

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

Opalescence of Serum After Total Body Radiation as a Prognostic Sign of Death

### Permalink

<https://escholarship.org/uc/item/33x3t9pz>

### Author

Rosenthal, Robert L.

### Publication Date

1949-01-14

UNIVERSITY OF  
CALIFORNIA

*Radiation  
Laboratory*

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy  
which may be borrowed for two weeks.  
For a personal retention copy, call  
Tech. Info. Division, Ext. 5545*

BERKELEY, CALIFORNIA

UCRL - 273  
D.D.

## **DISCLAIMER**

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.



UCRL - 273

Administrative General

UNIVERSITY OF CALIFORNIA  
Radiation Laboratory  
Division of Medical Physics

**UNCLASSIFIED**

Contract No. W-7405-eng-48

OPALESCEENCE OF SERUM AFTER TOTAL BODY RADIATION AS A PROGNOSTIC SIGN OF DEATH

Robert L. Rosenthal

January 14, 1949

Berkeley, California

Administrative General

Opalescence of Serum after Total Body Radiation as a Prognostic Sign of Death<sup>1</sup>Robert L. Rosenthal<sup>2</sup>

Radiation Laboratory, Division of Medical Physics

University of California

Berkeley, California

During an investigation of the clotting reaction of blood after irradiation with 200 kilovolt X-rays, the author noted the appearance of a marked opalescence in the serum and plasma of rabbits which subsequently died a few days after exposure to a single lethal dose of total body irradiation. This opalescence appeared within 24 hours following the exposure to radiation. In all cases, it disappeared completely 72 hours after exposure. A review of the literature has failed to reveal any mention of this phenomenon.

Rabbits of the New Zealand white strain were given over the total body single doses of 200 kilovolt X-irradiation, calibrated in air by a Victoreen ionization chamber. Dosage ranged from 200 to 1000 Roentgens (r). Blood samples were obtained by cardiac puncture before radiation and at various intervals after radiation (up to 30 days). Serum was obtained from the clotted blood and plasma obtained by centrifugation of either citrated or oxalated blood. In all cases the opalescence, when present, was noted in both serum and plasma.

---

<sup>1</sup>Portions of this study were aided by the Atomic Energy Commission and U.S. Navy Contract N60cri-111, Task Order III Project No. NR 171-138.

<sup>2</sup>The author wishes to thank Dr. John H. Lawrence and Dr. Hardin Jones for their valuable advice and assistance.

The opalescence was noticeable as a pearly white tint homogeneously distributed throughout the sample. Various degrees of intensity have occurred and can be classified as marked, moderate and slight, as shown in Fig. 1. All animals which showed the marked opalescence died as a result of radiation within 5 days following exposure. Animals having no opalescence or opalescence to a lesser degree usually survived the radiation for at least 30 days, unless death occurred from other causes.

The opalescence, when present, was prominent at 24 hours after radiation, and completely disappeared 3 days after radiation in all cases. No relation was noted between the occurrence of opalescence and diet or fasting. Serum obtained either with or without fasting (20 hours) has always been clear except for the opalescence following radiation. On the other hand, the opalescence has been found in both fasting and non-fasting animals.

In the present series of rabbits, there is no relation between the opalescence and changes in weight, white cell count, lymphocyte or heterophile count 24 hours after radiation. The absence of any red pigmentation in the opalescent serum tends to rule out erythrocyte hemolysis as a causative factor. Also, there does not seem to be any direct relation between opalescence and radiation dose rate. Table 1 lists data pertinent to this report. Detailed coagulation and hematological studies on these animals will be reported subsequently.

Studies are now in progress with the collaboration of Dr. John Gofman to determine the chemical nature of the opalescence. The opalescence can be eliminated from serum by acetone and ether extraction according to the method described by Blix<sup>3</sup>. In low-speed ultracentrifugation, material, responsible at least in part for the opalescence, rises to the top to leave a clear infranatant solution.

---

<sup>3</sup>Blix, G. J. Biol. Chem., 108, 64, (1946)

At present, there is no clear explanation of the mechanism by which radiation produces this opalescence. In view of its apparent relation to death, this phenomenon may not only provide a valuable, early measurement of the effect of acute exposure to radiation, but may lead to further knowledge concerning the nature of radiation sickness and its lethal mechanisms.



TABLE 1

Dosage of Total Body Irradiation, Appearance of Serum Opalescence, Survival Time, Lymphocyte and Heterophile Counts in Rabbits.

Habbit #	Radiation dose		Opalescence of serum 24 hours after radiation	Survival after radiation			Lymphocyte count		Heterophile count	
	r	r/min.		Died from radiation	Died other cause	Sacrificed	Before radiation	after radiation	Before radiation	After radiation
				days	days	days				
2	200	25.8	None	-	-	28*	4700	1960	4610	2640
1	400	25.8	None	-	-	28*	5560	1030	2570	3180
1	400	23.2	None	-	-	34	2067	840	3230	5810
2	400	23.2	None	-	-	34	1920	990	2880	5340
3	800	47	None	-	-	32	8360	240	2640	7520
7	800	24	Marked	5	-	-	9510	1020	5430	7310
8	800	52	Marked	2	-	-	6980	660	1870	10120
10	800	52	Slight	-	16**	-	6770	520	1850	9464
11	800	52	Slight	-	-	31	8450	970	1180	9400
12	800	54	Clear	-	9***	-	2840	159	2440	4980
13	800	54	Clear	-	-	31	5100	470	2100	3430
5	1000	24	Marked	5	-	-	5740	250	7760	8050
9	1000	52	Clear	-	-	30	4710	580	6330	6570
14	1000	43.5	Clear	-	10 <sup>+</sup>	-	4820	330	2190	3690
15	1000	43.5	Marked	31 hrs.	-	-	8500	4520	1360	2810
16	1000	44	Moderate	-	-	35	11400	310	2810	7330
17	1000	44	-	20 hrs.	-	-	6530	-	2400	-

\* Not sacrificed, 400 r. given on 28th day after first radiation.

\*\* Died 20 minutes after nembutal. Post mortem: small rt. hemothorax, otherwise negative on gross examination.

\*\*\* Died within 1 hour after nembutal and cardiac puncture. Post mortem: marked gastric dilatation with moderate pyloric hypertrophy, otherwise negative on gross examination.

<sup>+</sup> Died 1/2 hour after cardiac puncture. Marked hemopericardium present. Post mortem otherwise negative (gross examination).

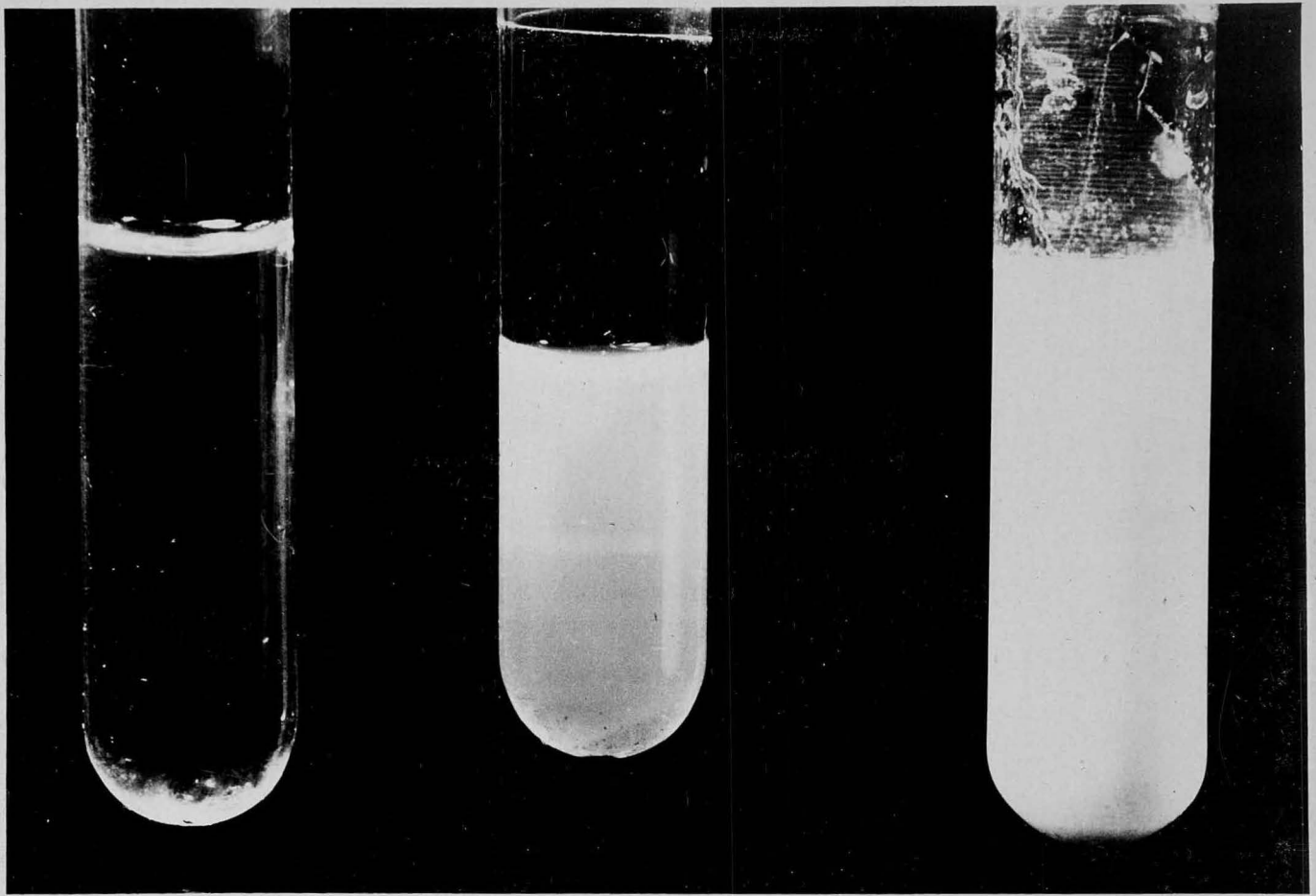


Fig. 1. Tube at left shows clear serum as found before irradiation of rabbit. Center tube shows moderately opalescent serum ( rabbit #16, 24 hours after irradiation; animal sacrificed 34 days after irradiation). Tube at right shows markedly opalescent serum (rabbit #15, 24 hours after irradiation; died a few hours later).