage

GELATIN STAB: age 19 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: abundant, smooth, glistening.

Fat agar: abundant: compact: glistening.

Glucose-nitrate agar: no growth

Glucose-nutrient agar: poor growth compared to nutrient agar.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, (microaerophilic.)*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. −, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	3 da
Citrate: *positive, negative.*	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.* slight	2 da

REDUCTIONS:

Nitrate: NO_2^-, NH_4^+, *gas*, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	18 da.
Tellurite: *positive, negative.*	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid*, *alkaline*, *neutral, gas.*	49 da.
Sucrose: *acid*, *alkaline* O, *neutral, gas.*	6 da.
Lactose: *acid*, *alkaline* O, *neutral, gas.*	49 da.
Xylose: *acid*, *alkaline*, *neutral, gas.*	49 da.
Mannitol: *acid*, *alkaline* O, *neutral, gas.*	48 hr.

HYDROLYSIS:

Gelatin: *positive, negative.* slight	5 da
Casein: *positive, negative.* slight	10 da
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	20 da
Cellulose: *positive, negative.*	60 da.
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline*	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.* very slight	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_4^+ from peptone: *positive, negative.* sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

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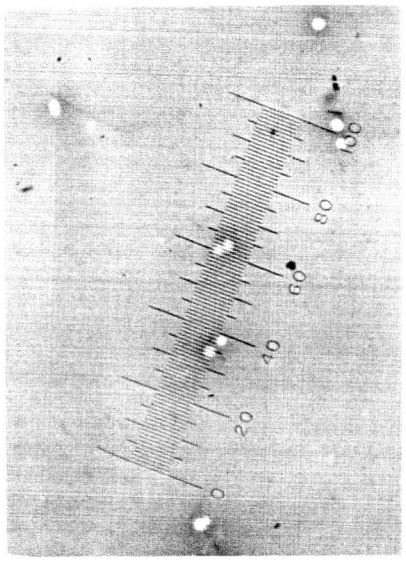
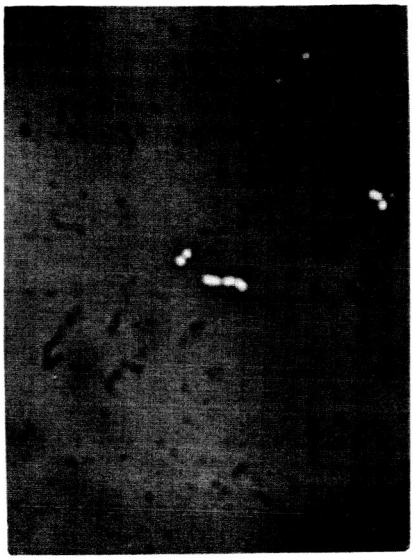
Descriptive Chart

293 D (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

(name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS





MORPHOLOGY:

Form: *rods, ends* _____, *filaments, cocci, spirals, branching* _____.

Size: *average* –
range –

Irregular forms: COCCI

GRAM REACTION:

18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL negative (85°C, 10 minu

Sporangia: *none, rods, spindles, elliptical, clavat*

Endospores: *swollen, not swollen,.*

Position: *central to excentric, terminal, subterminal.* NIGROSIN · 24 ↑

Shape: *spherical, ellipsoidal, cylindrical, oval.*

size: average –
range –

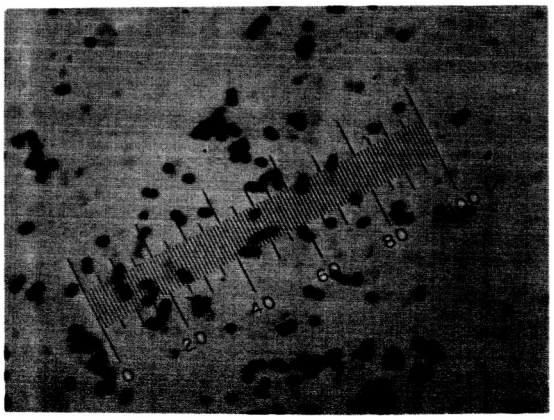
MOTILITY: – age 18-48 hr.

Flagella: –

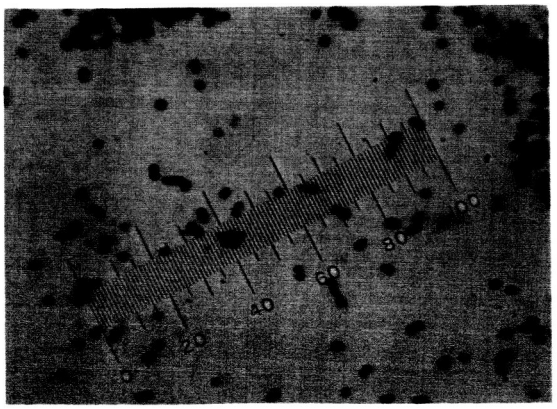
OTHER STAINS:

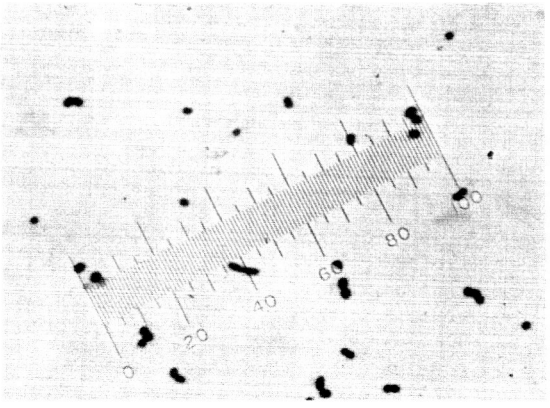
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

GRAM 18 →



24 ↓ 48 ↘





II. *CULTURAL CHARACTERISTICS*

AGAR STROKE: age 24hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Melon Yellow	3ga
Potato slant Eat Agar	Butterscotch	3lc

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* Sl.

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling Fecal.

GELATIN STAB: age 28 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: no growth.

Fat agar: abundant: spreading: glistening.

Glucose-nitrate agar: no growth.

Glucose nutrient agar: poor growth compared to nutrient agar.

DNA

G:C _____

G+C _____ moles %

III. *PHYSIOLOGICAL CHARACTERISTICS*

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24hr

Growth at 10°C. −, 20°C. +, 28°C ++, 37 ++, 45°C. −, 55°C. −.

SOLE CARBON SOURCE: age _____

Glucose: *positive, negative.*	3 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	3 da
Citrate: *positive, negative.*	8 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	3 da

REDUCTIONS:

Nitrate: NO_2^- ____, NH_4^+ ____, *gas* ____, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	18 da.
Tellurite: *positive, negative.*	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da.
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*	24 hr.
Lactose: *acid* ___, *alkaline* O, *neutral, gas.*	49 da.
Xylose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da.
Mannitol: *acid* ___, *alkaline* O *neutral, gas.*	49 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da
Casein: *positive, negative.*	22 da
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	20 da
Cellulose: *positive, negative.*	2 mo.
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* _____.	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	9 da.
NH_4^+ from peptone: *positive, negative.* Sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

293 E (code number)	Trypticase Soy Agar (medium)	Sahara Desert (source)
soil diphtheroid (name of organism)	28°C. (temperature)	Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGY:
Form: *rods*, *ends* pointed, *filaments, cocci, spirals, branching* _____.
Size: *average* – 0.58 x 1.45μ
range – 0.47-0.66 x 1.07-2.29μ
Irregular forms: coccoid: wedge

NIGROSIN -24 ↑

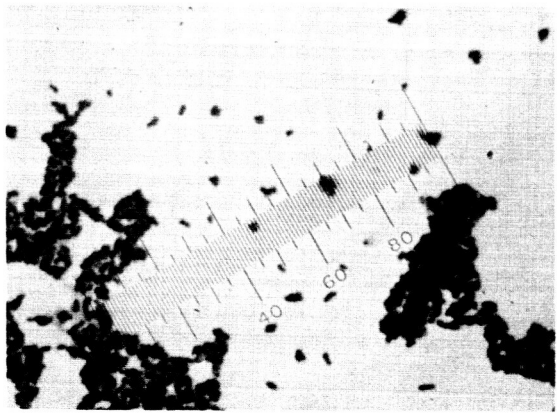
GRAM REACTION:
18 hrs: 100% - positive
24 hrs: 100% - positive
48 hrs: 100% - positive

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

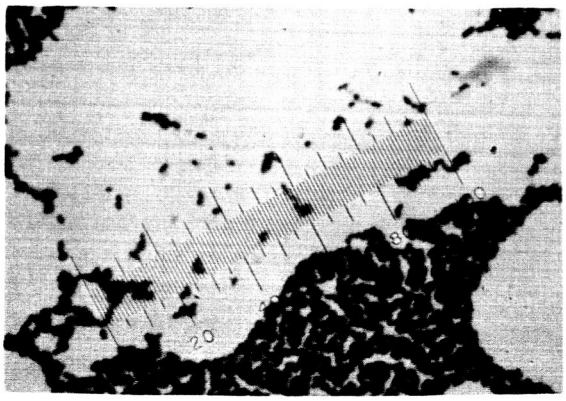
MOTILITY: – age 18 -48hr.
Flagella: –

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

GRAM -18 →



24 ↓



48 →

II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Bamboo	2fb
Potato slant		
Eat agar	Honey Gold	2ie

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* sl.

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling Fecal.

GELATIN STAB: age 19 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: moderate, smooth, glistening.

Fat agar: abundant; compact; glistening.

Glucose-nitrate agar: no growth

Glucose-nutrient agar- growth better than on nutrient agar.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24hr.

Growth at 10°C. +s., 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2 da
Citrate: *positive, negative.*	2 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	3 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, *gas* ___, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	5 da.
Tellurite: *positive, negative.*	14 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*	48 hr.
Lactose: *acid* O, *alkaline* ___, *neutral, gas.* sl.	49 da.
Xylose: *acid* ___, *alkaline* O, *neutral, gas.*	24 hr.
Mannitol: *acid* O, *alkaline, neutral, gas.* sl.	49 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da
Casein: *positive, negative.* slight	10 da
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	20 da
Cellulose: *positive, negative.*	60 da
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* ___	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	9 da.
NH_4^+ from peptone: *positive, negative.* sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
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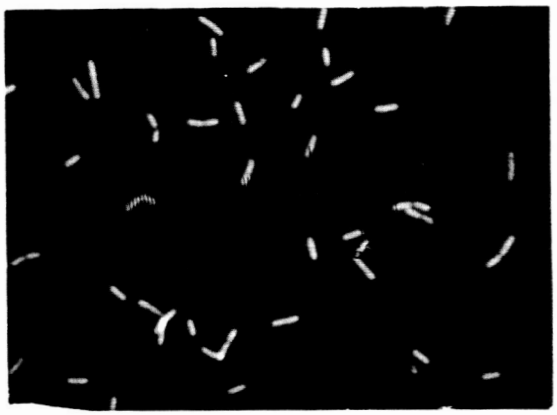
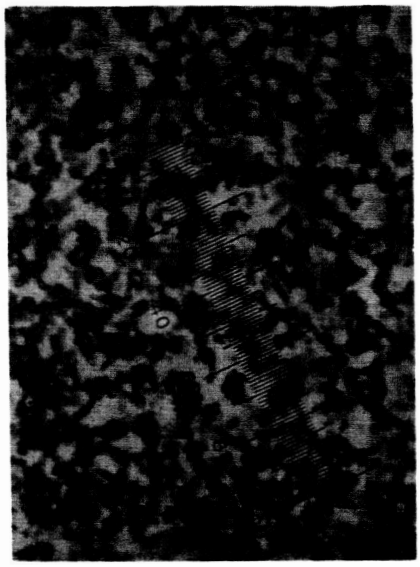
Descriptive Chart

293 2 (code number)	Trypticase Soy Agar (medium)	Sahara Desert (source)
Bacillus subtilis (name of organism)	28°C. (temperature)	Dr. W. B. Boller (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGY:
Form: rods, ends rounded
filaments, cocci, spirals,
branching _____.
Size: average – 0.67 x 3.00μ
range – 0.56 - 0.76 x
Irregular forms: 2.42 - 5.47μ





GRAM REACTION:
18 hrs: 95 % positive
24 hrs: 50 % positive
48 hrs: 0 % positive

PASTEURIZATION SURVIVAL (85°C, 10 minutes): positive

NIGROSIN -24↑

Sporangia: n[illegible] rods, spindles, elliptical, clavate, drumstick.
Endospores: swollen, not swollen.
Position: central to excentric, terminal, subterminal.
Shape: spherical, ellipsoidal, culindrical, oval.
size: average –
range –

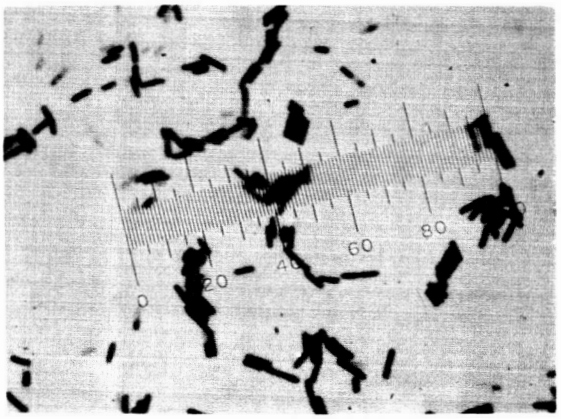
↑SPORE -72

MOTILITY: + age 18hr.
Flagella: peritrichous

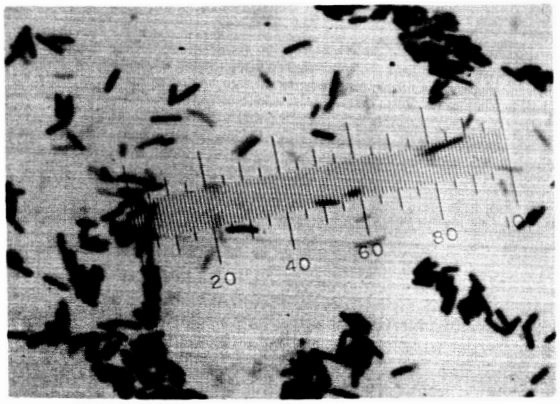
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

GRAM

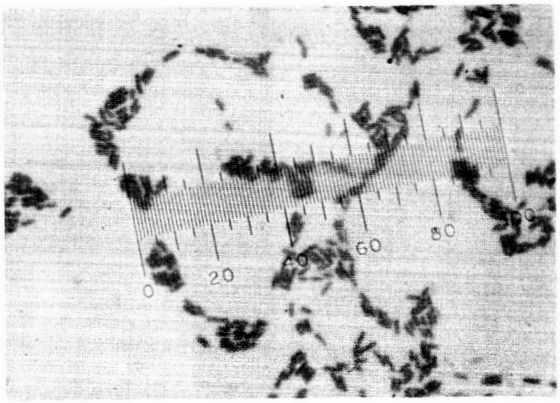
8 →



24↓



48 →



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: abundant, moderate, scant.

Form: aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.

Consistency: adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: filamentous, irregular, oval, puntiform, round.

Elevation: beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.

Topography: contoured, rough, smooth, striated, wrinkled.

Habit: compact, spreading.

Microscopic (100x)

Margin: Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.

Internal structure: amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.

Optical properties

Appearance by reflected light: dull, fluorescent, glistening, iridescent, opalescent.

Appearance by transmitted light: opaque, translucent, transparent.

Medium: blackened, blued, browned, grayed, greened, yellowed, unchanged.

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	lt. Ivory	2ca
Potato slant	Camel	3ie
Fat agar	Lt. Mustard Tan	2ie

NUTRIENT BROTH: age 24 hr.

Amount of growth: abundant, moderate, scant.

Surface growth: none, flocculent, membranous, pellicle, ring.

Subsurface growth: none, granular, turbid. sl.

Sediment: none, compact, flaky, flocculent, granular, viscid.

Odor: resembling fecal.

GELATIN STAB: age 48 hr. 4 da.

Liquefaction: none, crateriform, infundibuliform, napiform, saccate, stratiform. 14 da

Rate: fast, moderate, slow.

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth : dull : rough.

Fat agar: abundant : spreading glistening.

Glucose-nitrate agar: growth, moderate, thin.

Glucose-nutrient agar : growth better than on nutrient agar.

Potato Slant: potato lt. browned : growth tight wrinkles ; dull ; abundant.

Tyrosine agar - no pigment.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: aerobic, anaerobic, facultative, (microaerophilic.)

CATALASE: positive, negative. weakly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (50°C ±)

SOLE CARBON SOURCE: age

Glucose: positive, negative.	2 da
Sucrose: positive, negative.	
Xylose: positive, negative.	2 da
Citrate: positive, negative.	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: positive, negative.	2 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, gas ___, negative.	51 da.
Methylene blue: positive, negative.	48 hr.
Selenite: positive, negative. slight	18 da.
Tellurite: positive, negative. slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: acid + gas alkaline ___, neutral, gas.	24 hr.
Sucrose: acid ___, alkaline O, neutral, gas.	24 hr.
Lactose: acid + alkaline ___, neutral, gas.	24 hr.
Xylose: acid O, alkaline ___, neutral, gas.	49 da.
Mannitol: acid O, alkaline, neutral, gas.	6 da.

HYDROLYSIS:

Gelatin: positive, negative.	5 da
Casein: positive, negative.	24 hr.
Fat: positive, negative.	36 da
Starch: positive, negative.	48 hr
Cellulose: positive, negative.	2 mo.
Urea: positive, negative.	37 da

TOLERANCES:

Salt: 2%—positive, negative.	3 da
7%—positive, negative.	
10%—positive, negative.	
pH: acid 6.0, alkaline ___.	3 da

LITMUS MILK REACTIONS:

Reaction: acid, alkaline, neutral.	50 da.
Curd: acid, alkaline, absent, gas.	50 da.
Peptionization: positive, negative.	5 da
Reduction: positive, negative.	3 da.

OTHER REACTIONS:

H_2S from Lead acetate ___: positive, negative.	8 da
NH_3 from peptone: positive, negative.	5 da
Acetylmethylcarbinol: positive, negative.	7 da
Indol: positive, negative.	
Methyl red: positive, negative.	

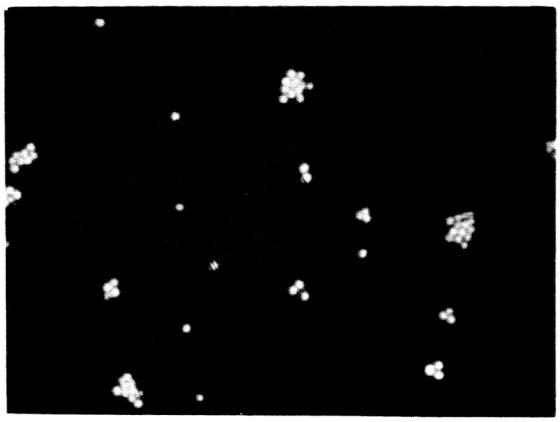
OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

293 G (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Micrococcus roseus (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS



NIGROSIN - 24 ↑

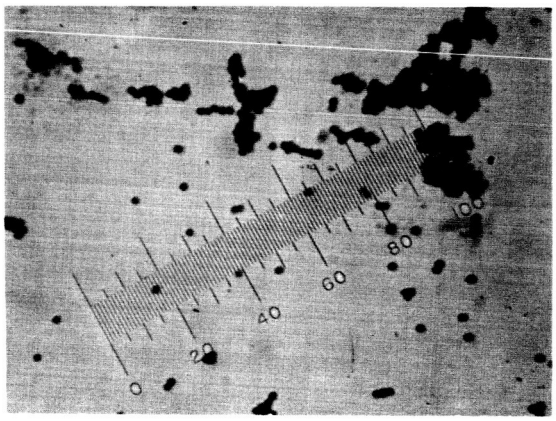
MORPHOLOGY:
Form: *rods, ends*_____,
filaments, cocci, spirals,
branching _____.
Size: *average* – 0.87μ
range – 0.68 - 1.17μ
Irregular forms:

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

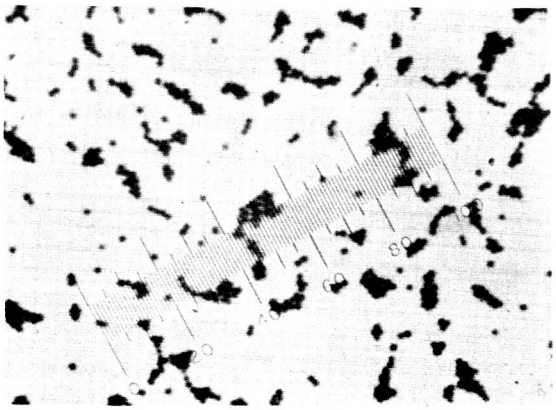
MOTILITY: – age 18 - 48hr.
Flagella: –

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:



GRAM - 18 →

24 ↓



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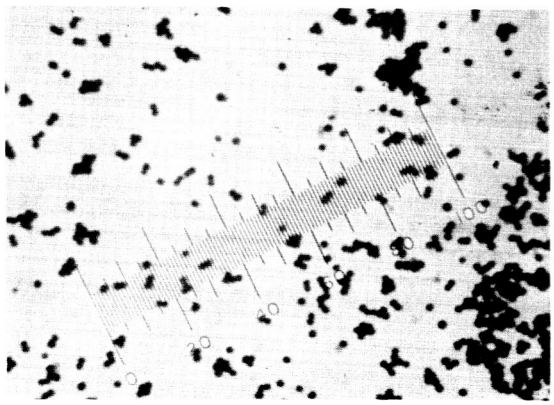


16

2984

II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: abundant, moderate, scant.

Form: aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.

Consistency: adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: filamentous, irregular, oval, puntiform, round.

Elevation: beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.

Topography: contoured, rough, smooth, striated, wrinkled.

Habit: compact, spreading.

Microscopic (100x)

Margin: Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.

Internal structure: amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.

Optical properties

Appearance by reflected light: dull, fluorescent, glistening, iridescent, opalescent.

Appearance by transmitted light: opaque, translucent, transparent.

Medium: blackened, blued, browned, grayed, greened, yellowed, unchanged.

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Brite Coral Rose	6ia
Potato slant	Burnt Orange	5pc
Fat agar	Chinese Red	6pc

NUTRIENT BROTH: age 24 hr.

Amount of growth: abundant, moderate, scant.

Surface growth: none, flocculent, membranous, pellicle, ring.

Subsurface growth: none, granular, turbid.

Sediment: none, compact, flaky, flocculent, granular, viscid.

Odor: resembling —

GELATIN STAB: age 28 da.

Liquefaction: none, crateriform, infundibuliform, napiform, saccate, stratiform.

Rate: fast, moderate, slow.

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: abundant, smooth, glistening.

Fat agar: abundant; compact; glistening.

Glucose-nitrate agar: no growth.

Glucose-nutrient agar - growth better than on nutrient agar.

Potato slant: growth smooth; glistening; moderate.

DNA

G:C _____

G+C _____ moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: aerobic, anaerobic, facultative, (microaerophilic.) 1/8" wide microaerophilic ring.

CATALASE: positive, negative. strongly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. —, 20°C. +, 28°C. ++, 37° ++, 45°C. ____, 55°C. —.

SOLE CARBON SOURCE: age _____

Glucose: positive, negative.	2 da
Sucrose: positive, negative.	
Xylose: positive, negative.	2 da
Citrate: positive, negative.	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: positive, negative.	2 da

REDUCTIONS:

Nitrate: NO_2^- ____, NH_4^+ ____, gas ____, negative.	51 da.
Methylene blue: positive, negative.	48 hr.
Selenite: positive, negative.	18 da.
Tellurite: positive, negative. very slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: acid ____, alkaline ____, neutral, gas.	49 da.
Sucrose: acid ____, alkaline O, neutral, gas.	48 hr.
Lactose: acid O, alkaline ____, neutral, gas. sl.	49 da.
Xylose: acid O, alkaline ____, neutral, gas. sl.	49 da.
Mannitol: acid O, alkaline, neutral, gas.	6 da.

HYDROLYSIS:

Gelatin: positive, negative.	22 da.
Casein: positive, negative.	22 da.
Fat: positive, negative.	36 da
Starch: positive, negative.	6 da
Cellulose: positive, negative.	60 da
Urea: positive, negative.	37 da

TOLERANCES:

Salt: 2%—positive, negative.	24 hr.
7%—positive, negative.	
10%—positive, negative.	
pH: acid 6.5, alkaline ____.	3 da

LITMUS MILK REACTIONS:

Reaction: acid, alkaline, neutral.	50 da.
Curd: acid, alkaline, absent, gas.	50 da.
Peptionization: positive, negative.	50 da.
Reduction: positive, negative.	30 da.

OTHER REACTIONS:

H_2S from Lead acetate: positive, negative.	9 da
NH_4^+ from peptone: positive, negative. sl.	5 da
Acetylmethylcarbinol: positive, negative.	20 da.
Indol: positive, negative.	____
Methyl red: positive, negative.	____

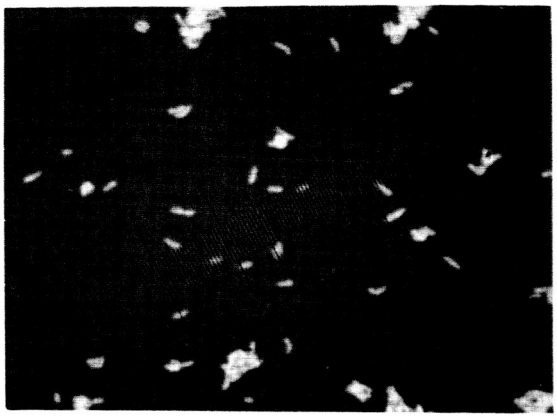
OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

294 A (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

soil diphtheroid (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. *STAINING & MORPHOLOGICAL CHARACTERISTICS*



NIGROSIN -24 ↑

MORPHOLOGY:
Form: *rods, ends* pointed,
filaments, cocci, spirals,
branching _____.
Size: *average* – 0.50 x 2.17 μ
range – 0.40-0.62 x 1.08-2.58 μ
Irregular forms: wedges: clubs: coccoid.

GRAM REACTION:
18 hrs: 100 % positive
24 hrs: 100 % positive
48 hrs: 100 % positive

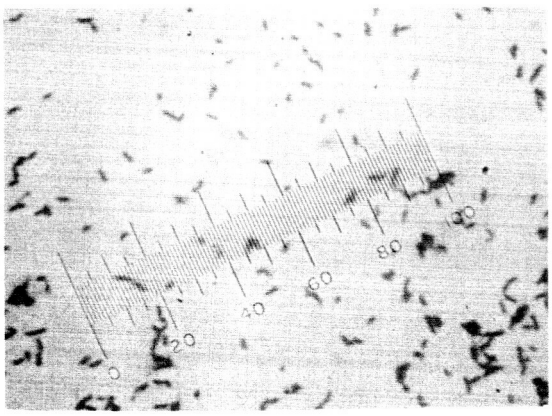
PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

MOTILITY: – age 18-48 hr.
Flagella: –

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

Gram 18 →

24 ↓ 48 ↓



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Bamboo	2fb
Potato slant Fat agar	Mustard Gold	2po

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 28 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: moderate, smooth, glistening.

Fat agar: abundant: compact: glistening.

Glucose-nitrate agar: no growth.

Glucose nutrient agar - growth better than on nutrient agar.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. +s, 20°C. +, 28°C. ++, 37° ++, 45°C. −, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da.
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	3 da
Citrate: *positive, negative.*	8 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.* sl.	3 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, *gas* ___, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	5 da.
Tellurite: *positive, negative.*	14 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* O, *neutral, gas.*	6 da.
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*	48 hr.
Lactose: *acid* ___, *alkaline* O, *neutral, gas.*	24 hr.
Xylose: *acid* ___, *alkaline* O, *neutral, gas.*	48 hr.
Mannitol: *acid* ___, *alkaline* O, *neutral, gas.*	48 hr.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da
Casein: *positive, negative.*	10 da
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	48 hr
Cellulose: *positive, negative.*	2 mo
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	24 hr.
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* ___.	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	20 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	30 da.

OTHER REACTIONS:

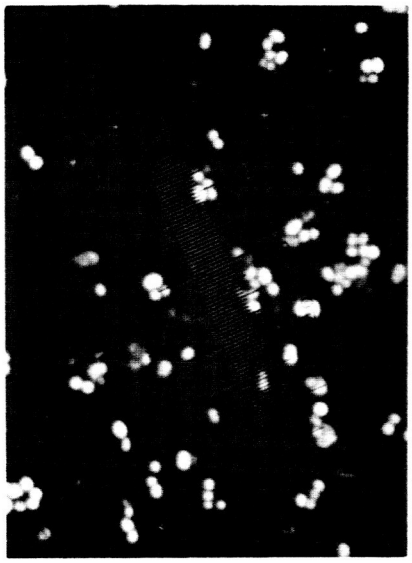
H_2S from Lead acetate: *positive, negative.*	8 da
NH_4^+ from peptone: *positive, negative.* sl.	5 da
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

294 D	Tryptcase Soy Agar	Sahara Desert
(code number)	(medium)	(source)
	28°C.	Dr. W. Bollen
(name of organism)	(temperature)	(studied by)

I. *STAINING & MORPHOLOGICAL CHARACTERISTICS*



MORPHOLOGY:
Form: *rods, ends* _____,
filaments, cocci, spirals,
branching _____.
Size: *average* –
range –
Irregular forms:

GRAM REACTION:
18 hrs: 100 % positive
24 hrs: 100 % positive
48 hrs: 100 % positive

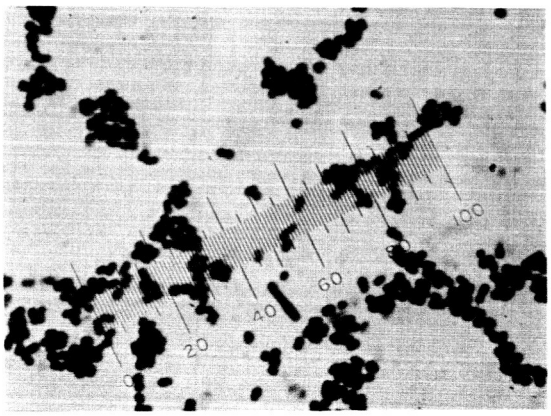
PASTEURIZATION SURVIVAL negative (85°C, 10 min)
Sporangia: *none, rods, spindles, elliptical, clava*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

NIGROSIN ·24 ↑

MOTILITY: – age 18 - 48 hr.
Flagella: –

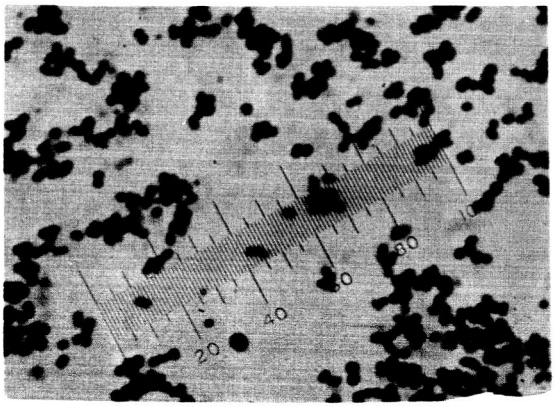
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

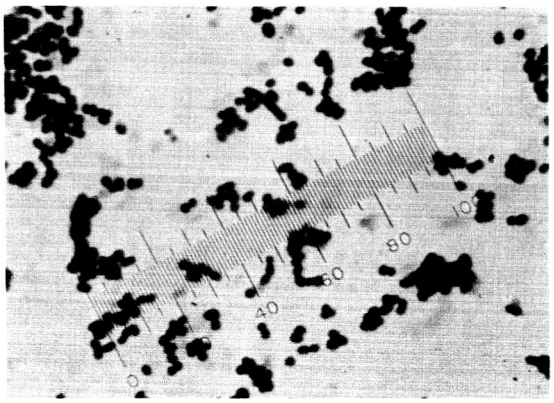
GRAM 18 →



24 ↓

48 →





II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 3 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt. Amber	3lc
Potato slant - n.g.		
Fat agar:	Orange Rust	4pe

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* sl.

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling Fecal.

GELATIN STAB: age 28 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: no growth.

Fat agar: abundant : compact : glistening.

Glucose-nitrate agar: no growth.

Glucose nutrient agar - growth not as good as on nutrient agar.

Potato slant: no growth.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24hr

Growth at 10°C. +s, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	3 da
Citrate: *positive, negative.*	8 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	3 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, *gas* ___, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	18 da.
Tellurite: *positive, negative.* very slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da
Sucrose: *acid* ___, *alkaline* 0, *neutral, gas.*	48 hr.
Lactose: *acid* ___, *alkaline* 0, *neutral, gas.*	48 hr.
Xylose: *acid* ___, *alkaline* ___, *neutral, gas.*	49 da.
Mannitol: *acid* ___, *alkaline, neutral, gas.*	49 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da
Casein: *positive, negative.*	22 da.
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	20 da
Cellulose: *positive, negative.*	2 mo.
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da.
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* ___	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_3^+ from peptone: *positive, negative.* sl.	5 da
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

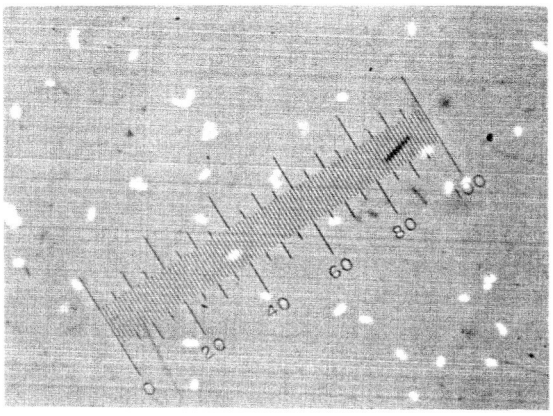
Descriptive Chart

294 E (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

soil diphtheroid (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

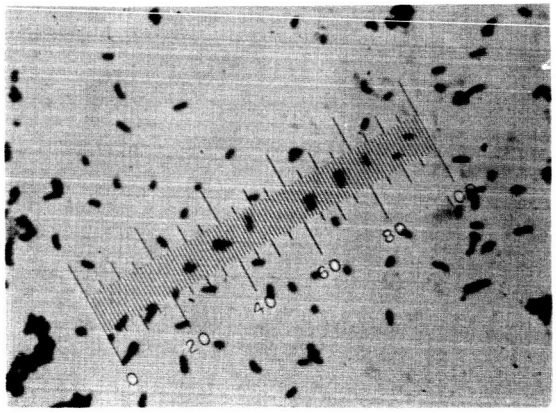
MORPHOLOGY:
Form: *rods, ends* pointed,
filaments, cocci, spirals,
branching _____.
Size: *average* – 0.59 × 1.23 μ
range – 0.40 - 0.79 × 0.75 - 1.53 μ
Irregular forms: coccoid.



NIGROSIN - 24 ↑

GRAM REaCTION:
18 hrs: 100 % positive
24 hrs: 100 % positive
48 hrs: 95 % positive

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

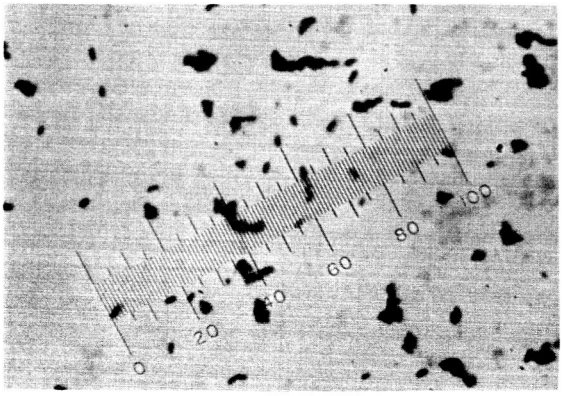


MOTILITY: – age 18 - 48 hr
Flagella: –

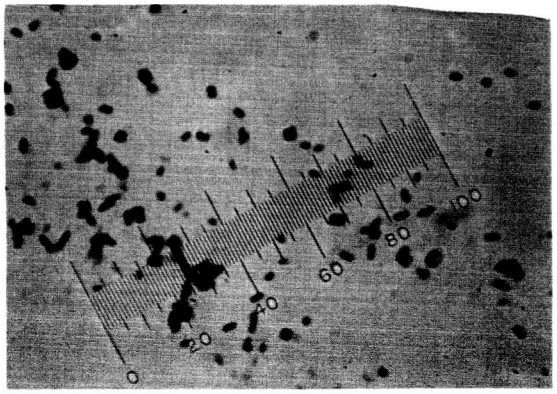
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

GRAM - 18 →

24 ↓



48 ↓



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 1 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Squash Yellow	2 ia
Potato slant		
Fat agar	Amber	3pc

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 1da. - 19da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform* 19da.

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: moderate, smooth, glistening.

Fat agar: abundant; compact; glistening

Glucose-nitrate agar: growth. moderate. pearly white.

Glucose-nutrient agar - growth better than on nutrient agar.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24hr.

Growth at 10°C. ++, 20°C. +, 28°C. ++, 37° ++, 45°C. −, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.* 2 da

Sucrose: *positive, negative.*

Xylose: *positive, negative.* 2 da

Citrate: *positive, negative.* 8 da

NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.* 2 da.

REDUCTIONS:

Nitrate: NO_2^-, NH_4^+, *gas*, *negative.*

Methylene blue: *positive, negative.* 48 hr.

Selenite: *positive, negative.* 18 da.

Tellurite: *positive, negative.* 14 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* O, *alkaline*, *neutral, gas* (dye red) 49 da.

Sucrose: *acid*, *alkaline*, *neutral, gas.* 24 hr.

Lactose: *acid* O, *alkaline* O, *neutral, gas* (dye red) 6 da

Xylose: *acid*, *alkaline* O, *neutral, gas* (dye red) 6 da.

Mannitol: *acid* O, *alkaline, neutral, gas* (dye red) 14 da.

HYDROLYSIS:

Gelatin: *positive, negative.* 5 da

Casein: *positive, negative.* 10 da

Fat: *positive, negative.* 36 da

Starch: *positive, negative.* 20 da

Cellulose: *positive, negative.* 60 da

Urea: *positive, negative.* 37 da

TOLERANCES:

Salt: 2%—*positive, negative.* 9 da

7%—*positive, negative.*

10%—*positive, negative.*

pH: *acid* 6.5, *alkaline* 3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.* 14 da.

Curd: *acid, alkaline, absent, gas.* 50 da.

Peptionization: *positive, negative.* 30 da.

Reduction: *positive, negative.* 50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.* 8 da

NH_3 from peptone: *positive, negative.* sl. 5 da.

Acetylmethylcarbinol: *positive, negative.* 20 da.

Indol: *positive, negative.*

Methyl red: *positive, negative.*

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

294 J (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Bacillus subtilis (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGY:
Form: rods, ends Rounded, filaments, cocci, spirals, branching _____.
Size: average – 0.68 × 2.72μ
range – 0.55 - 0.79 × 1.58 - 3.51μ
Irregular forms:

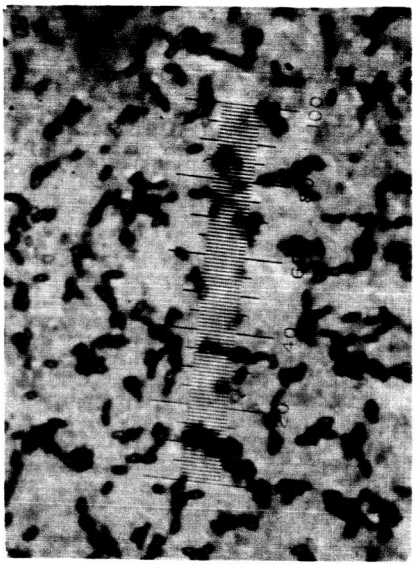
GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 min) positive
Sporangia: none, rods, spindles, elliptical, clav
Endospores: swollen, not swollen,.
Position: central to excentric, terminal, subterminal.
Shape: spherical, ellipsoidal, (cylindrical,) oval.
size: average – 1.06 × 1.72μ
range – 0.89 - 1.36 × 1.41 - 2.18μ

MOTILITY: + age 18 hr.
Flagella: peritrichous

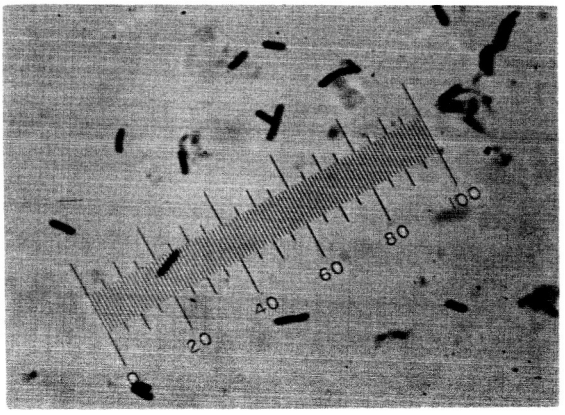
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

↑ NIGROSIN - 24

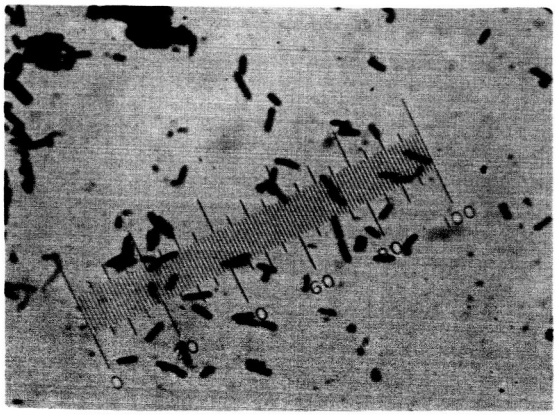


↑ SPORE - 72

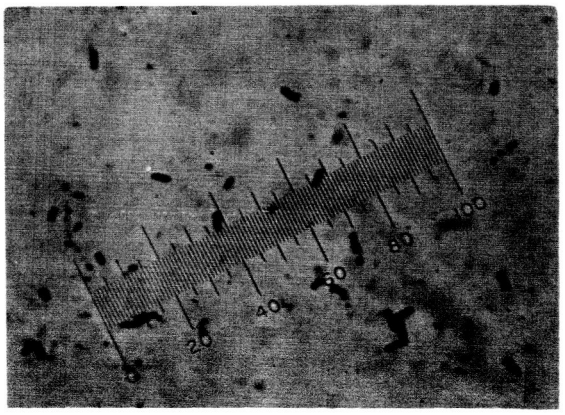
Gram - 18 →



24 ↓



48 →



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *arborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, (wrinkled.)*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, (erose,) granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt Ivory	2ca
Potato slant		
Fat agar:	Bamboo	2ac

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* Slight

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 2da - 4 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.* 4da

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth: wrinkled: dull.

Fat agar: abu: spreading: dull:

Glucose-nitrate agar: growth moderate, thin, dull.

dextrose-nutrient agar: better than on nutrient agar.

Tyrosine Agar - no pigment.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* STRONGLY

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (50°C +)

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2da
Citrate: *positive, negative.*	3da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	2da

REDUCTIONS:

Nitrate: NO_2^-, NH_4^+, *gas*, *negative.*	51 da.
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.* slight	18da.
Tellurite: *positive, negative.* slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ac, *alkaline*, *neutral, gas.*	24 hr.
Sucrose: *acid*, *alkaline* O, *neutral, gas.*	24 hr.
Lactose: *acid* O.C, *alkaline*, *neutral, gas.*	24 hr.
Xylose: *acid* O.C, *alkaline* O, *neutral*, *gas.* ac.c. neut. O	6 da.
Mannitol: *acid* ac, *alkaline, neutral, gas.*	24 hr.

HYDROLYSIS:

Gelatin: *positive, negative.*	5da
Casein: *positive, negative.*	24 hr.
Fat: *positive, negative.*	36da.
Starch: *positive, negative.*	48hr.
Cellulose: *positive, negative.*	2mo.
Urea: *positive, negative.*	37da.

TOLERANCES:

Salt: 2%—*positive, negative.*	3da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.0, *alkaline*	3da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	5 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da.
NH_3^+ from peptone: *positive, negative.* sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	3 da
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

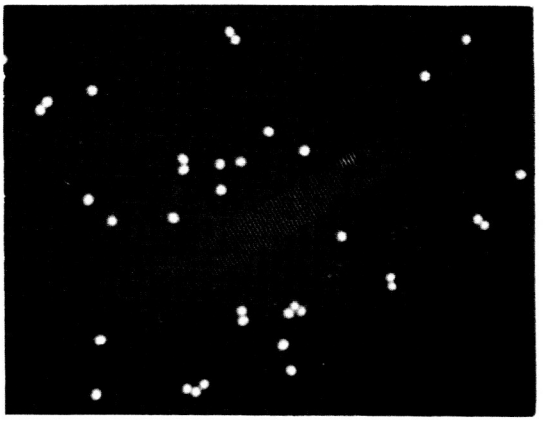
Descriptive Chart

295 B (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Micrococcus roseus (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. *STAINING & MORPHOLOGICAL CHARACTERISTICS*

MORPHOLOGY:
Form: *rods, ends*_____,
filaments, cocci, spirals,
branching _____.
Size: *average* – 1.05 μ
range – 0.87 – 1.22 μ
Irregular forms:



NIGROSIN - 24 ↑

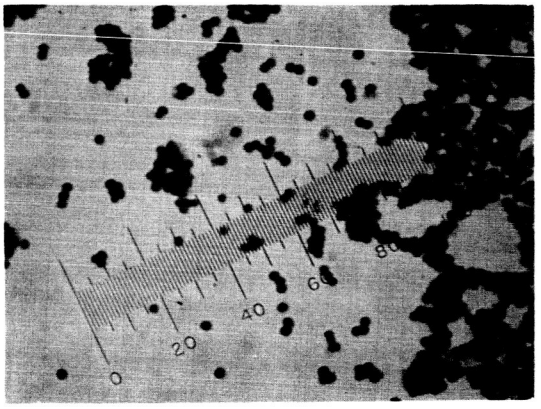
GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

MOTILITY: – age 18 - 48 hr
Flagella: –

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

Gram 18 →



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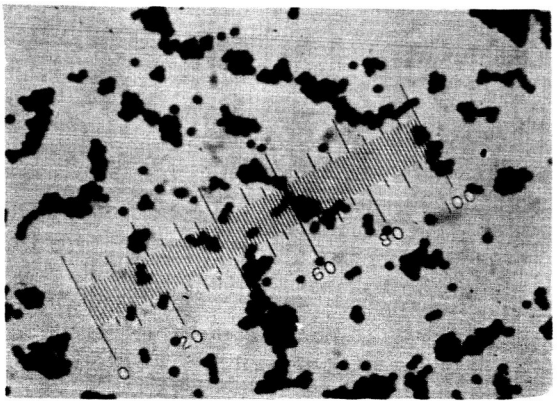

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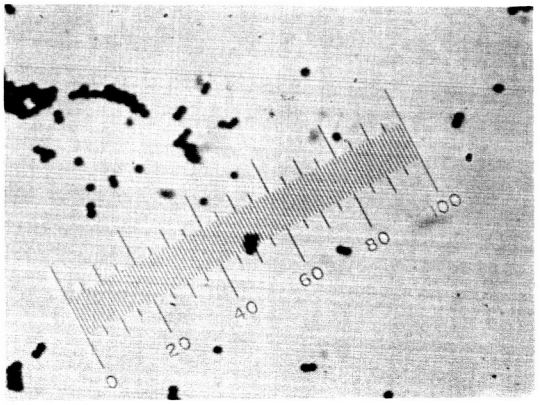

II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Apricot	4ga
Potato slant	Orange	3la
Fat agar:	Chinese Red	6pc

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 19 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: abundant, smooth, glistening.

Fat agar: abundant: compact: glistening.

Glucose-nitrate agar: growth scant, thin.

Glucose-nutrient agar: growth better than on nutrient agar.

Potato Slant: growth smooth; glistening; moderate.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. ++, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2 da
Citrate: *positive, negative.*	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	2 da

REDUCTIONS:

Nitrate: NO_2^- ____, NH_4^+ ____, *gas* ____, *negative.*	51 da.
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	18 da.
Tellurite: *positive, negative.* slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ____, *alkaline* ____, *neutral, gas.*	49 da.
Sucrose: *acid* ____, *alkaline* O, *neutral, gas.*	14 da.
Lactose: *acid* O, *alkaline* ____, *neutral, gas.*	49 da.
Xylose: *acid* ____, *alkaline* ____, *neutral, gas.*	49 da.
Mannitol: *acid* O, *alkaline, neutral, gas.*	6 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da
Casein: *positive, negative.*	22 da.
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	48 hr
Cellulose: *positive, negative.*	2 mo.
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	24 hr.
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.0, *alkaline* ____	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	14 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.* slight	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_3^+ from peptone: *positive, negative.* sl.	5 da
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
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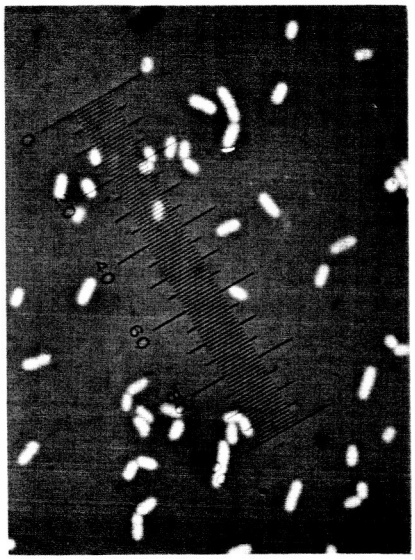
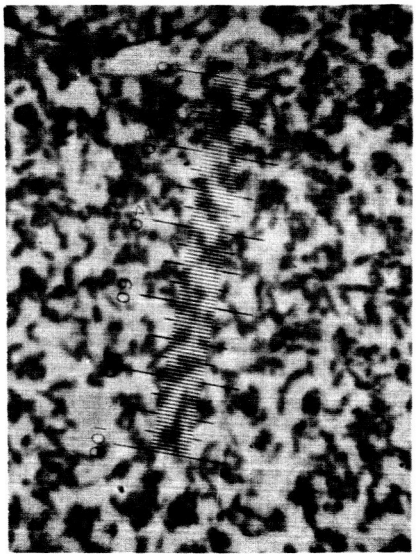
Descriptive Chart

296 A (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Bacillus megaterium (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS





MORPHOLOGY:
Form: rods, ends Rounded, filaments, cocci, spirals, branching _____.
Size: average – 1.12 × 2.22μ.
range – 0.85-1.3μ × 1.21-4.39μ
Irregular forms:

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 97% positive

PASTEURIZATION SURVIVAL (85°C, 10 min positive
Sporangia: none, rods, spindles, elliptical, clave
Endospores: swollen, not swollen.
Position: central to excentric, terminal, subterminal.
Shape: spherical, ellipsoidal, cylindrical, oval.
size: average – 1.11 × 1.68μ
range – 0.85-1.26 × 1.32-2.06μ

NIGROSIN - 24 ↑

SPORE - 72 ↑

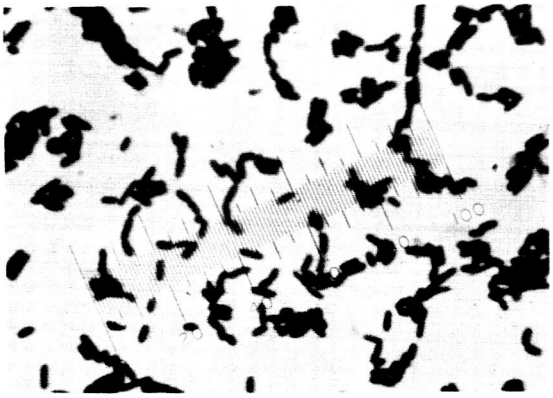
MOTILITY: – age 18 hr.
Flagella: –

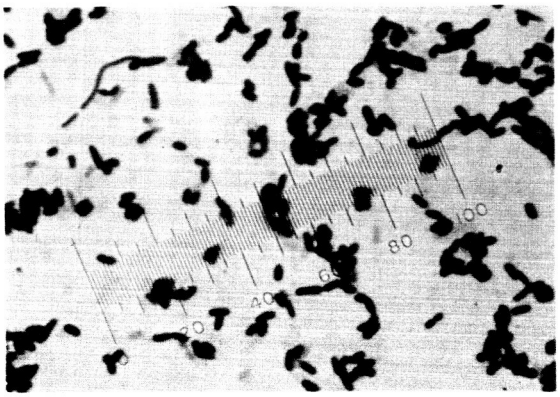
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: Positive
Metachromatic granules:

GRAM - 18 →

24 ↓

48 ↘





II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 4 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt. Tan	3gc
Potato slant	no growth	
Fat agar:	Yallow Maple	3ng

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal

GELATIN STAB: age 28 da

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: scant growth.

Fat agar: abundant: spreading; dull.

Glucose-nitrate agar: no growth.

Glucose nutrient agar. growth not as good as on nutrient agar

Potato slant: no growth.

Tyrosine Agar - no pigment.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative (microaerophilic)*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	sl.	3da
Sucrose: *positive, negative.*		
Xylose: *positive, negative.*		2da
Citrate: *positive, negative.*		8da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*		3da

REDUCTIONS:

Nitrate: NO_2^- +, NH_4^+ ___, *gas* ___, *negative.*		14 da.
Methylene blue: *positive, negative.*		48 hr.
Selenite: *positive, negative.*		22 da.
Tellurite: *positive, negative.*		14 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ___, *alkaline* ___, *neutral, gas.*		49 da
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*		24 hr.
Lactose: *acid* O, *alkaline* ___, *neutral, gas.*	sl.	49 da
Xylose: *acid* ___, *alkaline* ___, *neutral, gas.*		49 da.
Mannitol: *acid* O, *alkaline, neutral, gas.*		14 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	slight	5 da
Casein: *positive, negative.*		22 da
Fat: *positive, negative.*		36 da
Starch: *positive, negative.*		48 hr
Cellulose: *positive, negative.*		2 mo
Urea: *positive, negative.*		37 da

TOLERANCES:

Salt: 2%–*positive, negative.*		22 da
7%–*positive, negative.*		
10%–*positive, negative.*		
pH: *acid* 6.0, *alkaline* ___		3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*		50 da.
Curd: *acid, alkaline, absent, gas.*		50 da.
Peptionization: *positive, negative.*		50 da.
Reduction: *positive, negative.*		50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*		8 da
NH_3 from peptone: *positive, negative.*	sl.	5 da
Acetylmethylcarbinol: *positive, negative.*		20 da.
Indol: *positive, negative.*		
Methyl red: *positive, negative.*		

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

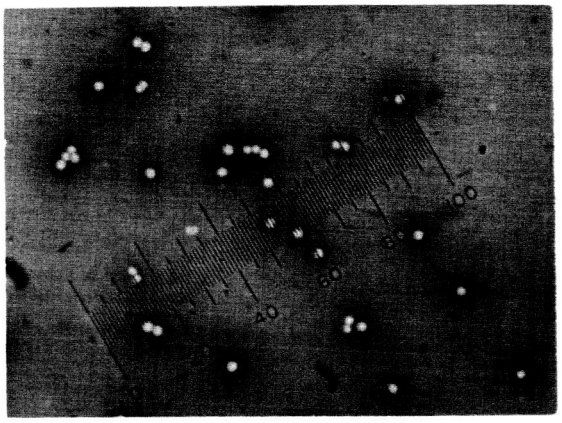
Descriptive Chart

296 D	TRYPTICASE SOY AGAR	SAHARA DESERT
(code number)	(medium)	(source)
Micrococcus roseus	28° C.	DR. W. B. BOLLEN
(name of organism)	(temperature)	(studied by)

I. *STAINING & MORPHOLOGICAL CHARACTERISTICS*

MORPHOLOGY:
Form: *rods, ends*_____, *filaments, cocci, spirals, branching* _____.
Size: *average* – 1.04μ
range – 0.79 - 1.16μ
Irregular forms:

NIGROSIN -24 →



GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

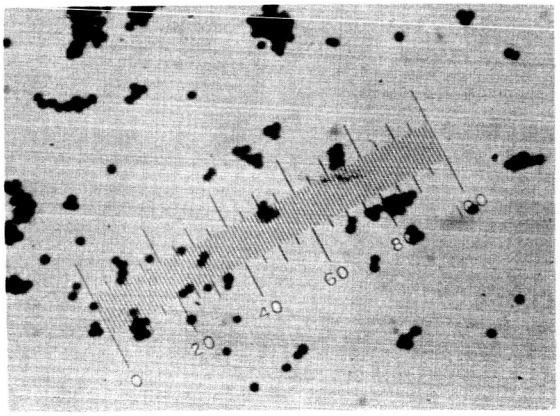
PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

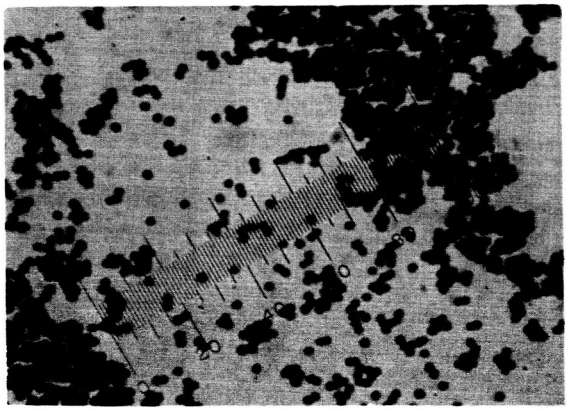
MOTILITY: –age 18 - 48 hr.
Flagella:

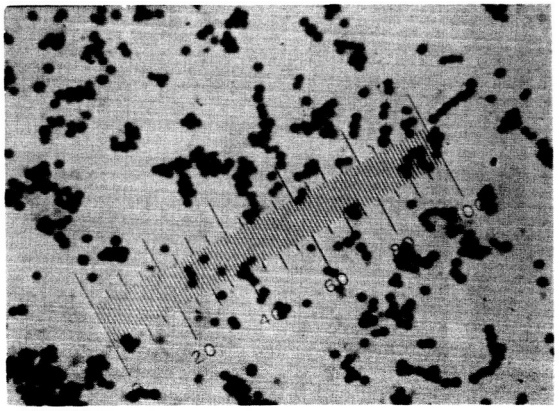
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules:
Metachromatic granules:

Gram: 18 →

24 ↓ 48 ↘







II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt. Mellon Yellow	3aa
Potato slant		
Fat agar:	Burnt Orange	5pc

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling Fecal.

GELATIN STAB: age 28 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: abundant, smooth, glistening.

Fat agar: abundant: compact; glistening

Glucose-nitrate agar: growth scant, pearly white.

Glucose nutrient agar. growth better than on nutrient agar.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.* strongly

TEMPERATURE RELATIONSHIPS: age 24hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*		2da.
Sucrose: *positive, negative.*		
Xylose: *positive, negative.*	sl.	2da.
Citrate: *positive, negative.*		3da.
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*		2da.

REDUCTIONS:

Nitrate: NO_2^-, NH_4^+, *gas*, *negative.*	51 da.
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.*	22 da.
Tellurite: *positive, negative.* very slight	14 da

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* 0, *alkaline*, *neutral, gas.* (sl.)	14 da.
Sucrose: *acid*, *alkaline* 0, *neutral, gas.*	48 hr.
Lactose: *acid* 0, *alkaline* 0, *neutral, gas.*	49 da.
Xylose: *acid* 0, *alkaline*, *neutral, gas.* (sl.)	49 da.
Mannitol: *acid* 0, *alkaline, neutral, gas.*	14 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	22 da
Casein: *positive, negative.*	22 da.
Fat: *positive, negative.*	36 da.
Starch: *positive, negative.*	48 hr.
Cellulose: *positive, negative.*	2 mo.
Urea: *positive, negative.*	37 da.

TOLERANCES:

Salt: 2%—*positive, negative.*	24 hr.
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.0, *alkaline*	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	9 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	30 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da.
NH_4^+ from peptone: *positive, negative.* sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

297 C	Trypticase Soy Agar	Sahara Desert
(code number)	(medium)	(source)
Bacillus subtilis	28°C.	Dr. W. B. Bollen
(name of organism)	(temperature)	(studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

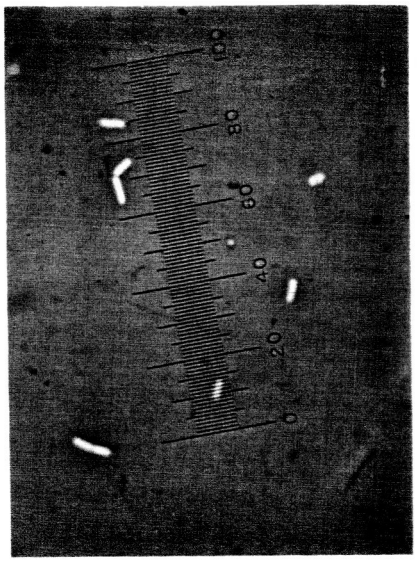
MORPHOLOGY:
Form: rods, ends rounded,
filaments, cocci, spirals,
branching _____.
Size: average – 0.81 x 2.79μ
range – 0.63 - 0.91 x 1.51 - 3.36μ
Irregular forms:

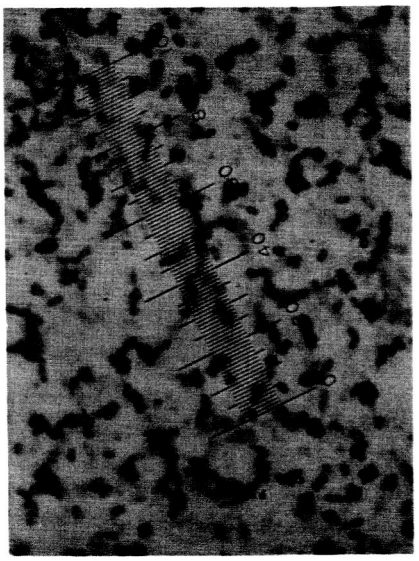
GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 minute: positive
Sporangia: none, rods, spindles, elliptical, clavate,
Endospores: swollen, not swollen,.
Position: central to excentric, terminal, subterminal.
Shape: spherical, ellipsoidal, culindrical, oval.
size: average –
range –

MOTILITY: + age 18hr.
Flagella: peritrichous

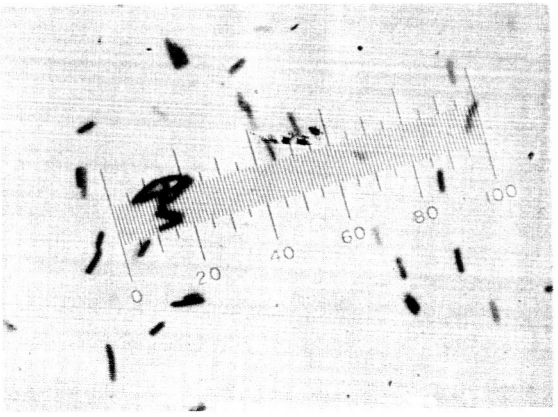
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:



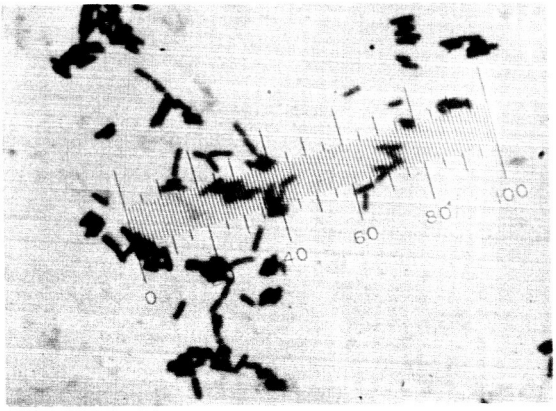


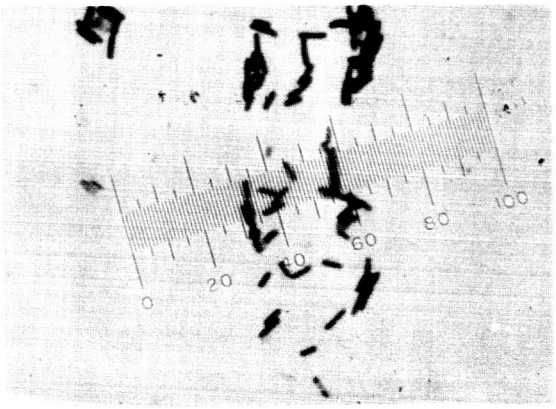
NIGROSIN - 24 ↑ SPORE - 72 ↑

GRAM - 18 →



24 ↓ 48 ↓





297C

II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, buturous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 3 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Pale Yellow	1ca
Potato slant Fat agar:	Bamboo	2fb

NUTRIENT BROTH: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* v. slight

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 2da - 4da

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.* 4da

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth : wrinkled; dull.

Fat agar: abundant : spreading: dull.

Glucose-nitrate agar: growth scant, thin, spreading.

Glucose-nutrient agar: growth better than on nutrient agar.

DNA Tyrosine Agar - no pigment.

G:C _____

G+C _____ moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, (microaerophilic.)*

CATALASE: *positive, negative.* weakly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (50°C +)

SOLE CARBON SOURCE: age _____

Glucose: *positive, negative.*	2da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2da
Citrate: *positive, negative.*	3da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	2da

REDUCTIONS:

Nitrate: NO_2^- +, NH_4^+ ___, *gas* ___, *negative.*	14 da.
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.* slight	18 da.
Tellurite: *positive, negative.*	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* O & C, *alkaline* ___, *neutral, gas.*	24 hr.
Sucrose: *acid* ___, *alkaline* O, *neutral, gas.*	24 hr.
Lactose: *acid* O, C, *alkaline* ___, *neutral, gas.*	24 hr.
Xylose: *acid* O, C, *alkaline* O, *neutral, gas.* neut. O sl. ac. C.	49 da.
Mannitol: *acid* O, C, *alkaline, neutral, gas.*	24 hr.

HYDROLYSIS:

Gelatin: *positive, negative.*	10 da.
Casein: *positive, negative.*	24 hr.
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	48 hr
Cellulose: *positive, negative.*	2 mo
Urea: *positive, negative.*	37 da

TOLERANCES:

Salt: 2%—*positive, negative.*	3da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.0, *alkaline* ___.	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptonization: *positive, negative.*	6 da.
Reduction: *positive, negative.*	5 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_4^+ from peptone: *positive, negative.*	5 da
Acetylmethylcarbinol: *positive, negative.*	3 da
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

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OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

297B (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Bacillus subtilis (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGY:
Form: rods, ends rounded,
filaments, cocci, spirals,
branching _____.
Size: average – 0.65 x 2.91 μ
range – 0.49 - 0.82 x 1.28 - 4.28 μ
Irregular forms:

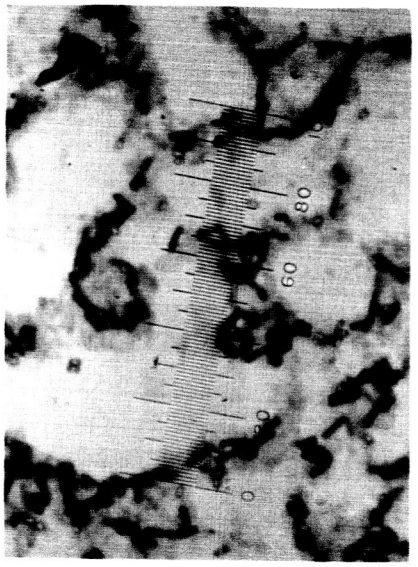
GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 minute) positive
Sporangia: none, rods, spindles, elliptical, clavate,
Endospores: swollen, not swollen,.
Position: central to excentric, terminal, subterminal.
Shape: spherical, (ellipsoidal) cylindrical, oval.
size: average –
range –

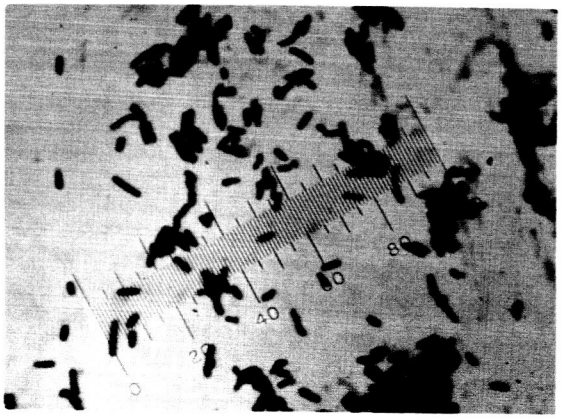
MOTILITY: + age 18 hr.
Flagella: peritrichous

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

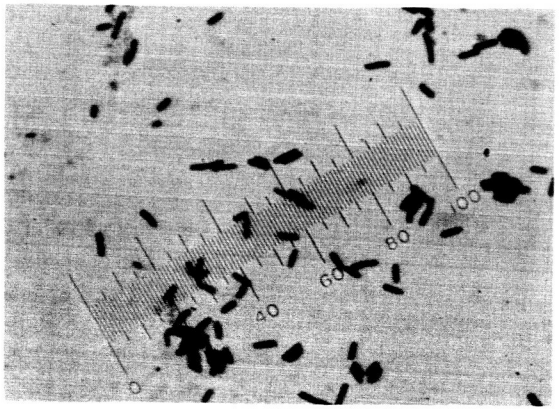
NIGROSIN - 24

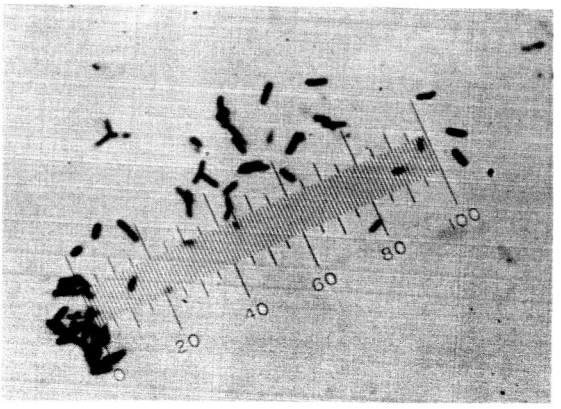


Spore - 72



Gram: 18 → 24 → 48





II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: abundant, moderate, scant.

Form: aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.

Consistency: adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 3 mm.

Shape: filamentous, irregular, oval, puntiform, round.

Elevation: beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.

Topography: contoured, rough, smooth, striated, wrinkled.

Habit: compact, spreading.

Microscopic (100x)

Margin: Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.

Internal structure: amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.

Optical properties

Appearance by reflected light: dull, fluorescent, glistening, iridescent, opalescent.

Appearance by transmitted light: opaque, translucent, transparent.

Medium: blackened, blued, browned, grayed, greened, yellowed, unchanged.

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Bamboo	26b
Potato slant		
Fat agar:	Lt. Mustard Tan	21e

NUTRIENT BROTH: age 24 hr.

Amount of growth: abundant, moderate, scant.

Surface growth: none, flocculent, membranous, pellicle, ring.

Subsurface growth: none, granular, turbid.

Sediment: none, compact, flaky, flocculent, granular, viscid.

Odor: resembling fecal.

GELATIN STAB: age 2da - 4da

Liquefaction: none, crateriform, infundibuliform, napiform, saccate, stratiform. 4da.

Rate: fast, moderate, slow.

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth: wrinkled: dull.

Fat agar: abundant: spreading: dull.

Glucose-nitrate agar: growth scant, thin, spreading.

Glucose-nutrient agar: growth better than on nutrient agar.

Tyrosine Agar - no pigment.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: aerobic, anaerobic, facultative (microaerophilic.) 1/3"

CATALASE: positive, negative. weakly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C.___, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. — (50°C +)

SOLE CARBON SOURCE: age

Glucose: positive, negative.	2 da
Sucrose: positive, negative.	
Xylose: positive, negative.	2 da
Citrate: positive, negative.	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: positive, negative.	2 da

REDUCTIONS:

Nitrate: NO_2^-___, NH_4^+___, gas___, negative.	
Methylene blue: positive, negative.	48 hr.
Selenite: positive, negative. slight	18 da.
Tellurite: positive, negative. slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: acid O & C alkaline___, neutral, gas.	24 hr.
Sucrose: acid___, alkaline O, neutral, gas.	24 hr.
Lactose: acid O, C alkaline___, neutral, gas.	24 hr.
Xylose: acid O, C alkaline___, neutral, gas. ac. sl. O & C	49 da.
Mannitol: acid O C alkaline, neutral, gas. ac. O neut. C	48 hr. 49 da.

HYDROLYSIS:

Gelatin: positive, negative.	5 da
Casein: positive, negative.	24 hr.
Fat: positive, negative.	36 da
Starch: positive, negative.	48 hr
Cellulose: positive, negative.	2 mo
Urea: positive, negative.	37 da

TOLERANCES:

Salt: 2%—positive, negative.	24 hr
7%—positive, negative.	
10%—positive, negative.	
pH: acid 6.0, alkaline___.	3 da

LITMUS MILK REACTIONS:

Reaction: acid, alkaline, neutral.	50 da.
Curd: acid, alkaline, absent, gas.	50 da.
Peptonization: positive, negative.	5 da.
Reduction: positive, negative.	3 da

OTHER REACTIONS:

H_2S from Lead acetate: positive, negative.	8 da
NH_4^+ from peptone: positive, negative.	5 da
Acetylmethylcarbinol: positive, negative.	3 da.
Indol: positive, negative.	
Methyl red: positive, negative.	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

298 A (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Bacillus subtilis (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS

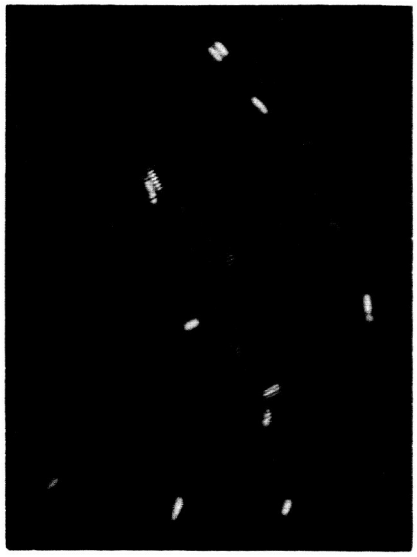
MORPHOLOGY:
Form: rods, ends rounded, *filaments, cocci, spirals, branching* _____.
Size: *average* – 0.73 x 2.33μ
range – 0.59 - 0.90 x 1.51 - 4.51μ
Irregular forms:

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive

PASTEURIZATION SURVIVAL (85°C, 10 minu positive
Sporangia: *none, rods, spindles, elliptical, clavat*
Endospores: *swollen, not swollen,*.
Position: central to excentric, *terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

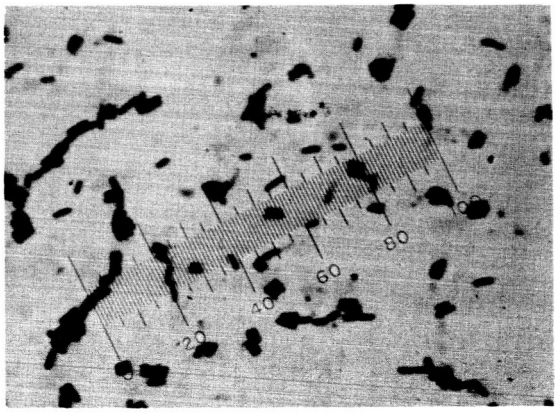
MOTILITY: + age 18 hr.
Flagella: peritrichous

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

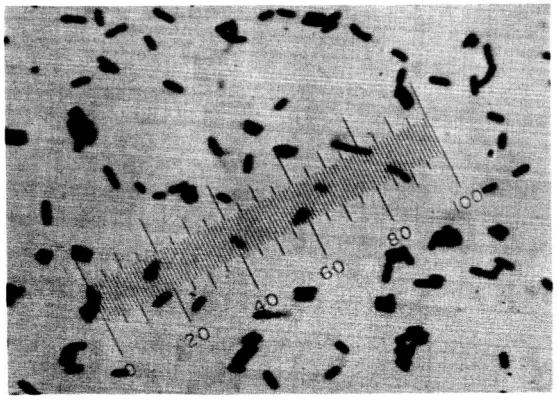


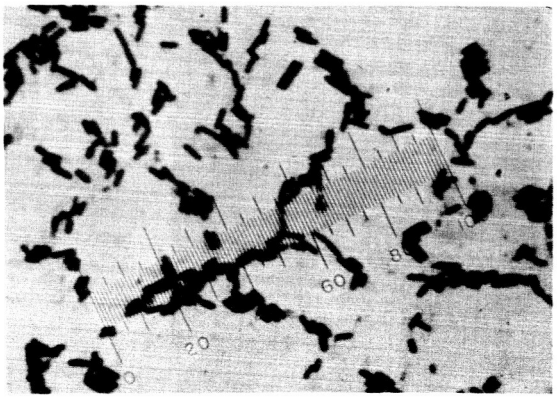
NIGROSIN -24↑

SPORE -72↑



Gram 24 18 48





II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: abundant, moderate, scant.

Form: aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.

Consistency: adherent, brittle, buturous, membranous, moist, slimy, soft, tough, viscid, waxy.

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 3 mm.

Shape: filamentous, irregular, oval, puntiform, round.

Elevation: beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.

Topography: contoured, rough, smooth, striated, wrinkled.

Habit: compact, spreading.

Microscopic (100x)

Margin: Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.

Internal structure: amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.

Optical properties

Appearance by reflected light: dull, fluorescent, glistening, iridescent, opalescent.

Appearance by transmitted light: opaque, translucent, transparent.

Medium: blackened, blued, browned, grayed, greened, yellowed, unchanged.

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt. Ivory	2ca
Potato slant		
Fat agar:	Yellow Maple	3ng

NUTRIENT BROTH: age 24 hr.

Amount of growth: abundant, moderate, scant.

Surface growth: none, flocculent, membranous, pellicle, ring.

Subsurface growth: none, granular, turbid.

Sediment: none, compact, flaky, flocculent, granular, viscid.

Odor: resembling fecal.

GELATIN STAB: age 2 da. - 4 da

Liquefaction: none, crateriform, infundibuliform, napiform, saccate, stratiform. 4 da

Rate: fast, moderate, slow.

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth: rough, dull.

Fat agar: abundant: spreading; dull.

Glucose-nitrate agar: growth scant, thin, spreading.

Glucose-nutrient agar: growth better than on nutrient agar.

Tyrosine Agar: no pigment.

DNA

G:C _____

G+C _____ moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: aerobic, anaerobic, facultative, (microaerophilic.) 1/4"

CATALASE: positive, negative. weakly

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (50°C +)

SOLE CARBON SOURCE: age _____

Glucose: positive, negative.	2 da
Sucrose: positive, negative.	
Xylose: positive, negative.	2 da
Citrate: positive, negative.	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: positive, negative.	2 da

REDUCTIONS:

Nitrate: NO_2^- ___, NH_4^+ ___, gas ___, negative.	51 da.
Methylene blue: positive, negative.	48 hr.
Selenite: positive, negative. slight	18 da.
Tellurite: positive, negative.	10 da

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: acid 0 & C alkaline ___, neutral, gas.	24 hr.
Sucrose: acid ___, alkaline 0, neutral, gas.	24 hr.
Lactose: 24↑ acid 0, C [illegible] neutral, gas.	24 hr.
Xylose: acid 0, C alkaline 0-48 neutral, gas. ac. d. 0 & C	49 da.
Mannitol: acid 0, C 24↑ alkaline, neutral, gas. ac. 0 neut. cl.	14 da.

HYDROLYSIS:

Gelatin: positive, negative.	5 da
Casein: positive, negative.	10 da
Fat: positive, negative.	3 da
Starch: positive, negative.	48 hr
Cellulose: positive, negative.	2 mo
Urea: positive, negative.	37 da

TOLERANCES:

Salt: 2%—positive, negative.	3 da
7%—positive, negative.	
10%—positive, negative.	
pH: acid 6.0, alkaline _____.	3 da

LITMUS MILK REACTIONS:

Reaction: acid, alkaline, neutral.	50 da.
Curd: acid, alkaline, absent, gas.	50 da.
Peptonization: positive, negative.	6 da.
Reduction: positive, negative.	5 da.

OTHER REACTIONS:

H_2S from Lead acetate: positive, negative.	8 da
NH_4^+ from peptone: positive, negative.	5 da
Acetylmethylcarbinol: positive, negative.	7 da.
Indol: positive, negative.	
Methyl red: positive, negative.	

OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

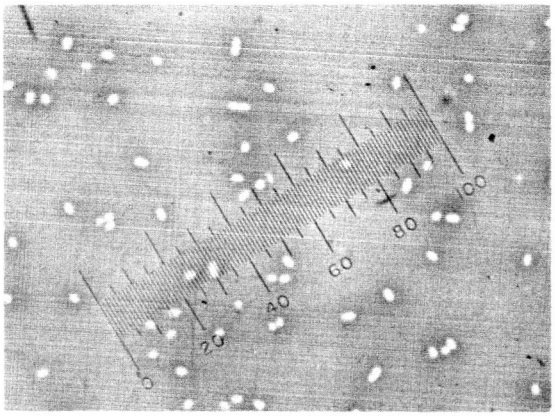
Descriptive Chart

298 C	Trypticase Soy Agar	Sahara Desert
(code number)	(medium)	(source)
(Brevibacterium ?)	28°C.	Dr. W. B. Bollen
(name of organism)	(temperature)	(studied by)

I. *STAINING & MORPHOLOGICAL CHARACTERISTICS*

MORPHOLOGY:
Form: *rods*, *ends* rounded,
filaments, cocci, spirals,
branching _____.
Size: *average* – 0.79 x 1.44μ
range – 0.62-0.95 x 1.13-2.19μ
Irregular forms:
Coccoid

GRAM REACTION:
18 hrs: 100% positive
24 hrs: 100% positive
48 hrs: 100% positive



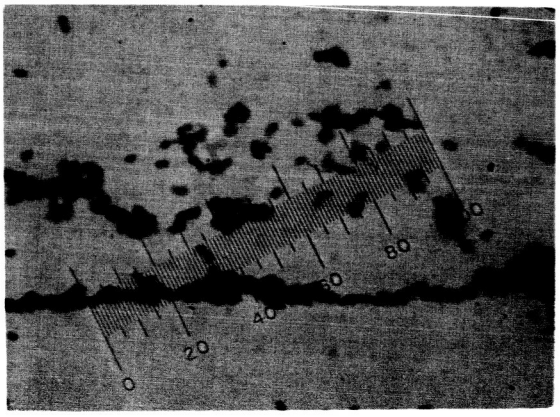
NIGROSIN - 24.

PASTEURIZATION SURVIVAL (85°C, 10 minutes): negative
Sporangia: *none, rods, spindles, elliptical, clavate, drumstick.*
Endospores: *swollen, not swollen,.*
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, cylindrical, oval.*
size: average –
range –

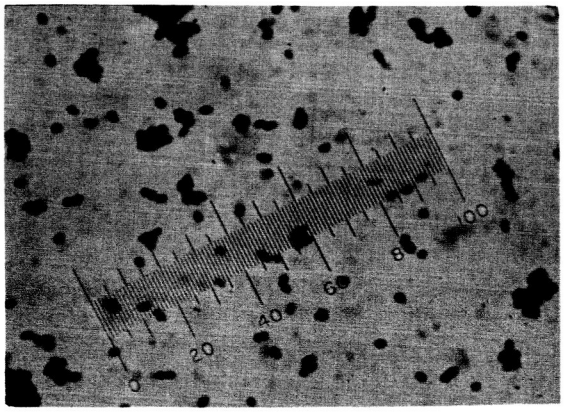
MOTILITY: + age 18 hr.
Flagella: peritrichous

OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

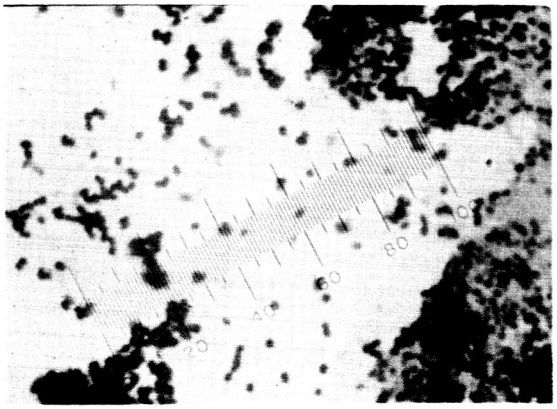
Gram - 18 →



24↓



48↓



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da.

Macroscopic

Size: 2 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, lobed, rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Lt Ivory	2 ca
Potato slant		
Fat agar:	Chocolate Brown	4pn

NUTRIENT BROTH: age 24hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.*

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling Fecal.

GELATIN STAB: age 19 da.

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: moderate, smooth, glistening.

Fat agar: abundant: spreading. dull: brown w.s.p.

Glucose-nitrate agar: no growth.

Glucose nutrient agar - growth not as good as on nutrient agar.

DNA

G:C _____

G+C _____ moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative, microaerophilic.*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24hr.

Growth at 10°C. ++, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −.

SOLE CARBON SOURCE: age _____

Glucose: *positive, negative.*	2da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2da
Citrate: *positive, negative.*	3da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	2da

REDUCTIONS:

Nitrate: NO_2^- ____, NH_4^+ ____, *gas* ____, *negative.*	
Methylene blue: *positive, negative.*	48hr.
Selenite: *positive, negative.*	5da.
Tellurite: *positive, negative.*	14da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* ____, *alkaline* ____, *neutral, gas.*	49 da.
Sucrose: *acid* ____, *alkaline* O, *neutral, gas.*	24 hr.
Lactose: *acid* ____, *alkaline* O (34hr), *neutral, gas.*	6 da.
Xylose: *acid* ____, *alkaline* ____, *neutral, gas.*	49 da
Mannitol: *acid* ____, *alkaline* O *neutral, gas.*	49 da.

HYDROLYSIS:

Gelatin: *positive, negative.*	22 da
Casein: *positive, negative.*	22 da.
Fat: *positive, negative.*	36 da
Starch: *positive, negative.*	48hr
Cellulose: *positive, negative.*	60 da
Urea: *positive, negative.*	37da

TOLERANCES:

Salt: 2%—*positive, negative.*	3da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.5, *alkaline* ____.	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	30 da.
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptionization: *positive, negative.*	50 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da.
NH_4^+ from peptone: *positive, negative.* sl.	5 da.
Acetylmethylcarbinol: *positive, negative.*	20 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	

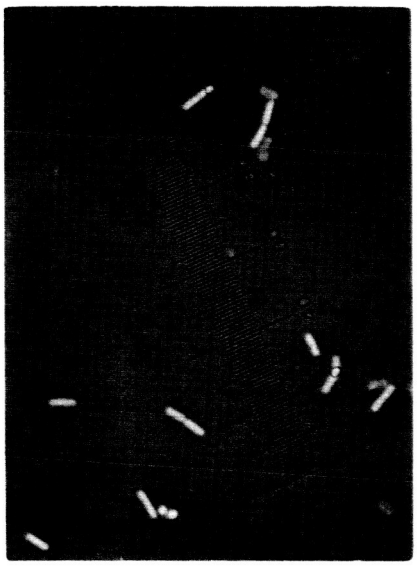
OREGON STATE UNIVERSITY
DEPARTMENT OF MICROBIOLOGY
(JPL–NASA)

Descriptive Chart

298 D (code number) | Trypticase Soy Agar (medium) | Sahara Desert (source)

Bacillus subtilis var. aterrimus (name of organism) | 28°C. (temperature) | Dr. W. B. Bollen (studied by)

I. STAINING & MORPHOLOGICAL CHARACTERISTICS



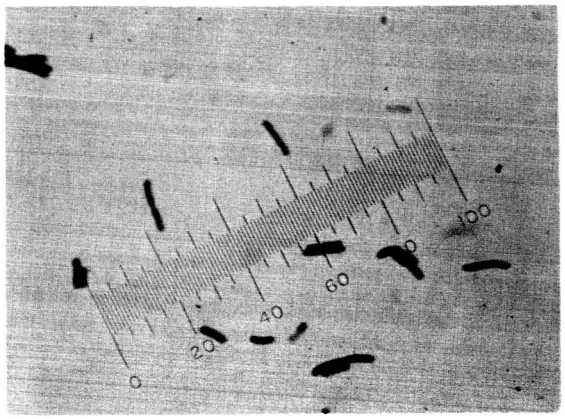
MORPHOLOGY:
Form: rods, ends rounded, *filaments, cocci, spirals, branching* _____.
Size: *average* – 0.68 x 3.50μ
range – 0.62-0.79 x 1.69 – 5.13μ
Irregular forms:

GRAM REACTION:
18 hrs: 100 % positive
24 hrs: 100 % positive
48 hrs: 100 % positive

PASTEURIZATION SURVIVAL (85°C, 10 min) positive
Sporangia: *none, rods, spindles, elliptical, clava*
Endospores: *swollen, not swollen*.
Position: *central to excentric, terminal, subterminal.*
Shape: *spherical, ellipsoidal, (culindrical,) oval.*
size: average –
range –

NIGROSIN-24

SPORE -72

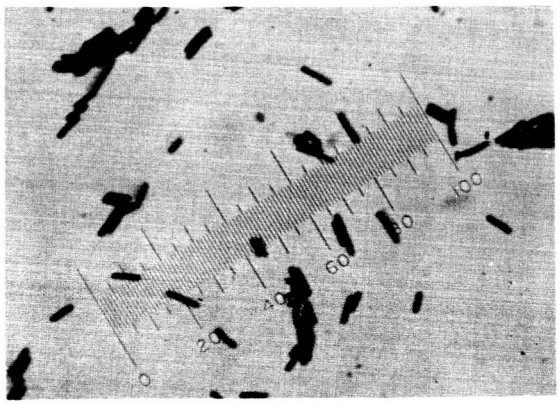


MOTILITY: + age 18 hr.
Flagella: peritrichous

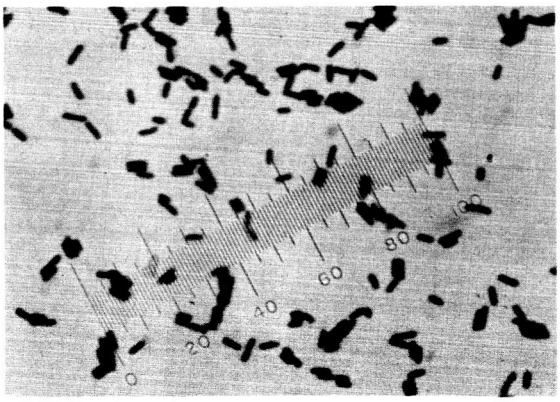
OTHER STAINS:
Acid fast:
Capsule:
Glycogen:
Crystalline dextrins:
Fat globules: negative
Metachromatic granules:

Gram -18 →

24 ↓



48 ↓



II. CULTURAL CHARACTERISTICS

AGAR STROKE: age 24 hr.

Amount of growth: *abundant, moderate, scant.*

Form: *aborescent, beaded, echinulate, effuse, filiform, rhizoid, spreading.*

Consistency: *adherent, brittle, butyrous, membranous, moist, slimy, soft, tough, viscid, waxy.*

AGAR COLONIES: age 1-7 da

Macroscopic

Size: 4 mm.

Shape: *filamentous, irregular, oval, puntiform, round.*

Elevation: *beveled, convex, effuse, flat, papillate, pulvinate, raised, rugose, umbonate.*

Topography: *contoured, rough, smooth, striated, wrinkled.*

Habit: *compact, spreading.*

Microscopic (100x)

Margin: *Ciliate, cleft, crenate, entire, erose, granular, (lobed,) rhizoid, undulate.*

Internal structure: *amorphous, dense, filamentous, granular (fine, coarse), interlaced, striated.*

Optical properties

Appearance by reflected light: *dull, fluorescent, glistening, iridescent, opalescent.*

Appearance by transmitted light: *opaque, translucent, transparent.*

Medium: *blackened, blued, browned, grayed, greened, yellowed, unchanged.*

Chromogenesis:

(medium)	(color)	(CHM No.)
Trypticase soy agar	Bamboo	26b
Potato slant		
Fat agar:	Sepia Brown	3pn

NUTRIENT BROTH: age 24hr.

Amount of growth: *abundant, moderate, scant.*

Surface growth: *none, flocculent, membranous, pellicle, ring.*

Subsurface growth: *none, granular, turbid.* v. slight

Sediment: *none, compact, flaky, flocculent, granular, viscid.*

Odor: resembling fecal.

GELATIN STAB: age 2-da-4da

Liquefaction: *none, crateriform, infundibuliform, napiform, saccate, stratiform.*

Rate: *fast, moderate, slow.*

OTHER GROWTH CHARACTERISTICS:

Soybean infusion agar: good growth; rough; dull.

Fat agar: abundant: spreading: dull: brown w.s.p

Glucose-nitrate agar: no growth.

Glucose-nutrient-agar: growth better than on nutrient agar.

Tyrosine Agar - no pigment.

DNA

G:C

G+C moles %

III. PHYSIOLOGICAL CHARACTERISTICS

RELATIONSHIP TO O_2: *aerobic, anaerobic, facultative (microaerophilic)*

CATALASE: *positive, negative.*

TEMPERATURE RELATIONSHIPS: age 24 hr.

Growth at 10°C. −, 20°C. +, 28°C. ++, 37° ++, 45°C. +, 55°C. −. (30°C +)

SOLE CARBON SOURCE: age

Glucose: *positive, negative.*	2 da
Sucrose: *positive, negative.*	
Xylose: *positive, negative.*	2 da
Citrate: *positive, negative.*	3 da
NH_4^+ AS SOLE NITROGEN SOURCE: *positive, negative.*	2 da

REDUCTIONS:

Nitrate: NO_2^-____, NH_4^+____, *gas*____, *negative.*	
Methylene blue: *positive, negative.*	48 hr.
Selenite: *positive, negative.* slight	18 da.
Tellurite: *positive, negative.* slight	10 da.

OXIDATIVE-FERMENTATIVE REACTIONS

Glucose: *acid* 0 1 C *alkaline*____, *neutral, gas.*	24 hr
Sucrose: *acid*____, *alkaline* 0, *neutral, gas.*	24 hr
Lactose: *acid* 0 1 C *alkaline*____, *neutral, gas.*	24 hr.
Xylose: *acid* C, *alkaline* 0, *neutral, gas.* alk. 0 mut. c.	49 da.
Mannitol: *acid* 0, *alkaline, neutral, gas.*	24 hr.

HYDROLYSIS:

Gelatin: *positive, negative.*	5 da.
Casein: *positive, negative.*	24 hr.
Fat: *positive, negative.*	36 da.
Starch: *positive, negative.*	48 hr.
Cellulose: *positive, negative.*	2 mo.
Urea: *positive, negative.*	37 da.

TOLERANCES:

Salt: 2%—*positive, negative.*	3 da
7%—*positive, negative.*	
10%—*positive, negative.*	
pH: *acid* 6.0, *alkaline*____	3 da

LITMUS MILK REACTIONS:

Reaction: *acid, alkaline, neutral.*	50 da
Curd: *acid, alkaline, absent, gas.*	50 da.
Peptonization: *positive, negative.*	5 da.
Reduction: *positive, negative.*	50 da.

OTHER REACTIONS:

H_2S from Lead acetate: *positive, negative.*	8 da
NH_4^+ from peptone: *positive, negative.*	5 da
Acetylmethylcarbinol: *positive, negative.*	7 da.
Indol: *positive, negative.*	
Methyl red: *positive, negative.*	