blood, rendering these cells resistant to the action of active agglutinins. The blocking effect was distinct but not very potent.

However, strong support for the specificity of the reaction was derived from an unexpected source. In view of the close serological relationship of goat and sheep blood, an attempt was made to elicit the Paul-Bunnel reaction with goat instead of sheep blood. The first results with six different goat bloods apparently met with failure. But on extending the series to include an additional eight goats, three sorts of reactions were observed as indicated by the results summarized in Table 1.

With goat bloods of types 1 and 2 a strong blocking effect was obtained which is quite analogous to that observed in Rh – mothers of erythroblastotic infants. That specific union occurred is evident from the uniform results obtained in the hemolytic tests and the absorption effect on sheep blood.

It is of interest that sheep blood did not remove much of the agglutinin for goat blood, types 2 and 3. This suggests that for the serological diagnosis of infectious mononucleosis, selected goat blood may be preferable to sheep blood. It is still to be determined whether or not individual differences of sheep blood can be demonstrated with sera of patients suffering from infectious mononucleosis.[7a]

A close analogy to the blocking effect obtained with goat blood or with Rh + blood is the specific absorption of phage by resistant strains of S. Stanley of the paratyphosus B group as observed by Levine and Frisch.[8] In other words, the first stage of the reaction—specific union—occurs in the absence of the visible effect of lysis.

The observations in erythroblastosis fetalis and infectious mononucleosis emphasize the practical and diagnostic importance of the first and far more fundamental reaction of antigen and antibody, *i.e.*, specific union. At the same time, another source for the study of serological components of red blood cells is now available. Thus, one can no longer refer to agglutinable properties demonstrable by direct reactions as the only serological components of red blood cells.

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[7a] Since this paper was submitted, Levine and Waller found individual differences in the agglutinability of sheep blood. However, selected goat bloods of the Nubian breed gave the highest titers.

[8] P. Levine and A. W. Frisch, *Jour. Immunol.*, 30: 63, 1936.

ALTERATIONS IN THE ANTIDROMIC POTENTIAL OF MOTOR NEURONS FOLLOWING CHROMATOLYSIS[1]

As a result of injury or virus invasion, neurons exhibit a wide range of pathological reactions. The best known of these and the one which is most easily controlled experimentally is retrograde chromatolysis. This may be produced in the spinal motor nuclei by cutting a peripheral nerve. Previous papers have shown that neurons so treated will not respond to the proprioceptive reflex[2] and that the motor neuron itself, rather than "presynaptic" elements, is the site of the deficiency.[3] However, a gap still exists in the demonstration that the activity of the whole cell is changed by the chromatolysis, for it is possible that the phenomena depend upon alteration of parts of the cell in contiguity with the *boutons termineaux* of the primary afferent neurons. The data described below were derived from a series of eight experiments which rule out the participation of such local mechanisms in the development of the deficiencies of the chromatolysed cell.

Cats were prepared by cutting the right tibial nerve in the popliteal fossa and allowing the retrograde degeneration to reach its height. The technic of firing the motor neurons antidromically[4] has been used in these experiments. The potentials of the cells, discharged without the mediation of other nervous elements, were recorded with a cathode-ray oscillograph. Systematic probing of the affected segments with micro-electrodes yielded data by which maps were made showing the distribution of the potential fields[5] of both the degenerated tibial nucleus and its normal control on the other side of the spinal cord.

The normal antidromic potential (Fig. 1a) consists of two phases, a positive deviation which represents the approach of the conducted impulse to the cells[6] and a second wave, of positive or negative sign depending on the spatial relations of the micro-electrode to the cells,[7] which represents the discharge of the neuron. The early component is unaffected by degeneration, but the second or cellular component is greatly decreased in amplitude in the chromatolysed nucleus (Fig. 1b). As conditioning curves of the affected nuclei (plotting height of response to a second shock to the interval between two stimuli) show

[1] From the Department of Anatomy, University of Minnesota Medical School. Aided by a grant from the National Foundation for Infantile Paralysis.

[2] B. Campbell, SCIENCE, 98: 114–115, 1943.

[3] *Idem, Anat. Rec.*, 88: 25–33, 1944.

[4] J. C. Eccles, *Proc. Roy. Soc.*, B107: 557–585, 1931.

[5] B. Campbell, *Anat. Rec.*, 91: 77–88, 1945.

[6] R. Lorente de Nó, *Jour. Neurophysiol.*, 2: 402–464, 1939.

[7] Descriptions of the potential fields will be published elsewhere.

an elongation of the refractory period and no hint that some of the cells may be stimulated subliminally, we may assume that the decrease in the potential size

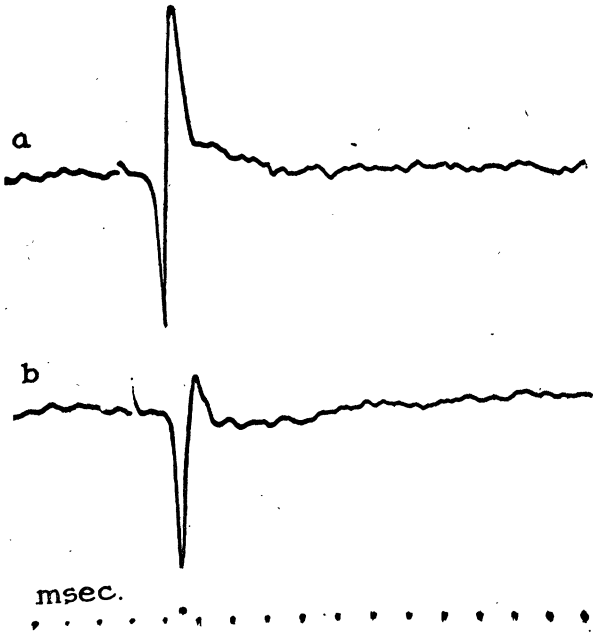

FIG. 1. Potential of ventral horn evoked by stimulation of tibial nerve and recorded by micro-electrode in 7th lumbar segment of the spinal cord of a cat. *a.* Normal side. *b.* Side altered by 27 days retrograde degeneration.

is due to a decrease in the external potential fields of the component cells of the nuclei. That this is apparently the equivalent of the loss of the ability to transmit the proprioceptive reflex offers a new field for theoretical consideration of interneuronal transmission.

CONCLUSION

Cells which have undergone chromatolysis as a consequence of peripheral nerve section respond to antidromic stimulation with reduced action potentials. No indication that any of the cells are stimulated subliminally is found in conditioning curves and the conclusion is drawn that the evoked external potential field of the individual cells is decreased in amplitude.

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THE ANTIBIOTIC ACTIVITY OF EXTRACTS OF RANUNCULACEAE[1]

SINCE the observation of Boas[2] that the leaves and stems of some species of Ranunculaceae contain a soluble substance which retards the growth of *Rhizopus nigricans,* several reports on the antibiotic properties of this family of plants have appeared.[3, 4, 5, 6] Extracts from two members of the Ranunculaceae (buttercups and *A. pulsatilla*) have been examined for their antibiotic activity in this laboratory.[7] Two types of extract were prepared as follows from buttercup, the plant more extensively investigated. The first, referred to as juice, was obtained by grinding the stems, leaves and blossoms of freshly picked buttercups in a meat-chopper, adding an equal weight of distilled water, mixing thoroughly and pressing out the juice through gauze. This was then autoclaved at 15 pounds pressure for 20 minutes. The fluid so obtained was greenish-brown, opalescent and of approximately pH 6.5. The second type of extract, referred to as distillate, was obtained from the juice by steam distillation. The distillate was water clear and of approximately pH 7.1.

The two types of buttercup extracts have been tested for their antibiotic activity against a number of cocci and bacilli which are listed in Table 1. The method of testing consisted in streaking blood agar plates with broth cultures of the organisms and adding Oxford cups filled with the test substance. After 24 hours' incubation at 37° C. the size of the zone of inhibition was measured. It will be seen from the table that all the organisms were sensitive to the antibiotic action of buttercup extract. The thirteen

TABLE 1

THE ANTIBIOTIC ACTIVITY OF BUTTERCUP JUICE AND DISTILLATE TESTED BY THE OXFORD CUP METHOD ON A SELECTED GROUP OF BACTERIA

Bacterium	Radius of inhibition of growth	
	Juice cm*	Distillate cm*
H. strep. 15A	0.9–3.0	1.5–3.0
H. strep. C203	1.5–2.2	1.1
Strep. viridans	0.9	0.5–1.5
Pneumococcus I	1.6	1.5
Pneumococcus III	0.6–1.0	0.6–1.0
N. catarrhalis	1.8	3.0
Staph. aureus BD	0.6	1.0
Staph. aureus Pos.	0.4	0.3–0.6
Staph. Oxford	0.5	1.0
B. anthracis	0.6	0.3–0.6
Pseudomonas aeruginosa (*B. pyocyaneus*)	0.6	0.5–0.7
S. schottmülleri (*B. paratyphosus* B)	0.5	0.6
Esch. coli	0.5	0.5

* The figures given represent the minimum and maximum radius of inhibition observed. When penicillin was employed as a control utilizing *H. streptococcus* 15A, C203 and *Staph.* Oxford as test organisms a solution reported to contain 3 units per cc produced a zone of inhibition with a radius of 0.8–1.0, 1.1 and 0.9–1.0 cm, respectively.

[1] From the department of bacteriology, College of Physicians and Surgeons, Columbia University, New York, N. Y.

[2] Friedrich Boas, *Ber. deut. botan. Ges.,* 52, 126, 1934.

[3] Friedrich Boas and Rudolph Steude, *Biochem. Z.,* 279, 417, 1935.

[4] Friedrich Keding, *Angew. Botan.,* 21, 1, 1939.

[5] Gisela Schmidt, *Z. f. Imm.,* 102, 233, 1942.

[6] E. M. Osborn, *Brit. Jour. Exp. Path.,* 24, 227, 1943.

[7] We are indebted to Miss Gertrude Herz for technical assistance.