which these minute intercellular formations play? Can one doubt that in various pathological affections of the brain as a whole, and of the cerebral cortex in particular, these delicate intercellular structures are the first to be exposed to disease, being the most vulnerable? Of special interest are these data from the point of view of pathological changes of the brain in the so-called "functional diseases" of the nervous system. Obviously, in various "functional diseases," and also in many cases of psychosis, where we are not in a position to identify definite changes in cellular structure, one must assume first of all an affection of these intercellular connexions. The examination of these amazingly fine and diverse structural formations of the cortex presents us with more problems, the resolving of which is one of the chief tasks of modern neurology and neurophysiology. The work of the research staff of the Moscow Brain Institute is dedicated to the study of these questions.

Summary

The classical method of Pavlov in conditioned reflexes enriches considerably our knowledge and understanding of the part which the cortex plays in the most differentiated nervous activity and of the connexion of the cortex with the functions of the inner organs. The novel method of bio-electrical currents, and the exploration of the finest morphological structures of the cortex and its intercellular connexions, open new ways and opportunities for establishing the laws governing the fundamental morphophysiological mechanism of the complicated activity of the cerebral cortex.

DERMATITIS FROM WEARING ARMY SPECTACLES

BY

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SPECIAL REPORT BY

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Although dermatitis due to the dye in artificial-shell glasses is fairly well known (Thistlethwaite, 1943; Gray, 1943) there has been little mention of a similar dermatitis resulting from the wearing of spectacles with metal frames, since its inconvenience is easily avoided under normal civilian conditions. Between December, 1941, and March, 1942, six cases of such a condition were seen by us at a military clinic in Scotland.

The Army spectacle frames (Mk. III) are made of "nickel silver" plated with nickel. Nickel silver has the advantage of useful corrosion-resisting properties; it is an alloy of nickel, copper, and zinc in the following proportions:

Part of Frame	Nickel	Copper	Zinc
Bridge ..	25%	60%-65%	10%-15%
End-pieces ..	25%	60%-65%	10%-15%
Cables ..	12%	60%-65%	23%-28%
Eye-wires ..	12%	60%-65%	23%-28%
Butts ..	10%	60%-65%	25%-30%

After manufacture the frames are given a solid nickel plating. It will be noted that the percentage of copper does not vary: the physical properties of ductility, hardness, etc., depend on the relative proportions of nickel and zinc. Common impurities—sulphur, lead, iron, and mercury—are all harmful in the alloy, and to avoid them the raw materials used in the casting consist only of pure nickel, electrolytic copper, and electrolytic zinc. Samples of each of these substances as well as the alloy, and alloy finally plated with nickel, were supplied by the metallurgists for the purpose of a patch test.

The physical state of the metal is of some interest. In the first place the raw material used is dead soft and therefore in an amorphous state. In the case of the eye-wires this condition is not greatly changed, as the only process is that of rolling and cutting. However, in the case of all other components, striking and reducing operations are carried out, and the metal must therefore be in a more or less crystalline state as a result.

A study of dermatological literature shows that dermatitis is not uncommon in the nickel industry (Blaschko, 1889; Landsteiner, 1924; Bulmer and Mackenzie, 1926; White, 1928; Jadassohn and Schaaf, 1929; Stauffer, 1931; Goldman, 1933; Stewart, 1933), but the first mention of sensitivity to spectacle frames containing nickel seems to be that of Lain (1931), followed by Fox (1933), Urbach (1935), Kristjansen (1937), and Löwenstein (1938).

Lain describes three cases of dermatitis occurring on the temples and ears of men wearing spectacles. In each case the frames were made of so-called "white gold," reported as an alloy of gold, copper, and nickel. In his first case the eruption occurred also across the bridge of the nose, but in the other two the bridge of the spectacles was of a different metal, and the eruption occurred only on the temples and ears. On his inquiry, the optical company manufacturing the glasses instituted a research in their laboratory and reported as follows:

"The trouble seems to be due largely to nickel that is found in white gold alloy. We believe that the action is largely electrolytic; that is, an electrolytic battery action is produced when there are dissimilar metals and an acid (or in some cases an alkaline) fluid is present and in contact with these dissimilar metals. When the perspiration, which is an electrolyte, acts upon the base, metal salts are formed, and such action is more pronounced in the presence of heat. It is probably a salt of the nickel that causes the irritation, which seems to be analogous to a trouble that is present in the nickel-plating industry called commonly 'nickel itch.'"

The case quoted by Fox (1933) was sensitive to both spectacle frames and a wrist-watch made of this white gold.

Goldman in 1933 surveyed the literature up to then and added two cases (not due to the wearing of spectacles) in nickel-workers. Citing the cases of Lain and Fox, he suggests that, in spite of strong presumptive evidence, the failure to perform eliminative patch tests had not positively incriminated the nickel. Both his cases gave a history of previous allergic disturbances (urticaria and hay-fever). Both gave strong responses to patch tests with nickel but negative to the closely allied metal, cobalt, thus showing a strong specificity to the nickel. This specificity, associated with the abnormally short latent periods in his cases (2 days and 3 days) before the appearance of the intolerance, suggests that the hypersensitivity may have been gained by: (1) inherited or congenital idiosyncrasy; (2) exceptionally rapid sensitization (the normal interval is 8 to 10 days); or (3) repeated brief contact with the metal (perhaps as nickel coins or suspender buckles) without appreciable clinical manifestation—the so-called "silent sensitization." Urbach (1935) described a case of sensitivity to nickel-framed spectacles. A patch test with an Austrian schilling, which contains a large percentage of nickel, gave a positive reaction. As the schilling contains other metals, this is of course insufficient as an eliminative test.

That this is not a very infrequent problem when the wearing of nickel-framed spectacles is necessary is shown by the fact that six cases were seen by us in a small area within three months and that similar cases (Bettley and Lyle, personal communication) have occurred in other parts of the country.

Case I

Pte. H. G.; Pioneer, aged 31; single. Received glasses Jan., 1941: myopia, -9.00 dioptres. Within a month a reddish patch developed where the spectacles touched the skin. After a time wearing the glasses for 5 to 10 minutes caused recurrence after a latent period of 15 to 30 hours. Since in spite of treatment it kept recurring on resumption of the spectacles, he was referred to us.

Examination on Dec. 2 revealed vesicular eczematous dermatitis wherever the spectacles touched the skin—behind the ears, over the temples and zygoma, on cheeks eyebrows, and sides of the nose where the pads touched. There was no history of drug sensitivity or other allergic phenomena. Mild pityriasis sicca capitis was present.

Treatment.—The skin healed with calamine lotion, but only when the spectacles were left off. A patch test was performed in the interscapular area with part of the frames, and gave a marked positive reaction in 48 hours. A control patch was negative. The following expedients were then tried: (1) A new pair of glasses: skin broke down in six hours. (2) Zinc adhesive plaster applied over parts of frames in contact with skin: lesion recurred. (3) Cellulose acetate varnish painted on to frames: successfully prevented recurrence, but started to peel off within four days. (4) Cycle-tyre valve tubing pulled over flexible ear-curls and pads, xylonite half-

rings ("washers" in optical trade) clipped over rims, and jaconet covers stitched over flat sides. This final attempt was highly successful, and the covering could easily be renewed when worn out.

Further patch tests were now carried out with the elements of the alloy received from the metallurgists.

Test Patches	24 hours	48 hours	72 hours	96 hours
Pure nickel	—			++
Nickel silver alloy	—	+	++	+++
Copper	—		+	+
Zinc	—			—
Plaster control	—			—

The copper test, repeated 10 days later, was then negative. On March 23, 1942, the Prausnitz-Küstner reaction was carried out on Cpl. B. (a volunteer test subject), and was negative to both nickel and nickel alloy.

Case II

Gnr. A. B., aged 38, married; Army and civil occupation, clerk. At school he was unable to wear metal-framed spectacles owing to "breaking down of the skin": no trouble with shell frames. Refractive error small, but finds glasses essential to his work as a clerk. While in France in 1939 he was provided with Mk. III spectacles. Within three days he felt an itching of the skin in contact with the frames. Soon it became reddened and moist, and began to peel. This stopped as soon as the glasses were left off. There was no history of allergic illness or skin disease. Examination on Dec. 8, 1941, revealed a condition similar to that in Case I. There was no other skin lesion. A patch test with a portion of his own spectacle frames gave a weak positive result. On discarding the glasses the skin on the face healed within seven days.

This man also had a trial of the cellulose enamel treatment to his spectacles, but it began to wear off even more quickly (24 hours), so a pair of frames were covered as in the final experiment in Case I, with equal success.

Case III

Gnr. N. H., aged 32; married; Army occupation, driver; civil occupation, machinist (costumes). Received Mk. III glasses Oct., 1941; myopia, -1.50 dioptres. The second day after wearing these the skin began to break—owing, he thought, to friction, as the glasses fitted rather tightly. Not until the next day did it become inflamed, starting with a burning pain and itching. He then left the glasses off and the skin healed after three weeks. Later, when on guard duty, he was ordered to wear them, and again the skin broke down after only two hours. There was no history of allergic disturbances, or skin disease except boils, nor was he taking drugs of any description.

On account of the abnormally wide distance across the forehead the fit of the glasses was not good. The dermatitis, distributed as above, was a vesicular eczematoid condition with slight secondary infection. There was also slight pityriasis sicca capitis with comedones. The glasses were withdrawn: no treatment was given, and when he returned in 20 days the skin was quite healed. The fit was then very carefully adjusted to avoid all friction, but once more the lesion recurred after six hours. Patch tests were then carried out with portions of frames from each of three manufacturers:

Test Patches	24 hours	48 hours	72 hours	96 hours
Frames "A"	—			doubtful
"B"	—			+
"C"	—			++
Plaster control	—			—

In view of the low refractive error it was considered that this was an ideal case for fitting with "respirator wafers" (Taylor, 1944), which give correction during the wearing of the respirator. At other times he was allowed to wear shell frames.

Case IV

Cpl. R.; Pioneer, aged 37; married; civil occupation, slater. Moderate myopic astigmatism. Received Army glasses in Aug., 1941, and wore them constantly with no trouble for about three or four weeks. First noticed a soreness over the bridge of the nose; then the skin broke and began to weep. Soon the eyebrows were involved, followed by the skin over the temples and behind the ears. The fit of the glasses was always good. Treatment with ointment had no effect, and calamine lotion also failed to cure, although it kept the lesion in check. He returned to the specialist who had prescribed the glasses, and was advised to wear his shell frames and leave off the Army pair. The skin then healed within three to four weeks, using only calamine lotion.

When examined by us on Feb. 1, 1942, after wearing metal glasses again for a few days, he had pityriasis sicca capitis and also a mild seborrhoeic eczematoid condition of forehead and cheeks. Treated with skin paste, this cleared up rapidly, revealing an underlying and resistant spectacle dermatitis. The glasses were removed, and in three days the skin healed. There was no history of allergic disease,

nor was he taking any drugs. He had not previously worn white-metal frames or a wrist-watch. Patch tests as in Case III.

Test Patches	24 hours	48 hours	72 hours
Frames "A"	—		+
"B"	—		+
"C"	—		+
Plaster control	—		—

A trial was made of the cellulose varnish, but within a day it was already starting to peel off, so the frames were covered as in Cases I and II. After wearing these for a month there was no recurrence.

Case V

Cpl. W. M. S., aged 26; married. Army occupation, M.O.'s clerk; civil occupation, schoolmaster. Mk. III glasses prescribed Dec. 10, 1940: low myopic astigmatism. At first, when these were worn only once a week for an hour during the gas practice period, no trouble was experienced. In May, 1941, he started to wear them constantly, and after six days the skin in contact with the frames began to discharge and the pads stuck to his nose. There was slight itching. When the spectacles were discarded the lesion cleared up in one or two days, but each time they were worn again the trouble recurred. He had not previously worn white-metal frames or a wrist-watch.

On Feb. 9, 1942, after wearing the glasses for five days, there was mild weeping and desquamation. No seborrhoea was present, and there was no history of other allergic disturbance or previous skin disease. He was not taking drugs of any sort. The skin actually healed without any treatment while under observation and while the same glasses were in occasional use, although adjusted so as to have little contact with the skin except behind the ears. Patch tests were carried out as follows:

Test Patches	24 hours	48 hours	72 hours
Frames "A"	—	doubtful	doubtful
"B"	—		+
"C" (nickel worn)	+	+	+
Plaster control	—	+	+

In view of these equivocal results and the behaviour of the lesion while under observation one wonders whether in the course of his Army occupation he had learned of this condition and perhaps caused an artefact. In any case, special correction did not seem necessary, and he did not return.

Case VI

Dvr. T. T., aged 32. Army glasses had been prescribed about a year previously. There was no trouble until after six months, when the skin over the bridge of the nose, around the ears, and over the temples broke down. It did not heal until he changed to his reserve pair. Thereafter it remained well until four days before we saw him. Examination on March 1, 1942, showed an eruption similar in appearance and distribution to the previous cases. Seborrhoea was well marked, and pityriasis sicca capitis and a tendency to comedo formation on the skin of the forehead were present. There was no history of skin disease or of previous allergic phenomena, nor was he taking drugs of any kind. The glasses were seen to be roughened, and the nickel plating was worn off over a large area; they were therefore withdrawn. In a week the skin had completely healed without other treatment. Patch tests were carried out.

Test Patches	48 hours	72 hours	96 hours
Nickel silver	—	+	
Alloy plated with nickel	++	++	
Zinc	—		—
Copper	—		—

The Prausnitz-Küstner test was performed, the result being negative to both the nickel silver and the plated alloy. On March 23 he was fitted with frames covered as previously described. In September he returned when the frames required renewal of the rubber tubing. There was a slight recurrence where the metal had come into contact with the skin, but otherwise he had remained perfectly well.

Discussion

These cases are clearly similar to those of Lain and Fox. What is the mechanism of this disorder? (1) It may be mechanical (artefact, roughness of metal parts, bad fit, or roughening of parts during adjustment with pliers). (2) It may be due to an ingested substance which can interact with the metal—sulphur, mercury, etc. (3) It may be an allergic phenomenon.

That our cases were not due to mechanical causes is shown by the fact that the fit was never a matter for complaint (except in Case III; and here, after great care had been taken to secure

a perfect fit, the intact skin broke down within six hours). Careful observation, in addition to the various patch tests, eliminated the possibility of artefact, except perhaps in Case V.

In every case except No. II careful inquiry was made as to the taking of any drugs such as sulphur or mercury, and it appeared that none of the patients was taking even a purgative or was under treatment for syphilis.

There remains the possibility of an allergic or pseudo-allergic cause. To incriminate the spectacle frames as a cause of an allergic skin response one must inquire: (1) Can the metal become ionized under conditions of wear? (Woods, 1933; Landsteiner, 1924.) (2) Do the history and mode of onset suggest allergy? (3) Does the lesion clear promptly on removal of the frames? (4) What is the response to specific patch tests? (5) Can this specific hypersensitivity be transmitted? (Prausnitz and Küstner, 1921.)

Lain quotes a company of manufacturing opticians who, after research, stated that they believed there was an electrolytic battery action between the dissimilar metals of the alloy in the presence of perspiration and aided by body heat.

Specimens of the frames were submitted to Lieut. Atkins, who reports as follows:

"The specimens were washed in absolute alcohol to remove traces of grease and then placed in distilled water, slightly acid as it always is, for several days. There was no trace of nickel by the most sensitive tests, and the surface remained bright. With sodium chloride in the water, between 1% and 2%, there was, however, slight reaction, so that after two or three days there was a marked pink with dimethyl glyoxine and ammonia with specimen 'C,' a definite but lesser pink with specimen 'A,' and no perceptible pink with specimen 'B.' It is possible that there would be still greater reaction if a complete frame was tested, due to one side being electronegative to the other. In this case the dermatitis might be earlier and more marked on one side. It is also obvious that this reaction requires the intermediary of sweat."

It will be noted that all the cases except II and V suffered from pityriasis sicca capitis, and all reported that they sweated very easily. The wearing of a respirator of course induces free perspiration under the rubber. In only one case was an inequality in the dermatitis noted—the worst case, No. III, in which the left side was earlier and more severely affected.

With regard to the second requirement, all these cases conform to the allergic types, with the exception of the doubtful case, No. V. Case II is the only one with a history of a previous intolerance, which explains the short latent period here. Case III also, with a brief latent period, had a breaking of the skin before the burning and itching, and may be explained as the mechanical effect of a bad fit which later became a true allergy, since, in the absence of mechanical irritation, the intact skin broke down in six hours. It does not seem necessary in any of these cases to appeal to the "silent sensitization" mentioned by Goldman, although the number of objects of everyday use which contain nickel is adequate—coins, badges, buttons, plumbers' fittings, parts of motor-cars, as well as the E.P.N.S. forms of tableware and cutlery.

The third requirement is fulfilled, since all cleared up promptly, only the most severe case taking more than a week to do so.

The response to specific patch tests is, as Goldman suggests, the vital test to detect the specific cause, and the results shown above strongly support the hypothesis that the nickel silver is the cause of a specific hypersensitivity. The tests were carried out with the standards laid down by J. Jadassohn and Bloch. Various tests were performed. Cases I to V were all patch-tested with a portion of the actual frames worn, and all were positive. Cases III, IV, and V were tested with portions of frames made by each of three different manufacturers. The results reveal no significant variation. Cases I and II were patch-tested with the separate elements of the alloy, and showed no reaction to the copper and zinc, but some reaction to pure nickel; there was a marked reaction to the alloy itself. The Prausnitz-Küstner reaction was tried in Cases I and VI. Both were negative. It is possible that the injected individuals did not perspire sufficiently.

Finally, a word might be said about occupational causes, but the wide variation in the civil and military occupations seems to rule this out.

Treatment

The occurrence of six cases in a short period of time from a fairly small group makes the question of treatment an important one from the military point of view. It is obvious that desensitization is too slow and uncertain a procedure for military use. The various methods employed by us have been discussed: it only remains to mention that rhodium and chromium plating proved a failure (Bettley and Lyle, personal communication, 1941).

From all points of view the most satisfactory solution was the adoption of the correcting wafer applied to the respirator eyepiece for use during gas attacks and of gold or shell frames at other times. When the refractive error is too high for satisfactory correction by a wafer the best expedient is to cover the frames in the manner prescribed for Case I. This involves only the use of easily obtained materials, and can be renewed by the soldier himself. It does not affect the gas-tightness of his respirator.

Summary of Conclusions

We conclude that dermatitis arising from the use of Army spectacles is an allergic phenomenon resulting from a prior electrolytic battery action which ionizes some of the nickel in the presence of the acid sweat and dissimilar metals, aided by the body heat.

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CEREBRAL FAT EMBOLISM AFTER ELECTRICAL CONVULSION THERAPY

BY

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Electrical convulsion treatment is rightly regarded as the safest of the shock methods available so far. Only a few fatal accidents have been reported in the literature (Alpers and Hughes, 1942; Ebaugh, Barnacle, and Neuburger, 1943; Napier, 1944). The last-mentioned author described 5 cases, which he considers to be the only deaths in England and Wales; in none of them had a microscopical investigation of the C.N.S. been carried out. According to Alexander and Löwenbach (1944), three possible mechanisms may account for the fatal outcome. The first is direct action of the electric current upon the brain tissue through which it passes, resulting in vasoconstriction and blanching of the tissue. They demonstrated this in animal experiments, but to obtain this effect shocks were necessary which in amperage, duration of flow, and density of current far exceeded those used in electric-shock treatment in human patients. The second mechanism is excessive stimulation of the vago-vasomotor centres of the medulla, causing generalized circulatory disturbances. This mechanism becomes operative only if the electrodes are placed in too posterior a plane, allowing the current to flow through the hind-brain. It is conceivable that some of the conflicting experimental results in animals