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Effect of x-ray irradiation on cell permeability. (preliminary report)

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(preliminary report)

By

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Contradictory opinions are prevalent concerning the effect of x-ray or allied irradiation on cell permeability. Some authors conclude from the effect of x-ray irradiation on artificial parthenogenesis, which is generally believed to be owing to the change of cell permeability, that the permeability is increased by x-ray irradiation. Others insist on the contrary that no permeability changes are caused by the irradiation.

As an indication of the permeability changes, I adopted the hemolysis of erythrocytes (human and cow's blood) and the least liminal strength of stimulus to cause the excitation of the nerve muscle preparation of a frog, and compared these values before, during and after the irradiation.

Methods.

A high tension transformer *Yasaka* (*Shimadzu*) and "original *Müller* x-ray tube" were employed. The potential across the tube was kept constant at 45,000 volts, at 5 milliamperes. The distance of the target from the material irradiated was 20 cm.

Results.

(1) Hemolysis of erythrocytes.

Red blood corpuscles of human and cow's blood were thoroughly washed and suspended in physiological saline solution. The suspension was irradiated for 5 and 10 minutes and diluted with common salt solution or with cane sugar solution of varying hypotonic concen-

trations. The necessary concentration to evoke hemolysis was determined after 12 hours.

In both the irradiated and the non-irradiated control samples, hemolysis occurred invariably at a concentration between 0,6 – 0,5 p. c. of NaCl (human blood). I could not find any differences in the hemolysis concentration between the control and the irradiated samples.

(2) Excitability of nerve muscle preparation of a frog.

In order to pursue exactly the excitability change of the preparation, I measured the intensity-duration curve before, during and after the irradiation.

After the irradiation rheobase tends to increase slightly, but there is no change of chronaxie (see Tables).

20/II, temp. 17° C., sciatic-gastrocn. preparation of frog.
Röntgendosis ; 86 international röntgen units (i. r. u.).

t (msec)	v (volts)	
	before	after
0,25	0,87 (0,94)	0,94 (1,08)
0,30	0,59	0,64
0,40	0,38	0,43
0,50	0,29	0,36
0,60	0,26	0,28
0,80	0,22	0,28
1,00	0,20	0,26
1,50	0,18	0,23
2,00	0,17	0,21
Rheobase	0,15	0,21

21/II, temp. 17° C., sciatic-gastrocn. preparation of frog.
Röntgendosis ; 86 i. r. u.

t (msec)	v (volts)	
	before	after
0,25	0,93	1,30 (1,15)
0,30	0,65	0,80 (0,63)
0,40	0,46	0,48
0,50	0,39	0,36
0,60	0,36	0,34

t (msec)	v (volts)	
	before	after
0,80	0,32	0,30
1,00	0,30	0,29
1,50	0,29	0,29
00,2	0,29	0,29
Rheobase	0,26	0,29

28/II, temp. 16,5° C., sciatic-gastrocn. preparation of frog.
Röntgendosis; 86 i. r. u.

t (msec)	v (volts)	
	before irradiation	after irradiation
0,20	8,3 – 8,2	8,6
0,25	5,9	6,6
0,30	4,5 – 4,8	5,3
0,40	3,3 – 3,5	4,0
0,50	2,9	3,2
0,60	2,5 – 2,6	2,9 – 3,0
0,80	2,1	2,5 – 2,6
1,00	1,9 – 2,0	2,4
1,50	1,6	1,9
2,00	1,5	1,8
Rheobase	1,2	1'5

28/II, temp. 16.5° C, sciatic-gastrocn. of frog.
Röntgendosis; 86 i. r. u.

t (msec)	v (volts)	
	before	after
0,20	8,0 – 7,0	7,90
0,30	4,4	4,50
0'40	3,4	3,40
0,50	3,0	3,00
0,60	2,9 – 2,6	2,70
0,80	2,5 – 2,2	2,10
1,00	2,1 – 2,0	2,00
1,50	2,0 – 1,7	1,70
2,00	1'9 – 1,5	1,60
Rheobase	1,4	1,30

	Strength of the threshold stimulus (Coil distance cm)				
normal	9,1	9,1	9,0	9,0	8,9
1 min. irradiation	9,0	8,9	9,0		
3 min. irradiation	9,1	9,0	9,3		
5 min. irradiation	9,1	9,0	9,3		
10 min irradiation	9,1	9,2	9,1		

Parallel with the intensity-duration curve determination the least liminal strength of stimulus for excitation to induction shocks was also determined. One of these results is given in the above table. There was no effect of irradiation on the value of the least liminal strength of stimulus to induction shocks.

Conclusion,

From the preceeding results, we conclude that x-ray irradiation at a strength of 86 international roentgen units during 10 min. has no effect on the permeability of the cell membrane.