

Bacteriological Studies in Idiopathic Epilepsy and Schizophrenia

Edward C. Rosenow, M.D.

Bacteriologic Research, Longview Hospital
Cincinnati, Ohio

Sept 52

The successful reproduction in animals and the obtaining of serologic and other criteria indicating causal relationship of alpha streptococci isolated in studies of diverse diseases, 1, 2 including diseases of the nervous system, currently considered as due to causes other than infection furnished important evidence suggesting that respective specific types of alpha streptococci might be etiologic in idiopathic epilepsy and schizophrenia. The results of bacteriologic studies in the following diseases and which were reproduced or simulated in animals with respective alpha streptococci isolated from nasopharynx or other foci of infection were especially relevant: — epidemic and post-operative hiccup,^{3, 4} persistent sneezings and convulsions,⁵ muscular spasms during general anaesthesia or ether convulsions,^{6, 7} spasmodic torticollis,⁸ respiratory arrhythmia,⁹ Sydenham's Chorea¹⁰ and Myasthenia gravis.^{11, 12}

The occurrence of convulsions or spasms in 109 or 17% of 629 rhesus monkeys from whose brains, alpha streptococci were isolated in 50 or 60% of 83 cultured following cerebral inoculation of natural and experimental viruses of poliomyelitis and encephalitis from which this type of streptococci was isolated and in somewhat higher incidence following inoculation of neurotropic streptococci isolated in studies of poliomyelitis and encephalitis; from outdoor air in summer during such epidemics, the changes which such streptococci undergo seasonally at ground level¹³ and on exposure to the high frequency field of radiant energy¹⁴ are all suggestive of the possibility that epilepsy and schizophrenia may be caused by specific types of alpha streptococci.

The recovery from symptoms in nervous states or psychoses following the removal of infected teeth from which neurotropic alpha

streptococci were isolated, which on inoculation in rabbits caused extreme excitation; and the favorable results from the use of vaccines prepared from neurotropic alpha streptococci were taken to indicate that a specific type of streptococcus might be causative of schizophrenia.

The strange behavior of rhesus monkeys such as threatening to attack, extreme excitation in which they dashed about violently, the apparent seeing of imaginary objects or of hearing noises and cataleptic states which occurred following intracerebral inoculation of neurotropic alpha streptococci as an integral part of other symptoms, such as blurred vision or blindness, nystagmus, myoclonic spasms and flaccid or spastic paralysis suggested a streptococcal etiology in schizophrenia.^{15, 16}

During the course of such studies. I inoculated monkeys and rabbits with streptococci isolated from the nasopharynx of a patient, a middle-aged woman, who was suffering from an acute attack of "psychoneurosis." The patient made a slow recovery under insulin shock treatment. She remained apparently well for eight years, when she had a recurrence incident to the death of a son.

My studies were made at the time of an attempted suicide during her first attack. Material obtained on the swab from her nasopharynx was washed off in 2 ml. of sodium chloride solution. Blood agar streak cultures of the sodium chloride suspension revealed large numbers of colonies of alpha streptococci, and short-chained streptococci grew out in pure culture in dextrose-brain broth. The sodium chloride solution suspension of the nasopharyngeal swabbing was inoculated intracerebrally into the right frontal lobe of two rabbits and one monkey.

Severe tremors and excitation developed in both rabbits. At times they dashed about in a wild fashion unmolested in their cages.

* And address delivered at a meeting of the South Dakota State Medical Association, Sioux Falls, South Dakota, May 20, 1952.

Hemorrhagic edema of the lungs and severe congestion of the brain were found at necropsy in both rabbits, and large numbers of the streptococci were isolated from the brain and blood after death.

Symptoms in the monkey were similar. It became extremely excitable the day after inoculation. On the second day, and for five days thereafter, excitability and hyperirritability were extreme. The animal seemed disoriented most of the time. It often acted as if it saw imaginary threatening objects always on its left side. Spinal puncture made on the day following inoculation revealed slightly turbid fluid from which the streptococcus was isolated in pure culture. The brain after death was diffusely congested. There was no gross evidence of meningitis and no mark at the site of intracerebral inoculation in the right frontal lobe. A large blood clot was found in the left cerebral ventricle adherent to the choroid plexus. The viscera were normal. Cultures in dextrose-brain broth of pipettings of the brain substance admixed with cerebrospinal fluid yielded a pure culture of the streptococcus. Cultures from the blood and brain on blood agar plates proved sterile.

One additional rabbit was inoculated with 1.2 ml. of a 1:200 dilution of the dextrose-brain broth culture of the streptococcus isolated from the spinal fluid on the second day, and one monkey was given 2 ml. intracerebrally and 3 ml intraspinally of a Berkefeld filtrate of 10% emulsion of the brain of the monkey. The third rabbit developed symptoms similar to those of the two rabbits that received the sodium chloride solution suspension from the nasopharynx of the patient. The monkey remained free from symptoms for twenty days, when it became extremely excitable and repeatedly threatened to charge when observed in its cage. On being prodded it developed severe tremors and slight clonic spasms. The temperature was 106° F. The following day the temperature was 105.2° F. It continued to be extremely excitable, threatening to charge for several days; then it recovered gradually. It remained well for three months, when it was inoculated with material from another source.

The disappearance of seizures in epilepsy following the use in guarded dosage of vaccines prepared from the streptococcus as iso-

lated from the nasopharynx and infected teeth in dextrose-brain broth in a small number of cases of epilepsy as opportunity occurred indicated a streptococcal etiology in this dread disease.

In addition, results similar though less striking as in the following case were noted. The importance of foci of infection harboring alpha streptococci was vividly shown in a case of idiopathic epilepsy in a man of middle age, a teacher, whose recurring grand mal seizures had become so frequent as to disqualify him from his occupation. A general examination revealed nothing of importance except for a pulpless roentgenographically positive tooth. During the local injection of novocaine for the extraction of this tooth, the patient fell to the floor in a typical grand mal seizure. A sample of blood was withdrawn during the attack for cultures and serologic study. Immediately following recovery from the seizure, the patient's tooth was extracted in a sterile manner. Cultures in dextrose-brain broth from the blood and apex of the tooth yielded a pure growth of an alpha streptococcus which, on intracerebral inoculation of rabbits, produced convulsions. The streptococci, both from the tooth and blood, were agglutinated specifically by the patient's serum. The grand mal seizures disappeared and did not return for a period of 9 years.

A study of cases of epilepsy and dementia precox from the infectious standpoint was undertaken while at the Mayo Foundation in 1943 and 1944. The cases studied resided in the Rochester, Minnesota State Hospital. Respective specific types of alpha streptococci were isolated and through the cooperation of Eli Lilly & Co., horses were immunized with appropriate dilutions of the freshly isolated streptococci whose specificity was maintained in dehydrated form at 10° C in very dense suspension of glycerin, two parts and saturated NaCl solution, one part. The anti-streptococcal horse serum thus obtained was used in agglutination and precipitation experiments and the euglobulin fraction in cutaneous tests served as a means of demonstrating respective specific streptococcal antigen in skin or blood.¹⁶ Owing to my becoming "of age" at the Mayo Foundation, these and other studies were unavoidably interrupted. However, opportunity for continuing studies on the production of thermal antibody

from streptococci became available through Alexander Goetz and Robert Milliken at the California Institute of Technology. One year later, owing to the creation of a special fund by Martin Fischer, Professor of Physiology of The University of Cincinnati and its administration by Dr. Earl A. Baber, Superintendent of Longview Hospital, Cincinnati, Ohio, I had opportunity to resume, full time, my studies of epilepsy and schizophrenia from a bacteriological point of view.

Isolation and Agglutination of Streptococci

Convincing evidence that respective specific types of alpha streptococci may in fact be causative of both epilepsy and schizophrenia have now been obtained during extended studies at Longview Hospital. Respective specific types of alpha streptococci have been isolated consistently in dextrose-brain broth from nasopharynx, infected teeth and sometimes from the blood in epilepsy and schizophrenia and in epilepsy especially from the blood obtained shortly before or during grand mal seizures. The respective strains were agglutinated and extracts in NaCl solution and solutions of the respective polysaccharides were precipitated in high incidence by the serum of patients and by the serum of horses that had been immunized with the streptococcus.

Similar, specific agglutinative titers were obtained with the respective antisera prepared in horses and rabbits and the thermal antibody prepared in vitro in NaCl solution in the autoclave at 17 pounds pressure for 96 hours and in NaCl solution in the autoclave for 3 hours after adding 1.5% hydrogen peroxide. Moreover, evidence of specificity was likewise obtained in absorption tests with the respective streptococci in the case of sera of patients, antisera of horses and rabbits and thermal antibodies.¹⁷ The results of precipitation reactions between solutions of the polysaccharides of the respective streptococci and the antisera prepared in horses and rabbits and the sera of persons ill were likewise highly specific and finally specific the interface between NaCl solution wash-precipitations occurred in high incidence at tings of nasopharyngeal swabbings and the antisera of horses and rabbits and the serum of patients.¹⁷

Localization of the Streptococcus in Animals

Intracerebral inoculation of suspensions in

NaCl solution of material directly from nasopharynx, tonsils and infected teeth, of dextrose-brain broth cultures diluted 1-200 to 1-10,000 from 46 cases of idiopathic epilepsy into 106 rabbits caused hyperirritability in 25%, tremors and spasms in 75% and convulsions resembling grand mal in 34%. Similar inoculation in 19 rabbits of the heat killed streptococcus of dextrose-brain broth cultures and of filtrates of such cultures caused hyperirritability in 11%, tremors and spasms in 75% and generalized convulsions in 47%. In sharp contrast, intracerebral inoculation of NaCl solution suspensions of material directly from nasopharyngeal swabbings or of dextrose-brain broth cultures diluted 1-200 to 1-10,000 from 45 cases of schizophrenia was made in 77 rabbits. Hyperirritability, great excitation, often associated with disorientation, developed in 87%, tremors in 79%, spasms in 21% and convulsions in only 3%.

The results obtained in mice were similar. Thus following intracerebral injection of the streptococcus as isolated in dextrose-brain broth from the nasopharynx of 30 persons having epilepsy and from the brain of mice that succumbed to experimental epilepsy through 9 consecutive brain to brain passages, spasms developed in 93% and convulsions in 69% of 130 mice inoculated. Of 44 control mice similarly inoculated with the streptococcus from the nasopharynx of well persons, spasms occurred in only 7% and convulsions in 2%. On similar inoculation of the heat killed streptococcus from 4 epileptics inoculated into 11 mice, spasms developed in 73% and convulsions in 60%. Filtrates of cultures of the streptococci from 6 epileptics inoculated into 22 mice produced spasms in 50% and convulsions in 18%. No spasms or convulsions developed following inoculation of live streptococci isolated from well controls nor with the corresponding heat killed cultures and corresponding filtrates. Similar spasms and convulsions in mice followed inoculation of the streptococcus from "petit mal" epilepsy and mentally deteriorated epileptics. During the course of these experiments, a pregnant mouse that remained apparently well following repeated intracerebral inoculation of the streptococcus from epilepsy gave birth to 4 apparently healthy baby mice. One of these was seen to die in a grand mal seizure several weeks after birth.

The remaining three grew to maturity and spasms were not seen to occur. This occurrence was first considered as perhaps an example of hereditary epilepsy. However, a pure culture of the streptococcus, was isolated from the brain in serial dilution cultures in dextrose-brain broth. The streptococcus from the end point of growth produced spasms in 19 and convulsions in 16 of 22 mice that were repeatedly inoculated intranasally.¹⁶

Mice receiving the living cultures often succumbed from overwhelming spasms. Those receiving the dead organisms usually had recurring spasms for 2 to 5 days and those receiving filtrates of active cultures had recurring spasms and seizures resembling grand mal for from 6 to 24 hours and then recovered. The experimental seizures resembled those in human beings in important respects. They occurred abruptly in animals seemingly well between attacks. They often fell to their sides and sometimes backwards unconscious (falling sickness) as violent generalized spasms occurred. Recovery during quiescent intervals seemed complete as in epilepsy and loss of bladder control occurred during especially severe seizures. Examination of the brain in mice that succumbed during status epilepticus revealed ischemia of the cerebral cortex instead of congestion as occurs following injection of the streptococcus of encephalitis. There was no mark at the point of injection in the right frontal lobe. Suppurative meningitis was not observed. Cultures from the brain of mice that succumbed to inoculation of live cultures yielded the streptococcus.

Diagnostic Cutaneous Antibody-Antigen and Antigen-Antibody Reactions

During extended studies of epilepsy at Longview Hospital and studies of epileptic colonies at Gallipolis, Ohio and Dixon, Illinois, the average immediate erythematous reaction to intradermal injection of thermal antibody prepared in the autoclave from streptococci isolated in studies of epilepsy in 330 grand mal epileptics remote from schizophrenia was 12.00 sq. cm., to schizophrenic antibody, 5.82 sq. cm. and to arthritis streptococcal antibody, 2.24 sq. cm. Cutaneous reactions to thermal and natural antibodies in petit mal were similar to those obtained in grand mal epilepsy. In 26 epileptics in contact with schizophrenics, the corresponding reactions were 10.91 sq. cm.; 7.08 sq. cm. and 2.60 sq. cm.

respectively indicating that prolonged exposure of "epileptics" to "schizophrenics" resulted in inapparent though active infection by the schizophrenic type of streptococcus. Attendants and nurses in wards caring for large numbers of schizophrenics also reacted abnormally to antibody prepared from the streptococcus isolated in studies of schizophrenia. Reactions in epileptics to thermal antibody indicating specific streptococcal antigen in skin or blood were found especially high shortly before seizures, highest during grand mal seizures, lowest shortly after seizures and then increased gradually until the next grand mal occurred. A sharp clearance of specific antigen occurred during seizures. Specific streptococcal agglutinins and specific antibody as revealed by the intradermal injection of specific streptococcal antigen were increased immediately after seizures. Moreover, results from the intradermal injection of epileptic thermal antibody have shown that the administration of phenobarbital and/or dilantin does not eliminate the reaction to thermal antibody even when given in dosage sufficient to prevent seizures indicating that the mental depression in such cases may not be due wholly to the ant-convulsant drugs. Results of cutaneous tests in epilepsy have been confirmed by Bering in a meticulous study of a large number of cases at the London Hospital.¹⁸

The two types of streptococcal antibody, natural antibody prepared in the serum of horses and artificial antibody¹⁹ prepared in vitro in the autoclave from NaCl solution suspensions, have been found highly useful in eliciting almost immediate erythematous reactions on intradermal injection indicating specific streptococcal antigen in skin or blood in diverse diseases and hence a corresponding streptococcal infection. Thermal antibodies used in cutaneous tests were prepared by autoclaving suspensions of streptococci in isotonic NaCl solution for 96 hours or for but 3 hours after adding 1.5% hydrogen peroxide.²⁰ Routinely three thermal antibodies prepared without hydrogen peroxide were injected intradermally prepared respectively from streptococci isolated in studies of epilepsy and schizophrenia and as a control from arthritis. The degree of reactions in persons ill proved remarkably specific. Thus of 468 persons having schizophrenia, the average

erythematous reaction to the "schizophrenic" thermal antibody was 8.33 sq. cm., to "epileptic" antibody 4.37 sq. cm. and to "arthritic" antibody 2.15 sq. cm. Reactions to "epileptic" antibody in schizophrenics exposed to epileptics, while less than to schizophrenic antibody, were greater than in schizophrenics not exposed to epilepsy. Reactions to schizophrenic antibody in cases of manic depressive psychosis, involutional psychosis and paranoia were somewhat less pronounced than in schizophrenics. Persons having acute, subacute and rheumatoid arthritis reacted differentially to antibody prepared from streptococci isolated in studies of arthritis. The average reaction was 10 sq. cm. in 81 cases of arthritis. Cutaneous reactions to the three types of antibody in well persons, not exposed to schizophrenia, were negligible. Reactions to schizophrenic thermal antibody in well attendants, nurses and physicians were directly proportional to the degree of exposure, but were significantly less than in persons having schizophrenia. The reaction to schizophrenic thermal antibody in a group of 54 persons having active symptoms characteristic of schizophrenia or manic depressive psychosis was 10.31 sq. cm. This was in sharp contrast to an average of 3.05 sq. cm. in 32 of these who were tested as unknowns after "recovery." The average reaction to schizophrenic antibody was only 2.74 sq. cm. in a group of 46 persons having senile psychosis or psychosis with arteriosclerosis. The average reaction in 25 persons having psychosis due to intoxication, involutional psychosis and paranoia was 7.85 sq. cm.

Results from Therapeutic Injections of Streptococcal Antibody and Vaccine

Immediate erythematous reactions to intradermal injection of .03 cc of respective streptococcal antigens consisting of bacteria-free supernatant of suspensions containing 10 billion streptococci per ml and which had been heated to 65° or 70° C for one hour have been found to indicate specific streptococcal antibody in skin or blood in diverse diseases quite as corresponding injection of thermal antibody has served to determine specific antigen. A study of erythematous reactions to intradermal injection of respective streptococcal thermal antibody and antigen indicating antigen and antibody respectively were made in relation to therapeutic injection of

thermal antibody and thermal hydrogen peroxide antibody in altogether 20 cases of epilepsy and 41 cases of schizophrenia. A consistent diminution of antigen and increase in antibody and sometimes clinical improvement occurred in high incidence including persons who had suffered from epileptic seizures or from schizophrenia for many years.

The effects of therapeutic injection of vaccines prepared from streptococci isolated in studies of epilepsy and schizophrenia are now under study with encouraging results. In one group of 57 persons, suffering from schizophrenia nearly all for many years, weekly injections of a vaccine prepared from streptococci isolated in studies of influenza and other acute respiratory infections were given successfully for the prevention of a threatened epidemic of influenza. The weekly injections were continued for 10 weeks in the hope that perhaps the neurotropic factor, shown in cataphoretic studies, of this type of streptococcus might have therapeutic value. However, this did not materialize. There was no reduction in reaction to intradermal injection of schizophrenic antibody and no improvement in symptoms. However, following several injections of the schizophrenic vaccine, there was a sharp drop in skin or blood of schizophrenic streptococcal antigen and concomitantly a significant clinical improvement especially in cases of relatively short duration in young persons having dementia precox. In another ward, no improvement and no diminution in cutaneous reactions indicating antigen occurred in 28 schizophrenics who received weekly injections of NaCl solution. In a corresponding test group in the same ward which received weekly injections of schizophrenic streptococcal vaccine, there was a progressive diminution in cutaneous reactions indicating specific antigen and concomitantly clinical improvement in significant incidence.

Comments and Summary

Through the use of special methods, respective specific types of alpha streptococci have been isolated in extended studies of idiopathic epilepsy and schizophrenia. These streptococci are indistinguishable culturally, but they are agglutinated specifically by the serum of persons ill, by respective antisera prepared in horses and by thermal antibody prepared in vitro by heat in the autoclave,

from NaCl solution suspensions without and especially with heat and hydrogen peroxide.

Spasms and convulsions resembling grand mal epilepsy have been produced in high incidence in monkeys, rabbits and mice on intracerebral inoculation of the living and heat-killed streptococcus and filtrates of dextrose-brain broth cultures from epileptics. Great excitation, disorientation and other symptoms resembling those of schizophrenia occurred in high incidence following intracerebral inoculation of the streptococci from schizophrenics in these three species of animals.

An immediate erythematous reaction to intradermal injection of natural antibody in the serum of horses immunized with the respective streptococcal and of artificial antibody prepared in vitro by autoclaving suspensions in isotonic NaCl solution of the respective streptococci for 96 hours and in NaCl solution at 70° C for one hour served as a measure of respective streptococcal antigen and intradermal injection of streptococcal antigen served for the detection of antibody in skin or blood. The cutaneous reactions obtained during these studies of persons suffering from idiopathic epilepsy, manic depressive psychosis, schizophrenia and involuntal psychosis, paranoia and paranoid states, and arthritis proved remarkably specific. They were not only maximal in persons suffering from the disease in question but were often directly proportional to the severity of symptoms and occurred regardless of geographic location, season of year, time of day, age, and sex, whether persons tested were hospitalized or not and, in the case of epilepsy, quite regardless of medication with anticonvulsant drugs. The test is not applicable in especially dark skin of Negroes. Moreover, the cutaneous reaction with thermal antibody served as a presumptive test for the detection of carriers of the streptococci from epilepsy or schizophrenia among well persons and persons suffering from dementia paralytica on exposure to persons suffering from these diseases.

Thermal antibodies prepared from alpha streptococci isolated from nasopharynx of well persons remote from epilepsy and schizophrenia and from the feces of persons suffering from epilepsy and schizophrenia and control injection of sodium chloride solution gave slight, nonspecific, or no reactions.

Repeated intradermal injections of 0.03 ml.

of respective thermal antibodies caused no change in cutaneous reactivity to re-injections. However, intramuscular or subcutaneous injections in therapeutic amounts of thermal antibody and thermal hydrogen peroxide antibody and the vaccine caused a diminution of specific antigen as determined by intradermal injection of thermal antibody and usually a striking increase in specific antibody as determined by intradermal injection of the corresponding streptococcal antigen and also by agglutination tests with the serum.

When respective specific streptococcal antibodies increased and specific antigen diminished following therapeutic injections of thermal hydrogen peroxide antibody and thermal antibody and vaccine prepared from the streptococcus isolated in studies of schizophrenia, clinical improvement and prevention of recurring exacerbations, seemingly attributable to this form of specific therapy occurred in significant incidence even in persons who had suffered from epileptic seizures or from schizophrenia for many years.

The prompt increase of respective specific streptococcal antibodies and a decrease of corresponding antigen in schizophrenia following electrically induced convulsion during electro-shock treatment and in idiopathic epilepsy following spontaneously occurring grand mal seizures indicate the presence of specific types of subclinical streptococcal infections and that preformed, so-called sessile antibodies are mobilized during the course of the violent reactions.

The question regarding the source of or reason for the presence of specific types of streptococci in epilepsy and schizophrenia, whether due to inherited susceptibility, to chance infection by the respective streptococci, or whether the inherited constitution affords the very conditions favorable for alpha streptococci normally present in the throat and elsewhere of human beings to acquire specific affinity for the respective structures in the brain remains unanswered.

The consistent isolation of alpha streptococci in studies of idiopathic epilepsy and schizophrenia, the reproduction in important respects of the disease pictures in animals, the proof of their serologic specificity by the special methods employed, and the data obtained

(Continued on Page 262)

We do not have to be reminded that the money we as students paid in tuition came no where near paying the cost of our education. The balance of this cost was met through taxation in the case of a state supported school, and through private gifts in the case of the private school. The economic situation has made both sources inadequate to meet the demands of present day costs. This is the reason an appeal is being made for funds.

It has been proposed by some, in desperation no doubt, that the Federal Government be urged to step in and meet this deficiency through Federal Grants. The issue that becomes involved is simply this: Medicine feels that should this be permitted we would become as guilty as anyone else in shifting our responsibility to the Government. This is the very thing we have been complaining about for the past several years. The Government has had everything shifted to it that the public has not wanted to be troubled with, such as welfare, insurance, hospital, and medical care. The Government cannot always be blamed, because it has followed the wishes of some of the people when the people themselves have made no effort to solve these problems. These are the questions: Is medicine to join in asking the Government to take over the financial support of medical schools? Are we to shift this additional responsibility to the Government? Are we to be a party to increasing taxes to carry this additional expense? Are we to join in making the Government more indispensable in our economic life? Are we to strengthen the position of Government in providing for us and our needs? This is Socialism by whatever name you will call it.

It becomes our job to prove that the medical profession is a believer in what it says, "All problems can be solved by the people at the community level." We should not delude ourselves with the false belief that paternalism by government is best for any country.

The committee makes this one appeal: We want to finish our campaign stating that every member of our association gave to this cause. If you can only spare a little, send it in. It will make the South Dakota campaign a total effort. It will prove that every physician in our state is participating in this effort to

prove that the individual can and will accept his responsibility.

Schizophrenia—

(Continued from Page 248)

in these studies indicate: (1) that persons suffering from epilepsy and from schizophrenia harbor in nasopharynx, in pulpless teeth, and sometimes in their blood, specific types of alpha streptococci of low general but high and specific "neurotropic" virulence; (2) that the streptococci produce neurotoxins which have predilection for certain structures in the brain and thus may play a role in pathogenesis and (3) that attempts to combat such inapparent infections specifically by passive and active immunization with the respective antigens and antibodies are indicated in addition to present-day methods of prevention and cure.

Further studies on the production and nature of artificial antibodies and on their therapeutic application are in progress and will be reported in due course.

REFERENCES

1. Rosenow, E. C.: Elective localization of streptococci. *Jour. Am. Med. Assn.* 65:1687-1691, 1915.
2. Specificity of streptococci in the etiology of diseases of the nervous system. *Jour. Am. Med. Assn.* 82:449-453, 1924.
3. The production of spasms of the diaphragm in animals by living cultures, filtrates, and the dead streptococcus from cases of epidemic hiccup. *Jour. Infect. Dis.* 32:72-94, 1923.
4. Etiology and serum treatment of persistent epidemic and postoperative hiccup. *Jour. Lab. & Clin. Med.* 28:277-289, 1942.
5. The experimental reproduction of persistent sneezing and convulsions with streptococci isolated respectively from one case each of persistent sneezing and post-influenzal convulsions. *Proc. Staff Meetings Mayo Clin.* 30:384, 1933.
6. Rosenow, E. C. and Tovell, R. M.: Etiology of muscular spasms during general anesthesia. *Am. Jour. Sug.* 34:374-481, 1936.
7. Rosenow, E. C., Further studies on muscular spasms during general anesthesia. Experimental results with neurotropic streptococci from nasopharynges of patients. *Anesthesiology*, 6:12-31, 1945.
8. Experimental studies indicating an infectious etiology of spasmodic torticollis. *Jour. Nerv. & Ment. Dis.* 59:1-30, 1924.
9. Experiments on the etiology of respiratory arrhythmias following epidemic encephalitis. *Arch. Neurol. and Psychiat.* 11:155-178, 1924.
10. Experimental observations on the etiology of chorea. *Am. Jour. Dis. Child.* 26:223-241, 123.
11. Rosenow, E. C. and Heilman, F. R.: Bacteriologic studies in myasthenia gravis. *Proc. Soc. Exper. Biol. and Med.* 34:419-425, 1936.
12. Rosenow, E. C. and Heilman, F. R.: Serologic studies with streptococci isolated in cases of myasthenia gravis. *Proc. Soc. Exper. Biol. and Med.* 34:477-480, 1936.

(Continued on Page 272)

fore, and it is against the ruling of National to do so. I trust that each District that is eligible will do all in its power to make this a successful understanding for Mrs. Saxton.

Dr. Jernstrom has offered to help us organize the unorganized Auxiliary Districts. Won't you members co-operate and help us make the task an easier and successful one?

The first Board meeting of the fiscal year will be held in Sioux Falls in the middle of September. Reports of this meeting will be sent the District Presidents as soon afterwards as possible.

South Dakota has been honored by the National Auxiliary to the American Medical Association once again. Last year Mrs. A. P. Reding of Marion was asked to be co-chairman of Organization with Mrs. Leo Schaefer and handled four States for her. This year Mrs. Reding has been appointed North Central Regional Public Relations Chairman in charge of twelve States. To my knowledge this is the first honor of this kind to be accorded South Dakota by National. Congratulations, Mrs. Reding! We are proud of you. We know you will do an excellent job.

Mrs. Reding received the acclaim of our own members when at the State convention in Sioux Falls the membership requested that she repeat as Editor of our Newsletter again. Our Newsletter you may recall was originated by Mrs. Reding two years ago. This year she will have a co-editor, Mrs. Howard Wold of Madison. The first Newsletter for this year will be printed in late September. Won't every District please send its news? The Editors love to receive it! The newsletter belongs to each one of us, lets all really try this year to make it that way. Districts three and nine have already had their first meetings of the year. Surely you have some tidbits to pass on.

We are sorry to hear that Mrs. E. R. Schwartz of Wakonda is leaving the State. She has been an active member of the Auxiliary for many years. May we wish you much happiness and success in your new location.

In case any of you would need help from our Advisory Council, the Councillors to our Auxiliary are as follows:

Roy E. Jernstrom, M.D., President South Dakota Medical Association, Rapid City

R. G. Mayer, M.D., Editor of the Journal
President-elect, Aberdeen

A. W. Spiry, M.D., Vice-President, Mobridge

R. E. VanDemark, M.D., Chairman of the Council, Sioux Falls

John C. Foster, Executive Secretary, Sioux Falls

Don't forget that the South Dakota Mental Health Association still needs your help. We receive some excellent material, or, for the answers to your questions regarding the Association write to 712-6th St., Brookings, South Dakota.

If you would like me to include any items regarding you or your District in the Journal please send them to me at 1325 South Second Ave., Sioux Falls.

May you all have a most interesting and happy year. Much success to each of you. If I can be of any assistance please write me, for I will do my best to help you.

Mrs. Verlyne V. Volin, President

Schizophrenia—

(Continued from Page 262)

13. Rosenow, E. C.: Seasonal changes of streptococci isolated in studies of poliomyelitis, meningitis and respiratory infection. *Postgraduate Medicine*, 7:117-123, 1950.
14. Rosenow, E. C., Pratt, C. B. and Sheard, Charles: Cataphoretic characteristics of streptococci. II. The effects of intravenous injection into rabbits of strains of streptococci which have been exposed to the high frequency field. *Protoplasma* 23:24-33, 1935.
15. Rosenow, E. C.: Bacteriologic, etiologic and serologic studies in epilepsy and schizophrenia. II. Effects in animals following inoculation of alpha streptococci. *Postgraduate Medicine*, 3:124-136, 1948.
16. Rosenow, E. C.: Bacteriologic, etiologic and serologic studies in epilepsy and schizophrenia. III. Cutaneous reactions to intradermal injection of streptococcal antibody and antigen. *Postgraduate Medicine*, 3:367-376, 1948.
17. Bacteriologic, etiologic and serologic studies in epilepsy and schizophrenia, I. *Postgraduate Medicine*, 2:346-357, 1947.
18. Bering, Edgar A.: Confirmation of the Rosenow Antibody-Antigen Reaction in Idiopathic Epilepsy. *Jour. Neurol., Neurosurgery & Psychiat.*, 14:205-208, 1951.
19. Rosenow, E. C.: Production in vitro of substances resembling antibodies from bacteria. *Jour. Inf. Dis.* 76:163-178, 1945.
20. Studies on the nature of antibodies produced in vitro from bacteria with hydrogen peroxide and heat. *Jour. of Immunol.* 55:219-232, 1947.