ulcer, the epidermis shows hyperplasia, and the edges are undermined.

Scrapings from the surface of the ulcer show in most cases numbers of darkly-staining fusiform bacilli and fine spirochætes (*Treponema vincenti*). The fusiform bacilli are mostly present in the superficial parts of the ulcer below the necrotic tissue, whereas the spirochætes are seen both at the base and edges of the ulcer.

Other organisms, *e.g.*, diplococci, streptococci, and bacilli, are also in evidence.

These appearances closely resemble the description of tropical ulcer given by Roy (1939), Rogers and Megaw (1939), and others.

Smears made from the material aspirated from the base of the ulcer (by puncturing the healthy skin surrounding the ulcer and pushing the needle beneath the base of the ulcer) were negative for *Leishmania tropica*.

Discussion

A considerable literature about tropical ulcer is already in existence. In India it has been given the greatest attention in Assam, where it is usually known as 'Naga sore'. In a previous paper from these laboratories about diet and anæmia in Coorg (Bhave and Bopaiya, *loc. cit.*), the similarity of conditions in Coorg and Assam was pointed out. In both areas there is a large coolie population, employed on tea plantations in Assam and coffee plantations in Coorg. In both areas malaria, hookworm and anæmia are prevalent and there is much malnutrition. It is interesting and significant that a high incidence of tropical ulcer should exist in both places.

The view that the factor of malnutrition is of importance in the causation of tropical ulcer has been put forward by various workers (McCulloch, 1928; Brown, 1935; Clements, 1936; James, 1938; Corkill, 1939). No direct proof of the relationship has, however, as yet been forthcoming. The present investigation throws little further light on the problem. It is, however, worth pointing out that tropical ulcer is relatively rare in tea plantation labourers in the Nilgiri hills. The diets consumed by coolies in this area are as defective as those consumed by coolies in Coorg and Assam (Wilson and Mitra, 1938; Krishnan, 1939; Bhave and Bopaiya, *loc. cit.*, in press). Malaria, hookworm and severe anæmia are rare in the Nilgiris. It thus appears probable that other factors besides malnutrition must be operative in areas in which the incidence of tropical ulcer is high. Presumably these include anæmia and debility resulting from blood-destroying diseases.

Summary

(1) Tropical ulcer is common in Coorg. The greatest incidence is among coolies on coffee plantations.

(2) A histo-pathological description is included and the relation of the condition to malnutrition is briefly discussed.

(Concluded at foot of next column)

PELLAGRA IN THE UNITED PROVINCES

By N. AHMED

Divisional Medical Officer, East Indian Railway

A REVIEW of literature appearing in the *Indian Medical Gazette* on this subject for last 12 years 1928–40 shows that, apart from 40 cases reported in 1931 and 30 cases in 1933 by Lowe from Dichpalli, Hyderabad (Deccan), there are only 34 cases more reported from different parts of India and one from Burma. Out of the 34 cases 12 were seen in Southern India (Guntur 4, Vizagapatam 8), one in Poona, 16 in the Punjab (Lahore 1, Kangra District 15) and 5 in Calcutta. Napier (1939) reports that they encounter 6 to 12 cases a year in the outdoor clinic of the Calcutta School of Tropical Medicine. No cases have yet been reported from the North West Frontier, Sind, Baluchistan, Rajputana, Central India, the Central Provinces, Assam, Bihar and the United Provinces.

Pellagra is probably not at all an uncommon affection in those provinces, but it is generally not diagnosed there. It is, in its typical form, so easily diagnosed and with the advent of nicotinic acid so quickly controllable a disease that it is a pity that pellagrins are allowed to suffer for years, only for want of correct diagnosis. One of my cases suffered for four years and in desparation was ready to resign his service twice, and in the end was given up as a hopeless case, when a correct diagnosis put him on to his feet in 20 days, enabled him to regain 42 lbs. in weight, and he returned to work in two months. Napier rightly remarks that if the medical officers would be on the lookout they would often find such cases in

(Continued from previous column)

Acknowledgments

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REFERENCES

BHAVE, P. D., and BOPAIYA, M. S. (1942). *Indian J. Med. Res.*, **30**, p. 53.

BROWN, A. A. F. (1935). *J. Trop. Med. and Hyg.*, **38**, 157, 170, 187, 201, 215. (Abstracted—*Trop. Dis. Bull.*, 1936, **33**, 470.)

CLEMENTS, F. W. (1936). *Med. J. Australia, ii*, 615.

CORKILL, N. L. (1939) .. *Trans. Roy. Soc. Trop. Med. and Hyg.*, **32**, 519.

JAMES, C. S. (1938) .. *Ibid.*, **31**, 647.

KRISHNAN, B. G. (1939). *Indian J. Med. Res.*, **26**, 901.

MCCULLOCH, W. E. (1928). *West African Med. J.*, **2**, 96, 101, 104. (Abstracted—*Trop. Dis. Bull.*, 1929, **26**, 109.)

ROGERS, L., and MEGAW, J. W. D. (1939). *Tropical Medicine*. J. and A. Churchill, Ltd., London.

ROY, D. N. (1939) .. *The British Encyclopædia of Medical Practice*, **12**, 256. Butterworth and Co., Ltd., London.

WILSON, H. E. C., and MITRA, D. D. (1938). *Indian J. Med. Res.*, **26**, 131.

their daily practice. I have encountered six definite cases of pellagra and many more of nicotinic-acid deficiency during my 18 months' stay—December 1938 to June 1940—in the United Provinces. Two cases were seen at Tundla (Agra, 1938), one at Allahabad (1939), two at Moradabad (1940) and one at Cawnpore and Mussoorie (1940).

Three typical cases* are described below :—

Case 1.—A shoe-merchant of Agra, aged 40 years, had very dry skin, cracked lips and severe constipation. He went to Karachi on business in November 1926 and found within a few days dark pigmented patches on his nose, cheeks, chest, back of hands and forearms and on extensor surfaces of legs which became scaly and cracked. He also felt very weak, lost weight and complained of severe indigestion and flatulence. He continued suffering and was diagnosed as lichen planus, dermal leishmaniasis and Addison's disease at various times. He consulted me at Tundla in December 1938. He was, then, very weak, morose, depressed and his skin very thick, black and scaly. The distribution of pigmentation though extensive was definitely symmetrical. I thought of pellagra and treated him with diet of high caloric value giving him meat, eggs, fish, milk, marmite and a cup of raw liver juice after meals. Nicotinic acid was not available. His general condition improved rapidly and his skin condition also changed by the end of January 1939. He continued treatment and changed his monotonous diet of beef curry and wheat chapaties to varied items of food. The next season he remained well and his skin also did not become black as it had done for the last 12 years.

Case 2.—A fair-skinned lady of Agra, aged 22 years, had rough, scaly, dark, pigmented patches on the tip of her nose and cheeks. She also had enlarged cervical and abdominal lymph glands and occasional attacks of indigestion and diarrhœa. Her usual diet was a mixed one of wheat chapaties, *dâl,* vegetables and beef. She had no inclination to eat fruits, eggs and milk. Her attending physician suspected her of suffering from intestinal tuberculosis and lupus on the face. She was brought to me at Tundla in December 1933 for ultra-violet therapy. I gave her a tonic course of ultra-violet and 30 injections of calcium with vitamin D (Glaxo) and a rich nourishing diet. She rapidly improved under treatment and the patches on her face became smooth and lighter in shade but did not altogether disappear. A recurrence occurred and she saw me again in November 1938. She, then, had typical skin pigmentation on the face, hands and forearms, below the scapular regions and eczematous patches on the dorsum of both feet. She was weak, irritable and hysterical. Her diarrhœa and indigestion were very troublesome and she had amenorrhœa as well. Her blood pressure was low, 95/60. She was a complete picture of tabes mesentrica except that the skin condition was not there. I treated her as pellagra. Nicotinic acid was not available. Medicinal yeast, 60 grains a day, and virol were added to a rich diet which she took for months. The improvement was rapid and when I saw her after a time she was in perfect health though I noticed faint reddish patches on her face and roughness of skin on the dorsum of her feet.

Case 3.—A 36-year-old man of Allahabad district, working as 'beldar' and living on a diet of wheat-atta, *dâl* and vegetables had symmetrical and pigmented erythematous patches on the exposed parts of legs, hands and face. He had spastic paresis with stiffness and loss of power of the lower extremities causing difficulty in walking. His knee-jerks were exaggerated. His tongue was flabby showing indentations of teeth laterally but he had no dyspepsia or any other symptoms of gastro-intestinal disturbance. Gastric analysis showed achlorhydria. Total leucocytes 6,000, red cells 3,005,000, hæmoglobin 65 per cent and colour index 1.1. Urine showed traces of albumin. He was first suspected of syphilis of the nervous system and later of leprosy. I saw the case on 27th June, 1939, and diagnosed it as pellagra with associated conditions of vitamin B_1 deficiency.

Treatment.—He was admitted to the railway hospital, Allahabad, and was treated with high protein diet and 5 oz. of wheat germ a day. Iron and arsenic were administered by mouth and liver extract by injection. Nicotinic acid was not available locally. I left Allahabad on 12th July, 1939, and my colleague later on informed me that the paresis and the skin lesions disappeared, his blood picture and hæmoglobin value came up to normal, and he was discharged as fit in a month's time. His case could only be followed for 6 months, *i.e.,* up to January 1940, and in spite of the winter season no relapse of the pellagra symptoms was noticed. He then left the service. The peculiarity of the case is the predominance of nervous symptoms and later on the persisting erythematous condition of skin very closely resembling leprosy, and the absence of practically all gastro-intestinal symptoms to the extent that even the loss of appetite was not complained of by the patient though achlorhydria was present.

Review of the known facts regarding pellagra

Ætiology.—It is now well established that pellagra is associated with nicotinic-acid deficiency. The exact ætiology is, however, not yet clearly understood, and certain attractive hypotheses have failed to stand the test of authentic observations recently made in this connection by various workers.

Association of maize with pellagra.—Chick (1933), reviewing the dietetic theories, mentions that one of the established facts about pellagra is that it is invariably associated with the use of maize as a staple cereal in diet, but in all my cases there is no history of any maize-eating even as a change of diet by choice or necessity. Three cases of Raman (1933) were not on maize diet. Castellani and Chalmers, writing as far back as 1913, record that 'persons who are alleged never to have tasted maize have suffered from pellagra' and Napier (1939) authoritatively asserts that pellagra does occur in non-maize-eating people. The claim, therefore, that pellagra is invariably associated with maize diet is, now, no more tenable.

Theories of maize and other food toxins.—Heatley-Spencer and Biggam (1938) mention that 'it is highly probable that the correct hypothesis is that advanced by Chick', namely, that pellagra is caused by a toxic substance derived from maize, or occasionally from other cereals, which can be corrected by sufficient good protein or perhaps by sufficient vitamin B_2, found to accompany good protein; but as non-maize-eaters do get pellagra, any theory that assumes invariable association of maize with pellagra should not hold good. However, there still remain George Mauriquand's observations that there are certain substances called 'dieto-toxin' which remain without toxicity under normal conditions, but reveal it when diet becomes deficient or ill-balanced. Viewed in this perspective the food toxin theory becomes very attractive. The association of peripheral neuritis with pellagra also lends support to it but the advent

*Full notes on other three cases omitted in interest of space.—EDITOR, *I. M. G.*

of nicotinic acid has proved that neuritis and similar troubles are associated conditions which do not belong to the pellagra syndrome and are corrected by vitamin B_1, showing their origin in a deficiency rather than in a toxin. The food toxin theories including Chick's hypothesis have also no sufficient clinical or experimental support and therefore do not stand on very solid ground.

Theories of protein deficiency.—These theories assume that lack of protein of high biological value or deficiency in diet of certain amino-acids causes pellagra. In my cases all of them except one used animal proteins. Case 4 had plenty of good proteins and case 6 had milk and eggs. Still they got pellagra. Moreover, nicotinic acid is giving marvellous results even in those cases who continue eating pellagra-producing diet. It, therefore, appears that the deficiency of protein of ordinary or specific variety is not the main causative factor, but as suggested by Napier (1939) a monotonous diet like that of my case 1, who ate nothing but bread and beef curry for years, or rich and varied but insufficient diet of my case 6, or medically restricted diet like that of case 5, are the important factors in producing the symptoms and keeping them up indefinitely until suitably corrected.

Castle's theory of anti-anæmic factor deficiency, as in sprue and pernicious anæmia. Cases of hyperchromic anæmia in pellagrins are recorded. It has also been noted that no improvement in the red cell occurs without liver-therapy (Gupta, 1935), but in my case 4, during the last stages of the disease, though hyperchromic anæmia was present, intensive liver therapy made no impression whatever but response was immediate to nicotinic-acid therapy. Observations like this show that Castle's theory does not fit the picture.

History of vitamin deficiency.—Goldberger cured pellagrins by administering yeast to them and found that vitamin B contains a heat-resisting water-soluble pellagra-preventing substance (P. P. factor) which was named B_2 in Europe and vitamin G in America. Later on it was found that the vitamin B_2 complex contains nicotinic acid, lactoflavine, and B_6 antidermatitis factor. Now, when nicotinic acid is synthetically prepared and clinically used it is the same thing as the P. P. factor of Goldberger and it definitely cures pellagra.

Pellagra appears to be a definite clinical manifestation of nicotinic-acid deficiency which may be produced in the body by a variety of causes and not necessarily by a single definite cause. The syndrome may, thus, manifest itself at any stage of certain exhausting diseases or food deficiency states or as a separate entity resembling a definite disease whenever a severe or complete depletion of nicotinic acid happens to occur in the system due to a pure and simple deficiency, almost in the same way as rickets manifests itself whenever there is a deficiency of vitamin D in the body through any cause whatever.

Age and pellagra.—Pellagra was considered to be an adult disease. The lowest age in Lowe's series of 70 cases in 1931 and 1933 was 14 years. Mitchell, as quoted by Chick, also observed that it was a disease of adults and in that respect differed from other nutritional diseases of children. The above observations are, however, not correct. Napier (1939) mentions that it may occur in patients aged 3 months to 100 years. The youngest patient of mine was 5 years of age. I find that nicotinic-acid deficiency is a very common factor in Indian children belonging even to middle and high-class families. In one building situated on a high hill in Happy Valley region at Mussoorie where 14 middle-class families lived in flats, I saw more than a dozen children who within few days of coming up from plains to the hills got erythematous patches, which later on became scaly and pigmented and were situated especially on the fingers, dorsum of the hands and forearms, the tip of the nose, malar regions of cheeks, and, in cases where the legs were kept exposed, on the extensor surface of legs. I first took the patches to be due to solar dermitis; I wanted to be sure. I took two such cases and to one I gave pellagra treatment and to the other various ointments for skin lesions. The first child was cured without local application within a week while the other continued to suffer for a month. On inquiry, I have also been informed that such dermal lesions at Mussoorie are known to resist all skin lotions and ointments applied locally. My conclusions, therefore, are that pellagra is not confined to adults but may occur at any age and that children in India very commonly suffer from grave nicotinic-acid deficiency which remains undiagnosed, because they generally do not show the skin lesions in the plains, unless exposed to a very dry and cool air and bright sun rays rich in ultra-violet radiations such as are found in Mussoorie in May and June.

Social status and pellagra.—Chick calls it a disease of the poor, but I find that it also attacks the ignorant rich and those middle-class people whose diet remains unsuitable or restricted for any length of time.

Clinical course

Onset.—It is generally gradual, afebrile and without grave constitutional disturbances if the gastro-intestinal or nervous system is not involved from the very first. Three cases of mine remained afebrile all through. Case 1 having seasonal dermitis, had no other troubles for years. Case 5, in spite of skin and mental conditions, continued working for a year until diagnosed, but case 4 starting with gastro-intestinal involvement had so severe an onset that it was taken to be cholera, and case 3, with nervous affection, was crippled from the very start.

Comparative involvement of various systems of body.—There are four particular systems,

viz, cutaneous (skin), gastro-intestinal (mucous membrane), nervous, and circulatory that are generally involved.

Skin lesions.—They are the most characteristic feature of the disease. In 4 out of my 6 cases skin lesions were first to appear or probably first to be noted. Rau and Raman's observation is the same. Lowe held the same view in 1931 but remarked in 1933 that glossitis may be the first symptom to appear. However, skin lesions are so characteristic that a definite diagnosis of pellagra is very difficult in their absence. I have been very fortunate to have come across practically every sort of skin lesions and in all their stages. One of my cases had 'butterfly patch' on his face. The dark 'collar patch' on the neck which is generally so very marked and striking was also observed by me from the very date of its appearance until the day of its disappearance under treatment. The initial and successive stages of the skin lesions were noted by me in case 6 as thickened, angry-looking, erythematous patches on the skin between the fingers. The erythema disappeared within three days leaving a dry, scaly, dark-brown patch with a minute raw surface in the centre, while in case 5 similar patches which were a year old were found to be thick, rough, black and having a scaly core in place of the raw centre noted in the initial stages of the other case.

Causation of the skin lesion.—A dry and cool season and strong sun-rays are definitely the exciting causes, but whether sun-rays activate a pre-toxin or merely act as a trauma, or whether it is the presence in the blood of a toxin of dioxy-phenylalamine type (dopa) which resembles tyrosine that gives the skin pigmentation is not yet definitely settled. However, I think that 'effect of sun is purely a matter of trauma' (Stannus, 1937). My observations show that a destructive dose of ultra-violet rays gives pigmentation of the skin only in a person with nicotinic-acid deficiency and even then only when the skin is prepared for it by a dry and cool season, and, as Lowe (1933) points out, when there is marked difference between day and night and sun and shade temperatures which make the exposed part of the skin dry and liable to cracks.

In one of my cases there was evidence that the rubbing of the shoes had caused the pellagrous dermatitis.

Gastro-intestinal lesions.—Lesions of the mucous membrane, when they do occur, are generally not of the ulcerative but of the atrophic type. They are followed by grave constitutional disturbance. In one case the disease started with diarrhœa and vomiting; he suffered for a year and was almost dying when recurrence occurred.

Case 2 had skin lesions in the beginning but, when diarrhœa started, her health was so much disturbed that she looked a picture of advanced tabes mesentrica. However, diarrhœa is not a common complication and occurs only when the disease attacks in a severe form. Three cases out of the six had constipation, loss of appetite, vague abdominal pains and troublesome gases in the intestines, but never diarrhœa. The lesions of the tongue and fauces are also not always present. Lowe (1931) noted such lesions in only 50 per cent of his cases.

Lesions of the nervous system.—Nervous lesions in pellagrins do not all belong to the pellagra syndrome. Peripheral neuritis and involvement of the cord, such as was present in case 3, are associated conditions and are often due to vitamin-B_1 deficiency. 'Mental conditions' like the depression almost melancholic in nature which made my case 4 resign his service twice and despair of his final recovery, or the suicidal tendency which my case 5 had, definitely come under pellagra syndrome and are very easily cured by nicotinic-acid therapy. Lowe recorded a case of pellagra (1931) who became so 'mental' that he actually committed suicide by drowning. Cleckley, Sydenstricker and Geeslin (1939) treated with nicotinic acid 19 cases of a typical psychotic state with malnutrition in elderly patients suffering from arterio-sclerosis and other chronic diseases, with great improvement in 4 cases and dramatic 'cure' (of psychotic state and glossitis) in the rest. The presenting symptoms were those of chronic diseases *plus* 'hebetude to profound stupor' and in 4 cases glossitis, but dermatitis and gastro-intestinal symptoms were not present. They came to the conclusion that 'many patients are allowed to die because of failure to recognize the cerebral symptoms of pellagra when other evidences of the disease are absent' and that 'a therapeutic test with nicotinic acid is justified in unexplained cases of hebetude or unconsciousness'. They also agree with the suggestion of Jolliffe that cerebral manifestations may be the first evidence of severe or complete depletion of nicotinic acid.

Circulatory lesions.—Myocarditis and degeneration of heart-muscle in pellagra cases have been recorded but I am not sure whether pellagra is responsible for the troubles or the gradual heart failure is due to prolonged suffering and continued severe illness. I noted in my case 4 that the œdema of feet and hands, dyspnœa, rapid and weak pulse and the blood pressure as low as 92 systolic and 59 diastolic, all suddenly improved to normal within 20 days of beginning nicotinic-acid treatment. I wonder how one could explain such a rapid and dramatic recovery of a failing heart if we persuade ourselves to assume that it was solely damaged by prolonged and severe illness and not directly by nicotinic-acid deficiency.

Diagnosis.—Skin lesions in my cases were mistaken for simple dermatitis, lichen planus, dermal leishmaniasis, Addison's disease, lupus, leprosy, eczema, syphilitic pigmentation, spider lick, scabies and solar dermatitis. Gastro-intestinal conditions were wrongly diagnosed as tuberculosis of intestine, hill diarrhœa, cholera,

chronic dysentery, sprue, colitis, dyspepsia, gastric ulcer and deranged liver. The mental states were taken to be due to anxiety and worry, hysteria, syphilis of the nervous system, nerve-leprosy, depression and despair due to prolonged illness, over sensitiveness, neurasthenia, melancholia, malingering and mental backwardness in the child. The above mistakes made by very highly qualified and experienced doctors should be enough to show that pellagra can be diagnosed only if we always keep its existence and its definite manifestations in mind when dealing with our cases of skin, gastro-intestinal tract and vague nervous and mental conditions in places with a cool and dry season and plenty of strong sunshine.

Laboratory findings.—These do not help much in the diagnosis except that achlorhydria is frequently found. Stools and urine show nothing except that when diarrhœa is present it is of lienteric type with non-fatty stools. Urine test for porphyrin was not done in my cases and I believe is not of much help in clinching the diagnosis. Hypotension is common. Total leucocyte count is generally normal, total red cells below normal and hæmoglobin value may or may not be very low. Hypochromic anæmia is believed to be commonly present but cases with megalocytic hyperchromic anæmia, including two of my own cases, are recorded. The latter type so closely resemble pernicious anæmia that one can be very easily mistaken for the other, if the characteristic skin lesions of pellagra are not present or not carefully noted and the therapeutic test with nicotinic acid is not tried in very doubtful cases. Wilkinson (1936) goes so far as to say that 'it is highly probable that in the more tropical zones cases of what is essentially pernicious anæmia may so closely resemble sprue or pellagra as to be so diagnosed according to local bias'. As cases of true pernicious anæmia are almost unknown in India, Wilkinson's remarks could be reversed and we may say that no case should be diagnosed as pernicious anæmia unless pellagra is definitely excluded. Apart from characteristic skin lesions and a favourable history the only sure test for pellagra available to us is the therapeutic test with nicotinic acid, which has assumed such an importance that if a suspected condition gives no response to the test it may be taken to be due to anything but pellagra.

Prognosis.—In India, Lowe had a mortality of 50 per cent in his cases with mucous membrane involvement in 1931. He also thought that most mental cases end fatally. In 1933, when 60 grains of yeast and half a pound of meat a day was added to the dietary of his patients the death rate became *nil*. The introduction of nicotinic acid has now made the prognosis invariably good. My case, 4, who was in the terminal stage of the disease recovered so rapidly that I now believe that if nicotinic acid is available no case of pellagra should ever be declared as hopeless, in whatever condition he may be.

Treatment.—I find that when nicotinic acid is not available, cases of pellagra can very successfully be treated if 60 grains of yeast, 5 ounces of wheat germ, and a cupful of raw liver juice, or two cups of liver soup, prepared without addition of water in a steam cooker, are added to a daily liberal mixed diet and iron and arsenic given when needed. I treated the first three of my cases on the above lines. The results were rapid and good. The skin condition of case 1 did not clear altogether. The last three cases received nicotinic acid as well. The results were dramatic. As for doses, case 1 got 500 mg. a day by mouth for 10 days, 200 mg. for another 10 days, 100 mg. for two days in a week for about 2 months, and is now having 100 mg. for 2 or 3 days once a fortnight, as a maintenance dose. To combat anæmia, weakness and loss of appetite during convalescence I find caldeferrum (Glaxo), two tablets immediately after meals, an excellent iron tonic. Liver injections are essential for cases with hyperchromic anæmia and vitamin B_1 for actual neuritis, paresis and similar associated conditions. Anti-diarrhœa mixtures and powders usually do not control diarrhœa of pellagrins, and when they do they produce sickness, distension, heaviness and uneasy feeling in the abdomen. I find that one or two teaspoonfuls of ispaghul mixed in a small quantity of curd (*dahi*), swallowed without chewing, prevents diarrhœa without causing any inconvenience The residual diarrhœa persisting for 2 months after nicotinic-acid treatment in one case did not yield even to opium but did so to ispaghul in two days.

Sodium thiosulphate.—Sabry in Egypt got good results by intravenous injection of sodium thiosulphate in pellagra cases. He thought the drug neutralized the maize-toxin which circulates in the blood of pellagrins. Lewis (1938) reported that he cured a case in Burma by giving 10 c.cm. of 10 per cent sodium thiosulphate intravenously twice a week. He gave no other treatment to his case. Rau and Raman (1936) found that protein diet and liver soup gave invariably good and rapid results, whether sodium thiosulphate was given or not. Napier (1939) recommends its use for rapidly clearing the skin lesions in pellagra. I have no experience of it and find no records to show that dermatitis of pellagrins could rapidly be cleared by injection of sodium thiosulphate. However, as the skin condition, especially when in a chronic state, does not altogether clear for months after even combined nicotinic-acid and B_1 and B_2 treatment, sodium thiosulphate deserves a trial.

My thanks are due to Dr. F. E. R. Laborda, the Chief Medical Officer, East Indian Railway, for permitting me to submit this paper for publication. I have also to thank my colleagues, Dr. S. N. Lahiri, D. M. O., Allahabad, for sending me the follow-up notes of case 3 and Dr. B. G. Kane, D. M. O., Moradabad, who supervised the treatment of cases 4 and 5.

(*Concluded on opposite page*)

A NOTE ON EVE'S HALOMETER

By PRAN NATH CHUTTANI, M.B., B.S. (Punjab), D.T.M. (Cal.)

RECENT inquiries have shown that a large number of important medical teaching institutions in India are still using the Eve's halometer for measuring the red cell diameter. Outside India also, the instrument continues to be treated with respect by some workers (Beaumont and Dodds, 1941). The observations recorded in this paper were made during the course of an inquiry into anæmias at the Mayo Hospital, Lahore, in 1939. In thirty-one cases the average red cell diameter was estimated both by Eve's halometer and Price-Jones' method from blood smears taken at the same puncture. Halometric observations were carried out on the same day on dried, unstained and properly-made blood films, but the Price-Jones curves were drawn from the preserved Giemsa-stained films about a year later at the School of Tropical Medicine, Calcutta. The thirty-one double diameter observations and the corresponding mean corpuscular hæmoglobin values have been tabulated.

The value of correlation between the Price-Jones and the halometric readings (*see* table) works out to 0.1979, which has no statistical significance. Accordingly either one or both the instruments are definitely biased. The means of the two series are also significantly* different from each other at even one per cent value.

TABLE

Mean diameter of 500 red cells as obtained by the Price-Jones method	Mean diameter obtained by Eve's halometer	Mean corpuscular hæmoglobin values
μ	μ	$\gamma\gamma$
6.73	8.00	30.78
7.16	8.10	26.36
7.50	8.00	29.39
7.64	7.40	29.31
6.88	8.19	28.50
7.41	8.00	20.11
6.74	7.80	20.52
6.87	8.40	25.65
6.45	7.90	21.60
5.85	7.65	23.67
6.45	7.65	22.44
7.21	7.90	11.80
7.24	7.80	22.50
6.92	7.90	20.31
8.12	8.44	40.18
8.27	7.70	40.18
9.06	8.20	43.06
8.06	8.60	39.79
8.03	8.39	46.63
8.22	8.20	46.03
8.00	8.00	38.30
8.40	7.80	34.20
8.06	7.80	53.10
7.37	7.70	34.94
7.66	8.40	20.72
7.42	8.40	20.30
7.21	8.20	27.48
7.40	7.80	34.20
7.86	7.00	33.34
8.29	8.20	39.97
7.85	7.90	36.39
Average mean. 7.49	7.98	31.02

The figure drawn to bring out sympathetic growth, if any, between the two methods also shows a complete lack of relationship. Adopting the standards of Price-Jones for macrocytosis and microcytosis we find that according to the halometer twenty-five cases are definitely macrocytic, four are suspiciously macrocytic and only two are normocytic. (It may be noted here that in this investigation selection of halometrically macrocytic cases was deliberate.) According to observations taken by the Price-Jones method, on the other hand, it is found that only twelve cases are definitely macrocytic, two suspiciously macrocytic, twelve normocytic, three definitely microcytic, and two suspiciously microcytic.

The macrocytic cases by the Price-Jones method appeared to bear greater correlation to the corresponding halometric observations than

* Unqualified significance means significance of 5 per cent value.

(*Continued from previous page*)

REFERENCES

CASTELLANI, A., and CHALMERS, A. J. (1913). *Manual of Tropical Medicine.* Baillière, Tindall and Cox, London.

CHICK, H. (1933) .. *Lancet, ii,* 341.

CLECKLEY, H. M., SYDENSTRICKER, V. P., and GEESLIN, L. E. (1939). *J. Amer. Med. Assoc.,* **112,** 2107.

GUPTA, S. N. (1935) .. *Indian Med. Gaz.,* **70,** 148.

HEATLEY-SPENCER, J., and BIGGAM, A. G. (1938). *British Encyclopædia of Medical Practice,* **9,** 468. Butterworth and Co., Ltd., London.

LEWIS, D. R. (1938) .. *Indian Med. Gaz.,* **73,** 616.

LOWE, J. (1931) .. *Ibid.,* **66,** 491.

Idem (1933) .. *Ibid.,* **68,** 379.

NAPIER, L. E. (1939) .. *Ibid.,* **74,** 136.

RAMAN, T. K. (1933) .. *Ibid.,* **68,** 381.

RAU, G. D., and RAMAN, T. K. (1936). *Ibid.,* **71,** 570.

WILKINSON, J. F. (1936). *British Encyclopædia of Medical Practice,* **1,** 408. Butterworth and Co., Ltd., London.

BIBLIOGRAPHY

AHMED, N. (1939) .. *Patna J. Med.,* **14,** 316.

BAJAJ, N. L. (1939) .. *Indian Med. Gaz.,* **74,** 145.

EDITORIAL (1939) .. *Ibid.,* **74,** 163.

GHOSH, M. (1939) .. *Ibid.,* **74,** 318.

GOODALL, J. W. D. (1940). *Ibid.,* **75,** 147.

MODY, M. S. H. (1935). *Ibid.,* **70,** 625.

SEN GUPTA, P. C., RAI CHAUDHURI, M. N., CHAUDHURI, R. N., and NAPIER, L. E. (1939). *Ibid.,* **74,** 143.