

FY 72

*H. B. Rowland*

**BIOLOGY AND MEDICINE PROGRAM BUDGET**

May 1970  
CONTRACT W-31-109-ENG-38  
SUPPLEMENT NO. 16

1. TITLE  
Biology and Medicine Program 728232

2. BUDGET ACTIVITY NO.  
AEC 06 Summary  
ANL 60000 Summary (BIM, RPY, ERP, CHM, AMD)



3. SCIENTIST RESPONSIBLE R. B. Duffield, W. M. Manning, R. E. Rowland, and W. K. Sinclair

4. WORK STARTED  
FY Continuing

5. RELATED WORK (With Same Contractor or Others) This program is integrated with the other AEC programs in this area and is closely correlated with relevant work of other governmental agencies, universities and research institutions.

6. MANPOWER AND COST DATA	ESTIMATED FOR FISCAL YEARS		
	1970	1971	1972
<b>6a. DIRECT MANPOWER (Man Years)</b>			
<b>SCIENTIFIC</b>			
REGULAR	150.3	145.9	160.4
TEMPORARY PAID BY ANL	13.6	6.8	13.0
TEMPORARY PAID BY OTHERS	3.1	9.8	10.0
<b>TOTAL SCIENTIFIC</b>	<b>167.0</b>	<b>162.5</b>	<b>183.4</b>
<b>OTHER TECHNICAL</b>			
REGULAR	10.2	8.1	21.0
TEMPORARY PAID BY ANL	-	-	-
<b>TOTAL OTHER TECHNICAL</b>	<b>10.2</b>	<b>8.1</b>	<b>21.0</b>
<b>TOTAL MAN YEARS</b>	<b>177.2</b>	<b>170.6</b>	<b>204.4</b>
<b>6b. OPERATING COSTS (In Thousands)</b>			
EFFORT-RELATED COSTS	\$5,198	\$4,971	\$6,314
MATERIALS AND SERVICES	1,685	2,089	2,460
MAJOR PROCUREMENTS	74	209	200
<b>TOTAL COST</b>	<b>\$6,957</b>	<b>\$7,269<sup>(A)</sup></b>	<b>\$8,974</b>
<b>6c. Cost (Recap of Subactivities) (In Thousands)</b>			
06-01 Interaction of Radiation with Biological Systems	\$4,323	\$4,253	\$4,758
-02 Assessment, Evaluation and Control of Radiation Exposure to Man and His Environment	2,634	3,016	4,216
<b>Total 06 Program</b>	<b>\$6,957</b>	<b>\$7,269</b>	<b>\$8,974</b>
<b>6d. Major Procurements (In Thousands)</b>			
06-02 Assessment, Evaluation and Control of Radiation Exposure to Man and His Environment	\$ 74	\$ 209	\$ 200 (over)

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(A) \$20,000 in excess of the President's Budget - see Appendix B "Fiscal

6e. Equipment Obligations (In Thousands)

	<u>FY 1970</u>	<u>FY 1971</u>	<u>FY 1972</u>
General (see below for detail)	\$115	\$ 58	\$160
06-01 Interaction of Radiation with Biological Systems	228	221	237
-02 Assessment Evaluation and Control of Radiation Exposure to Man and His Environment	127	281	402
Total 06 Program	<u>\$470</u>	<u>\$550</u>	<u>\$799</u>

See individual 189's for detail.

The following equipment items are for general service in the Biological and Medical Research Division and are, therefore, not allocated directly to individual 189's.

	<u>FY 1970</u>	<u>FY 1971</u>	<u>FY 1972</u>
Scanning Electron Microscope	\$ 76	-	-
Tri-Carb Oxidizer	9	-	-
Animal Cage Washer	-	\$ 30	-
High Level Gamma Source (AECL-600)	-	-	\$ 45
Replacement of Electron Microscope	-	-	50
Minor Items - Animal Quarters	1	8	15
Minor Items - Other General Services	29	20	50
Total General Equipment	<u>\$115</u>	<u>\$ 58</u>	<u>\$160</u>

Explanation of Equipment Items

Animal Cage Washer

Replacement of the Animal Cage Washer is long overdue. The present machine was purchased in FY 1958. It has become obsolete in performance, and has a demand for maintenance on a frequency far beyond what would be termed normal. Extensive repairs were made in FY 1968; however, the machine has reached the point where further repairs will become uneconomical. The large volume of cage washing in the Division requires the machine to operate 7 days a week and to be reliable for use during periods when maintenance help is unobtainable.

High Level Gamma Source

The present high intensity cobalt-60 source in the high level gamma room was 12,000 curies in 1963 and has decayed to less than half its original intensity. Replacement by a source of similar design would be uneconomical in view of the high cost of high specific activity cobalt-60. It is proposed to retain the present mechanism and sources while adding a further mechanism containing 20,000 curies of cobalt-60. The physical arrangement of the proposed source permits standard cobalt-60 to be used and yet would permit uniform exposures of small samples at higher dose rates than in the present

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6e. <u>Equipment Obligations</u> (Contd.)  facility. The maximum flexibility and operational convenience would be achieved in a most economic way.  <u>Replacement of Electron Microscope</u>  Our present work load and need for improving the quality of our electron micrographs requires replacement of our oldest electron microscope. This instrument gives limited production due to excessive maintenance, photographic capabilities, and specimen handling facilities. It is also lacking in image sharpness and resolution. Several electron microscopes are now available which will remedy these shortcomings.	
7. <u>Description</u>  The program of the Division of Biological and Medical Research includes a spectrum of studies subdivided, conceptually, into (1) long range programmatic research in radiation biology, (2) basic research in radiation biology, (3) basic research in other related aspects of biology such as biochemistry, biophysics, genetics, and molecular biology.  In accordance with statements made in the recent Biology and Medicine budget assumptions, the main studies in category (1) are receiving immediate attention in FY 1971. These include the Janus program in which biological experiments will start early in FY 1971 and will then be pursued vigorously. (Detailed experimental plans are available in these budget statements and in separate reports to AEC-DBM [Feb. 1970].) The transfer of personnel from other research efforts into the Janus program, increasing it from less than 4 scientific man years in FY 1969 to 11 in FY 1971 (during a time of severe budget limitations which required involuntary termination of personnel), has placed a serious strain on the Division's other programs. At the present time 10 to 12 additional scientific man years of support personnel are needed for various scientific programs other than Janus which cannot presently be filled. The Janus program still requires additional professional personnel, for example, in cytogenetics and in virology and these needs will become critical in FY 1972. They cannot be provided out of further transfer within the Division and additional effort will need to be provided unless further severe reductions are made by eliminating complete programs in other research areas.	

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## 7. Description (Contd.)

A major long range program, the Metabolism and Toxicity of Fission Products in Dogs, has been reduced further. Recently an excellent record of productivity in the publication of results of past work has been achieved and the next phase of this program requires expansion in certain experimental areas, notably in the further development of chronic external  $^{60}\text{Co}$   $\gamma$ -radiation exposures in dogs. The  $\gamma$ -radiation exposure series forms an important background not only for the fission product experiments, but for probable neutron toxicity studies in dogs later.

The program on the toxicity of the actinide elements and attempts to combat their effects therapeutically should be expanded into a program of broader scope, with studies in dogs in addition to those in mice. The current budget statements refer only to the program in its present form but an expanded program is expected to be developed soon.

Basic research in radiation biology has suffered some contraction into the Janus program and by other forms of attrition (such as administration!). However, strong programs are, with some difficulty, being maintained in radiation effects in bacteria, in mammalian cells, and in some in vivo cell compartments in animals; and in various theoretical and mathematical approaches to responses in dynamic systems. These programs will inevitably move somewhat more slowly than formerly due to decreased available manpower.

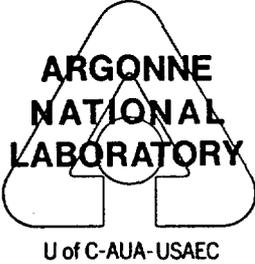
In the basic research areas certain segments of the programs have suffered severely. Carcinogenesis and related studies in biochemistry have been cut drastically by various staff changes. Carcinogenesis is an area of research of vital and unique concern to those engaged in study of radiation and environmental problems, and this subject area must be rebuilt, probably with a modified program orientation, as soon as possible.

A number of other areas require further development and would deserve expansion if this were feasible. Excellent progress has been made in the general area of macromolecular structure by both NMR and x-ray crystallographic techniques, and possible applications to some medical situations are even beginning to emerge. Development of the gas chromatograph-mass spectrometer and its utilization for stable isotope studies, with eventual clinical application, is continuing. Various studies in microbial genetics, particularly those concerned with the control of growth and others with the nature and mapping of bacterial chromosomes, have been making good progress and are also continuing. Time-related phenomena in mammalian and other cells show clearly the importance of time-dependent control factors in governing radiation and other responses. The decline of activities in this important area is a cause for concern.

In addition to the critical effect of reduced numbers of scientific support personnel on some programs, the reduction in the number of temporary personnel over a period of years has a very serious effect on the scope and vitality of most of our activities. The numbers of temporary personnel, paid by the Laboratory, have dropped from over 16 scientific man years in FY 1967 (which was not in itself a sufficiently high number) to less than 6 man years in FY 1971. Means must be found to support well-qualified candidates in the temporary category. In

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7. <u>Description</u> (Contd.) <p>addition to outside sources of support which we are seeking, the AEC-DBM program should provide for more appointments in those programs of unique concern to them.</p> <p>Efforts to encourage research and teaching cooperation with university groups are continuing. Staff personnel of this Division are cooperating in the provision of expanded course work at two institutions in the area and it is anticipated that these activities will lead to additional research cooperation by both staff and students.</p> <p>A desirable change of emphasis has been introduced in relation to medically oriented programs. The medical aspects and applications of some of the basic research are being encouraged, cooperation with appropriate medical departments of universities such as Chicago is being developed and, hopefully, appropriate temporary personnel with medical backgrounds will conduct some research here. Ultimately, in more favorable conditions, appointments designed to take advantage of medical exploitation of basic research here in the Division may be considered.</p> <p>Within the Radiological Physics Division a new program - Radium Studies - is underway to study the effects of internal emitters on man. This Center for Human Radiobiology has completed the transfer of Prof. Robley Evans' staff from the MIT laboratory. The remaining small satellite laboratory at MIT is to be funded as a subcontract from Argonne starting Sept. 1, 1970. It will function as a Boston field office of the Radium Studies where total body <math>\gamma</math>-ray measurements and radon breath measurements will be carried out on those radium patients that are not brought to Argonne for study.</p> <p>Although budget and space limitations presently prevent adequate staffing of the Center for Human Radiobiology, it is clearly evident that a medical branch must be added to this program. Plans call for the addition of a Medical Director in FY 1972, and an office and laboratory building to house the expanded staff.</p> <p>Two programs of the Radiological Physics Division - Radiation Physics, and Radioactive and Trace Element Metabolism - have curtailed research efforts because of recent budget restrictions. Because these two programs provide the basic research on which advances in Biology and Medicine are built, it is imperative that these two groups be brought up to an efficient operating level during FY 1972.</p>	

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7. Description (Contd.)

The Great Lakes Ecology Study which is jointly funded by DBM and RDT, was initiated in FY 1970. This program is conducted by personnel from RPY and from Argonne's Center for Environmental Studies. The program objectives are to determine the influence of thermal and radioactive discharges from nuclear power plants sited along Lake Michigan upon the physical and biological environment of the lake. The RPY effort involves the study of radioactivity in the lake and its biota; intensive physical and biological studies at selected sites such as Waukegan and Zion; and the meteorological effects of releasing heat into the lake. The program is expected to grow in FY 1971, and a relatively large field effort will be conducted in conjunction with university investigators in this region.

The Atmospheric Sciences program continues to document relevant parameters on the site and to correlate these with urban measurements as part of the Chicago Air Pollution Program. Urban meteorology and an intensified program in rain scavenging - inadvertent weather modification are essentially new efforts in FY 1970 and FY 1971. Research on energy transfer at the air-water interface is being directed to examine energy loss mechanisms on Lake Michigan.

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