

IMMUNOLOGY

RELATIONSHIP OF ANTIBODY FORMATION TO THE DURATION OF CONTACT OF ANTIGEN WITH SKIN RECEPTORS

A. N. Gordienko, R. B. Tsynkalovsky, B. A. Saakov and
N. V. Karnitskaya

From the Dept. of Pathophysiology (Chairman—Professor A. N. Gordienko) of the Rostov
Medical Institute

(Received May 18, 1955. Presented by Academician A. D. Speransky)

Indications are found in the literature that even the briefest contact, measurable in seconds of antigen with skin receptors is sufficient for the formation of antibodies [1, 3].

In view of the small amount of facts available regarding this problem and their controversial interpretation, it appeared worthwhile to us to continue research in this direction.

We tried to discover whether antibodies are formed during a minimal contact time of antigen with the chemoreceptors of the skin and whether there is a direct relationship between the antibody titer and the length of time the antigen is in the skin.

Heated typhoid fever vaccine containing 4 billion bacteria per 1 ml and live culture of pertussis bacteria isolated from a sick child during the first week of the convulsive period (in a suspension of 10 billion per 1 ml) were used as antigens.

The experiments were carried out on chinchilla rabbits. 0.2 ml of the antigen was administered strictly intradermally into the tip of the ear. Various lengths of time after the administration (from 5 to 30 seconds), the ear with its antigen supply was removed. The antibody titer (agglutinin) was determined 4-7 days after the antibody administration. All the rabbits were investigated earlier for the presence of N-agglutinins of the antigens used.

We took pertussis antigen, to which rabbits do not have N-antibodies in the majority of cases, in order to exclude the possible rise in N-antibody titres.

Preliminary experiments established that a 10 or even 5 second contact between the antigen and the skin receptors of the rabbit's ear is enough for the appearance of antibodies in the blood (their titers are basically small — 1:160, 1:8-, sometimes 1:320). It should be pointed out that we only use the data of a very distinct reaction (+ + +). Less distinct agglutination was observed at much greater dilutions.

Control experiments carried out in the same way with the administration of physiological solution instead of antigen gave negative results. Having confirmed the data in the literature, and, convinced of the occurrence and reproducibility of antibody formation during short-term contact of antigen with receptors, we proceeded to clarify the question whether the height of the antibody titers obtained depends on the length of the contact (5-30 seconds).

The data of this series of experiments are compiled in the Table.

As is evident from the Table, we could not establish any distinct relationship between the duration of the contact of the antigen with the skin receptors and the height of the titer of the antibodies which were formed.

Relationship Between Antibody Titer of Rabbits and the Duration of the Antigen Contact with the Receptors of the Skin of the Ear

Rabbit No.	Duration of contact (sec)	Agglutinin titers and distinctness of the reaction		
		original background	4th day	7th day
Antigen-typhoid fever vaccine				
2	10	1:10+	1:20+++	1:80+++
4	10	1:20+	1:20+++	1:320+++
7	20	1:10±	1:40++	1:160+++
10	20	1:20±	1:40+++	1:320+++
12	20	0	1:40+++	1:80+++
13	20	1:10++	1:20+++	1:40+++
6	30	0	1:20+++	1:160+++
11	30	0	1:20+++	1:40+++
16	30	0	1:20+++	1:20+++
Antigen-live pertussis culture				
21	10	0	1:40+	1:40+++
22	10	1:20±	1:80+	1:80+++
23	10	0	1:80+++	1:160+++
26	10	0	1:40+++	1:160+++
24	5	0	1:80+++	1:160+++
25	5	1:20±	1:40+++	1:160+++
27	5	1:10±	1:20+++	1:40+++
28	5	0	1:40+++	1:80+++

This contradicts the contact-resorptive theory of antibody production and differs from the data of V. A. Bashenin and L. Kh. Gushanskaya [1].

If the antibodies obtained in the above experiments were formed due to the penetration of antigen into the blood stream, their level would grow in proportion to the length of the contact, i. e. in proportion to the amount of absorbed antigen, which we did not observe.

It should be noted that the discussion is about small amounts of time — of the nature of seconds and tenths of seconds. Other relationships doubtless exist for longer lengths of time.

The above conclusions confirm the importance of the very first seconds of the antigen's contact with the receptor field, which A. D. Speransky [4], A. N. Gordienko [2] and others repeatedly pointed out, and testifies to the fact that antibody formation is triggered by reflex.

In the next series of experiments we tried to obtain a summation of antigen activity, using the methods described above of administering and removing the antigen.

We based ourselves on the data of the laboratory directed by A. D. Speransky [4], which indicated a very swift reconstruction of the system's reactivity, occurring in the first minutes after the administration of antigen, and the possibility of the summation of antigen reactions during microintervals between injections of antigen.

The experimental method was as follows. After a 10-second contact between 0.2 ml of typhoid fever vaccine or live pertussis culture and the receptors of the skin of the ear, the latter was cut off. After 30 minutes, the same amount of antigen was administered in the second ear for the same length of time, which was also cut off after 10 seconds (5 rabbits). Antigen was administered to 6 rabbits four times in both ears with 15 minute intervals between administrations. The ears were removed by sections.

In the course of the described experiments, we could not obtain a summation of antigen activity. The antibody titres of the last group of rabbits did not differ from the titres of the other rabbit groups. The explanation of this should be sought in the famous law of competition between weak and strong stimuli. The detachment of the ear after the first injection of antigen, accompanied by severe pain stimulation, inhibits the subsequent action of the weaker antigen stimulus. As a consequence, there was no summation in this case.

The factual material we have presented is one more proof of the importance of the neuroreflex component in the mechanism of the formation of immune bodies.

LITERATURE CITED

- [1] V. A. Bashenin and L. Kh. Gushanskaya, Zhur. Mikrobiol. Patbol. i Infekts. Boleznei, Vol. 2, No. 2-3, pp. 27-39 (1925).
- [2] A. N. Gordienko, The Neuroreflex Mechanism in Antibody Production and in the Regulation of Phagocytosis* (Moscow, 1954).
- [3] A. A. Kanarevskaya, Byull. Eksptl. Biol. i Med. Vol. 20, No. 4-5, pp. 18-20 (1945).
- [4] A. D. Speransky, Elements of Medical Theory* (Moscow, 1935).

* Published in Russian.