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FINAL REPORT

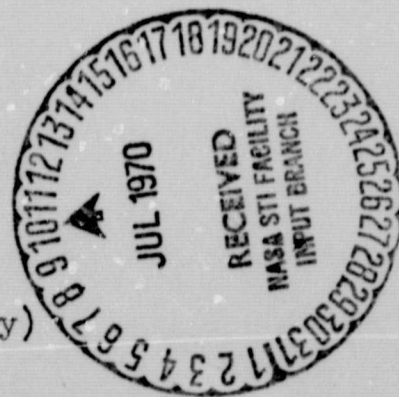
Microorganism Study: Bacterial Isolants
from Harsh Environments

Jet Propulsion Laboratory
California Institute of Technology
Contract 950783

This work was performed for the Jet Propulsion Laboratory,
California Institute of Technology, sponsored by the
National Aeronautics and Space Administration under
Contract NAS7-100.

Professor W. B. Bollen, Microbiologist
and

Karen M. Byers Kemper
(Formerly Assistant in Microbiology)
Oregon State University
Corvallis, Oregon



May 22, 1970

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FINAL REPORT

Part 1

Microorganism Study: Bacterial Isolants
from Harsh Environments

Jet Propulsion Laboratory C/T Contract 950783

Professor W. B. Bollen
Department of Microbiology
Oregon State University
Corvallis, Oregon
February 20, 1970

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3

Final Report

Part 1

This report is a summary of isolants received from from Dr. Roy E. Cameron, Senior Scientist, Bioscience Section, Jet Propulsion Laboratory, and of the isolants identified.

Procedures, methods and media employed have been described in the series of Progress Reports listed in the table presented herewith. Generic and species names were applied where possible.

Isolants not named were unidentified for one of the following reasons:

- 1) They failed to grow on subsequent transfer. This is characteristic of many soil isolants; presumably some nutritional factor in the soil or provided by some associated microbe is not carried over by the inoculum in subsequent cultures.
- 2) The isolant grew in subsequent cultures on the various test media but the results did not conform to any species description in Bergey's Manual or in current literature. In such cases only a generic or a morphological designation was given.

All except preliminary and summary reports were accompanied by Descriptive Systematic Charts with photographs.

At termination of the contract on March 1, 1969 funds remaining were sufficient to continue the work on a reduced basis until June 30, 1969. Since this later date only the last lot of isolants shipped to us by Dr. Cameron remain to be processed. These are now being worked on by Mrs. Karen Kemper, 3317 Somerset Drive, Castro Valley, California 94546 (Telephone: 415-538-4502), who will complete the study and identifications as time allows. Completion of this work is essential for her MS thesis, which is on "Soil Diphtheroids from Harsh Environments." Many of the cultures submitted by Dr. Cameron proved to be diphtheroids, about which little is known or published. It is expected that the thesis will prove to be a valuable contribution to knowledge of this group of soil bacteria.

When available, results for the last lot of isolants will be submitted to Dr. Cameron as a Supplementary Report.

Table 1

Summary of Isolants Identified

Microorganism Study, JPL. CIT Contract 950783

Shipment No. and source of isolants	Data results reported	Cultures received	Bacillus	Diphth- eroids	Strepto- myces	Other	
						Bacteria	
1 White Mountain	3-15-64	34				Preliminary	
2 and	6-15-64	14				"	
3 Alaska	9-10-64	48		9		(12) 1/	1 yeast
	4-9-65		19		(2)	5 cocci	1st Systematic report
	5-5-65		(5)				Preliminary
	8-14-65	31	(12)		(9)	15 cocci	Summary
	8-20-65			12			
4 Sahara Desert	4-1-66	30	8	5	(3)	4 Micrococcus	
5 Hilgard soils	1-31-67	soil					Sulfur oxidation
6 California desert	3-9-67	soil				"	"
7 Chile desert	5-31-67	soil				Ammonification	
						Nitrification	
						Sulfur oxidation	
8 Chile-Atacama	6-6-67	49	4		(8)	1 Micrococcus	
9 Hilgard soils	6-12-67	58	44	9		1 Pseudomonas	
10 Hawaii	9-20-67	43	21	5	(13)		
11 Antarctic	3-27-68	soil					Am., Nitrif., S ox
12 Little Lake	1-4-68	19	7	5	(2)	1 Mic., 1 mold, 2 yeasts	
13 Chile, Hawaii,	4-25-68	20			17	2 not determinable	
Oregon, Wyoming							
14 Chile	4-7-68	34	10	2	(6)	2 Mic., 4 Mycoccus,	
						1 mold, 1 yeast	
15 Mexico	6-1-68	10	6		(1)		
16 Chile, Mex., Arizona	8-10-68	36			18		
17 Chile, Antarctic, Ariz.	2-18-69				67		
18 Chile-Atacama	3-21-69	67	8	5	(20)	1 Mycoccus, 3 Mycobacterium,	
						1 Arthrobacter, 6 Nocardia,	
						2 yeasts, 8 molds	
Totals:		493	127	52	102	44	
Identified	325 =	68%	39%	16%	31%	14%	

1/ Number in () identified in subsequent reports

FINAL REPORT
Part 2
Final

Microorganism Study, CIT Contract No. 950783

Systematic Description of Antarctic Soil Isolants

Professor W. B. Bollen, Microbiologist

and

Karen M. Kemper
(Formerly Assistant in Microbiology)

Oregon State University, Corvallis, Oregon

May 22, 1970

This report supplements and concludes my Final Report of February 20, 1970. It is based upon careful examination and consideration of the Descriptive Charts and data in the notebooks obtained from Mrs. Karen M. Kemper and sent to me by Dr. Roy E. Cameron, April 13, 1970, for appraisal. Although the work has not attained the extent of completion anticipated, the progress has been substantial, considering the great number of cultures involved and the conditions under which Mrs. Kemper attempted to complete the task.

Following, according to sources of isolants, are (1) lists of identifications, and (2) lists of incompletely studied isolants.

List of 73 Antarctic soil isolants, with identifications where possible^{1/}

Asgard Ranges Isolants

501	Unidentified rod
661	<u>Arthrobacter</u> sp.
665	<u>Micrococcus</u> sp.
667	Unidentified rod
672	<u>Arthrobacter</u> or pleomorphic coccus
673	Unidentified coccus
675	Unidentified rod
676	Unidentified rod

King David

636a1	Actinomycete + yeast
637.01	Actinomycete
644a1	Actinomycete

Marble Point

562	Actinomycete
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McKelvey Valley Isolants

500	<u>Mycobacterium</u> sp.
500A	Diphtheroid
500A-1	<u>Mycoccus</u>
500A-2	<u>Arthrobacter</u> sp.
500B	<u>Bacillus</u> sp.
501A	<u>Arthrobacter</u> sp.

501A-1	Unidentified rod
501C	Diphtheroid
502	<u>Mycoccus</u> sp.
502A.	<u>Mycobacterium</u> sp.
502B.	<u>Bacillus cereus</u>
502-1	Diphtheroid
502-2	Unidentified coccus
503	<u>Mycoccus</u> sp.
503-1	Unidentified rod
503-2	<u>Arthrobacter</u> sp.
503-3	<u>Arthrobacter</u> sp.
503-A	Diphtheroid
503A-1	Pleomorphic rod
503A-2	<u>Bacillus pumilus</u>
503B	<u>Bacillus cereus</u>
507A	<u>Microoccus ureae</u>
507Aa	Flagellated rod
508A	<u>Sarcina</u> sp.
508B	Diphtheroid
510A-1	<u>Bacillus coagulans</u>
510A-2	<u>Bacillus cereus</u>
510B-1	<u>Bacillus cereus</u>
510B-2	<u>Bacillus cereus</u>
511A	Unidentified coccus
513A	Diphtheroid
514A-1	Diphtheroid
514B	Failed to grow
515A	<u>Bacillus megaterium</u>

Victoria Valley Isolants

537A	<u>Mycoccus ruber</u>
537B	<u>Bacillus cereus</u>
538A	<u>Bacillus cereus</u>
539A	Diphtheroid
539aA	<u>Bacillus circulans</u>
539B	Diphtheroid
539aB	<u>Micrococcus albus albidus</u>

540A	<u>Bacillus cereus</u>
542A	Diphtheroid
543B	<u>Bacillus cereus</u>
575Ab	Yeast
575Ac	Yeast

Wheeler Valley Isolants

609	Actinomycete + yeast
609-1	Unidentified micrococcus
609-2	Unidentified micrococcus
609-3	Unidentified rod
609-4	Unidentified pleomorphic rod
611	Actinomycete
611-1	<u>Arthrobacter</u> sp.
611-2	Unidentified rod
614	Actinomycete + yeast
617	Actinomycete
618	Actinomycete
619	Actinomycete + yeast
620	Actinomycete

1/ Reasons for lack of systematic identification are:

- (1) failure to grow on subsequent transfer;
- (2) results of growth on various test media do not conform to any published description or
- (3) physiological and/or biochemical tests not completed.

The foregoing lists include the following:

7 Arthrobacter	10%
15 Bacillus	21%
10 Diphtheroids	14%
3 Micrococcus	4%
2 Mycobacterium	3%
4 Mycoccus	6%
1 Sarcina	1%
11 Actinomycete	15%
2 Yeasts	3%
5 Unidentifiable cocci	7%
12 Unidentifiable rods	16%
1 failed to grow	

As noted in the Final Report of February 20 species, of Bacillus, diphtheroids and Streptomyces predominated among the isolants. Arthrobacter, closely related to the diphtheroids, also were relatively abundant. As previously observed these forms seem most adaptable to harsh environments, regardless of climatic temperature.

NOTE: Microccus should be indicated as Micrococcus. Mycoccus should be indicated as Mycococcus.

On the following 92 isolants only the cultural characters - colony, slope and broth culture descriptions - were made. This information is not sufficient for identification.

Asgard Range

503, 514, 615, 663, 664, 666, 668, 670, 675, 676

Beacon Valley

533

King David (King Valley (David Valley)

636-1, -2; 637-1, -2; 638-1, -2, -3, -4, -5;
639-1, -2, -3, -4, -5; 640-1, -2, -3; 642;
643-1, -2, -3; 644

Marble Point

562; 562-1; 562-3

McKelvey

503, 506-1, -2, -3; 509, 510, 511, 513, 514

Olympic Range

651-1, -2; 652

Victoria Valley

538; 539a; 539-1, -2; 574; 575-1, -2, -3; 576

Wheeler Valley

609; 611-1, -2, -3; 612; 613-1, -2, -3, -4, -5, -6, -7, -8, -9, -10;
514-1, -2, -3, -4, -5; 615-1, -2, -3, -4, -5, -6; 616; 617;
618-1, -2; 620-1, -2; 622-1, -2, -3