All stitches should be out by the eighth day, except the posterior and deep ones, which are generally spat out or swallowed later. The Porgett splint is used to help the discharge of exudate from the nose and mouth. Any erosion in the nostril is checked with 10 per cent. argyrol solution, two drops two or three times daily, followed by sterile paraffin (a drop or two). Sedatives are not used as a routine, but if there is much crying a minim or two of tinct. opii, repeated as required, is effective. The infant is discharged on the ninth day, but is reviewed again in four days. The palate is repaired at 2 years. Subsequent repairs to the lip are carried out after 4 or 5 years of age.

TREATMENT OF ASTHMA BY ULTRA-VIOLET LIGHT

BY

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By way of experiment I began in 1930 to treat asthmatic patients with ultra-violet irradiation. Encouraged by the results, I proceeded to develop a technique, record observations, and invent explanations.

The lamp used was a Hanovia "Alpine Sun" (1930 model), 220 volts A.C. The irradiations were given to the whole body, back and front, at a distance of forty inches from the burner. Exposures were given twice or thrice a week. The optimum dosage was found to be that which produced a uniform erythema lasting twelve to twenty-four hours. The actual length of time for the first exposure varied with individuals from four minutes to eleven minutes. Each successive exposure was about one and a half times as long as the previous one. As the skin became pigmented, erythema production came to take an unconscionable time, so treatments would be stopped at this point for a few weeks until the pigment had faded and the skin resumed its erythematous response.

Case I

A farmer, aged 50, developed severe asthma after ill-managed peptone injections in 1921 aimed at relieving very mild hay fever. By 1930 attacks came on every few weeks; he was "never clear," and could not go outdoors after dusk. In February, 1930, adrenaline, pituitrin, asthmolysin, and morphine were used nightly in increasing doses. As a last resource he had a short exposure to the lamp, which produced deep erythema; he rang up later in the day to say that his "chest was clear," and he slept naturally that night.

After two doses he had no trace of asthma for fourteen months and resumed all his activities. He had never been free for so long a period. However, at signs of recurrence I gave him three exposures. During the third exposure he received (what was for him) an overdose. That night he was in high delirium; temperature was 101° F.; chest and back were painfully erythematous; his eyelids (protected by goggles during exposure) were almost closed with oedema. Joints were swollen and painful. All these symptoms, suggestive of "serum sickness," subsided by the next morning, except the joint pains, which were gone in another twenty-four hours. He was clear from asthma for two years after this.

In September, 1933, he complained of "feeling desperately ill." For a fortnight he had felt progressively more tired and weak every day, until now he could barely stand. In addition he had vague abdominal discomfort and anorexia. Temperature was normal, pulse 100, blood pressure 75/60, heart sounds feeble. His grip was weak, and he looked "shrunk in on himself." There was no Addisonian pigmentation, and Loewi's test was equivocal. "Acute suprarenal dysfunction" was diagnosed. Suprarenal extract (Parke, Davis and Co., 90 grains a day) was given, and his blood pressure rose steadily to 120/80 in seventeen days, at

which point his asthma recurred. Mild erythema-producing doses of ultra-violet light were applied for the remainder of the year. In May, 1934, his blood pressure was 128/90 on 40 grains of suprarenal extract a day; weight increased by 7 lb. Occasional tightness of the chest was kept in check by ephedrine, ephazone, and occasional injections of adrenaline.

In January, 1935, asthma set in furiously, and after ten consecutive disturbed nights (for both of us) the patient agreed to undergo more light therapy. Once again the first exposure gave him a natural night's rest, and three more doses were given with a view to producing pigmentation. He has been clear ever since, and once again can take articles of diet which during asthmatic periods invariably brought on a spasmodic attack.

COMMENT

This case presents several features for discussion. A sufferer from importunate asthma gains long spells of freedom after ultra-violet rays. Is the skin an endocrine organ which liberates a substance to restore the endocrine imbalance expressed by asthmatic attacks, either by inhibiting the over-stimulation of the vagus nerve or by stimulating the sympathetic nervous system?—and not only supplying this substance during stimulation but continuing to do so, giving immunity from attacks for several months, even when particular allergens are exhibited? The nature of this substance and its possible relation to erythema production and pigmentation will be discussed later.

Case II

A farmer, aged 28, had had attacks since the age of 6, following whooping-cough, and by now was reconciled to spending most winter days over the fire and many nights propped up with four pillows, with injections of adrenaline when he could not hold out any longer.

Three exposures to ultra-violet light in March, 1931, rendered him free from attacks for seven months. During that summer, at my suggestion, he worked in the fields in zephyr and shorts, and retained his pigmentation. Although light-haired he tanned well. During this period he could take liberties with his diet. By November wheeziness and tightness of the chest returned; so he was given a course of exposures until the end of December. The first dose aborted the chest symptoms, and he was free for six months. In May, 1932, four doses were given, and he was free for a year. In May, 1933, three doses were again given and he was free until October 31st, 1933. Then came the most severe attack he had ever had. Adrenaline, pituitrin, atropine, barbiturates, and, finally, morphine were given.

On November 2nd, 1933, at 5 a.m., he had morphine grain 1/4 and atropine grain 1/100 with no effect, and the dose was repeated at 10 a.m., again with no effect. The patient wrote instructions for a car to be hired—he was past speech—and arrived at my house at 2.30 p.m. He was carried gasping, cyanosed, and with protruding eyeballs into my consulting room, where he gesticulated towards the lamp. After eight minutes—I was sitting screened from the light—I noticed that his breathing was quieter, and he made no reply to my comment. On inspection he presented an alarming appearance, so I switched off the lamp and tried ineffectually to rouse him. He was in deep coma. This state lasted ten minutes, when quite suddenly he cleared his throat and was wide awake, surprised to find the lamp extinguished and myself and his mother standing by him. It was a complete "black-out" (to use his expression) for him for more than ten minutes. His breathing and pulse became normal and his pressure was 120/70. After he had vomited he dressed himself, chatting the while, and walked to the car. Since then he has kept at full work on his farm, controlling occasional chest symptoms with single doses of ephazone. Last summer he kept himself well tanned by sun-bathing. A striking feature of this case is the freedom from attacks while his skin is pigmented and the impotence of his allergens during this time.

COMMENT

What mechanism produced the "black-out"? One of the narcotic drugs taken within the preceding twenty-four

hours and lying latent in the tissues may have been liberated, flooding the system. But the coma did not resemble that of any of the alkaloid poisonings, although it was not dissimilar to that of barbiturate poisoning. Even if we regard the condition as one of "surgical shock" the question arises, What caused it? The amount of exposure to the rays was small compared with his accustomed dosage, and yet it was obviously material in producing the effect.

Fortunately the remaining cases presented no untoward complications.

Case III

A massive, phlegmatic schoolgirl, aged 15, had had attacks since the age of 13. East wind was provocative, and the date of incidence was often two days before menstruation. Latterly she had been a "weekly boarder," and her worst attacks were on Friday nights, when she was home for the week-end. No psychological or protein factor could be discovered for this phenomenon, but change of diet was probably responsible. Her father suffered greatly from asthma, but he did not live at home. In November, 1932, I gave her six exposures in four weeks, during which time she gained 3½ lb. in weight and was free from any attack. She remained free for six months. Since then she has had one or two erythema-producing doses at the first sign of respiratory difficulty, which now only comes on every six months.

Case IV

A gentleman farmer, aged 38, had been bothered by short irrelevant asthmatic attacks. They came on chiefly in bed at night, but would sometimes linger during intervening days. In March, 1931, four exposures "cured" him, and the sun-bathing habit through the summers "kept him free" for three years all but a month. In February, 1934, his wife bullied him into having another course, as his (? their) bad nights were returning. A pigmenting course was given, and there have been no further attacks.

Case V

A willing and hard-working housewife, aged 56, in an overcrowded cottage, had been subject for ten years to severe asthmatic attacks which would incapacitate her even from going upstairs to bed. In December, 1931, at the third exposure, she proudly demonstrated her ability to lie flat on the couch. She had not lain flat in bed for six months. Throughout the winter she had occasional doses until March, from when she went for six months with no trace of asthma. In November a couple of doses appeared to abort an attack, and it was then two years before she came to see me again with threatened recurrence. A single dose was given in November, 1934, and she has remained well ever since.

Case VI

A schoolboy, aged 12, was first seen in July, 1933, in a typical attack of spasmodic asthma; he had had the attacks for a few weeks. I gave him three exposures (his chest showed no abnormal signs or symptoms after the first), and told him he ought to keep his skin tanned in the summer sun. He followed my suggestion, and when I last saw him one could not tell where naked skin ended and khaki shorts began. He has had no further asthma.

The next series of cases presented, in addition to asthma, an element of respiratory tract infection, exacerbation of which more often than not preceded the asthmatic attack, often with marked pyrexia.

Case VII

A schoolboy developed asthma in March, 1928, when 10 years old. He suffered from a chronic nasal discharge, and the attacks accompanied his recurrent acute bronchitis. In September, 1928, his middle turbinate bones were removed, his antra were explored (and exonerated), and his tonsils and adenoids removed. Nasal discharge ceased, as did his mouth-breathing, and bronchitis became rarer, but the habit of spasmodic asthma continued. For two and a half years

potassium iodide and tincture of stramonium may be said to have been part of his diet. School attendance was rarely unbroken for longer than a week.

In February, 1931, I gave him four doses—enough to pigment his very pallid body. He developed non-pyrexial rheumatic pains in his limbs, controlled and eliminated in a day or two by aspirin, but no more asthma for two months, when there was a slight recurrence. As it was a warm May I bade him expose his body to the real sun in the back yard and to keep tanned. He had no more than transient "wheeziness," and did not miss another day at school to the end of his life eighteen months later, when he was killed in a road accident.

Case VIII

A pigeon-chested schoolboy, aged 9, had been subject to attacks ever since the age of 2 years—they were always inaugurated by acute bronchitis. He had never attended school for two consecutive weeks. In January, 1931, his very septic tonsils and hypertrophied adenoids were removed without improvement.

He was a blond and he had a great erythema reaction, so the dosage of ultra-violet light had to be kept low at first. He pigmented but slightly. There was a marked steady improvement, and within a week he was having unbroken nights' sleep, the first for eight weeks. At the end of the month I recorded "eating furiously, plays all day." He was free from asthma for another month. Another "cold in the head" started an attack, which was apparently aborted by an exposure. Now the parents have developed the habit of bringing him along for an exposure whenever an attack threatens. He has been immune for as long as two months at a time. This is a comparatively disappointing result, but I have learned that lengthy immunity does not seem to obtain in those who do not pigment well.

Case IX

A girl, aged 21, living at home, was seen in March, 1933. She had been perfectly well until the previous November, when she developed acute bronchitis. Since then there have been a more or less persistent wheeze, and a dry cough with exacerbations of acute bronchitis. On examination no signs or symptoms of lung disease were found, with the exception of rhonchi over both bases with greatly prolonged expiration. She complained of difficulty in respiration on exertion. After three exposures her chest was completely clear. She had two more to deepen her pigmentation, and she has been well ever since.

Case X

A retired Army captain, aged 54, had been subject to attacks of acute bronchitis followed by asthma for five years. Incidentally, he is a great sufferer from flatulent dyspepsia, due apparently to a "grumbling appendix," and he suffers from recurrent attacks of *B. coli* pyelitis. Sandy in complexion, he has a great erythema reaction, necessitating small exposures to ultra-violet light, and pigments poorly. Immediately after the pyrexia of the bronchitis has subsided he comes for three doses of ultra-violet rays. The asthma clears up in less than a week, whereas he reports that formerly he would have nights broken by coughing and "sitting up for breath" for four weeks. He is convinced that a course of ray therapy gives him immunity for six to eight weeks.

Case XI

A schoolboy, aged 6, had been subject to recurrent bronchitis with asthma, and never seemed to "get on." This boy was very blond, and normal doses of ultra-violet light produced no erythema. In twenty days I gave him a succession of increasing exposures, which caused no erythema and no pigmentation. Neither did he gain an ounce in weight. Just after the sixth exposure he embarked on an attack of asthma, lasting twenty-four hours. This provoked me to give him an enormous exposure two and a half times as big as any previous dose. It produced only a moderate erythema, but his improvement dated from that dose. In the next month he gained two and a quarter pounds, and had no more attacks for four months—the best winter he had ever had. Since then he has had courses of similar massive doses at intervals of three, four, and five months. Even with big doses his pigmentation is slight.

The interest in this case is in the fact that ordinary doses had no effect, but that massive doses not only appeared to check the asthma, but also affected his metabolism, causing increase of weight. It is doubtful whether, if the effects of irradiation were purely psychological, as is sometimes maintained, this discrimination would obtain.

Case XII

A boy, aged 5 years, had had "croup" as an infant, and had been subject to bronchitis and asthma throughout each winter. He is not an ideal "case," because several environmental factors have been altered. He is the precious only child of a mother who had more faith in wool than in fresh air. Twice weekly for three weeks I administered average doses of ultra-violet light without once provoking an erythema. At the end there was no improvement in his "chestiness," no increase in body weight, and no pigmentation. In the next three weeks I doubled the "predetermined dose" and produced a good erythema each time. His condition at once improved, and he gained 2½ lb. in weight. The following three weeks I continued on the same lines; his pigmentation deepened, and he gained another 1½ lb. His chest then remained clear for six months, and now the mother brings him along for two or three erythema-producing doses at the first sign of respiratory trouble.

Summary of Apparent Results

Case No.	Age	Sex	Complexion	Erythema Response	Pigmentary Response	Immunity Response
1	50	M	Dark	Normal	Normal	14-24 months
2	28	M	Fair	Marked	Normal	5-24 months
3	15	F	Fair	Normal	Below normal	6 months
4	38	M	Fair	Normal	Normal	3 years
5	56	F	Dark	Normal	Normal	6-24 months
6	12	M	Dark	Marked	Marked	Nearly 2 years
7	13	M	Dark	Normal	Normal	2-18 months
8	9	M	Very fair	Marked	Below normal	2 months
9	21	F	Fair	Normal	Normal	24 months
10	54	M	Medium	Marked	Below normal	2 months
11	6	M	Very fair	Much below normal	Below normal	3-5 months
12	5	M	Very fair	Much below normal	Below normal	6 months

Discussion of Results

It will be asked: "Can the beneficial results be due to suggestion?" Now, although asthmatics are suggestible patients, some of these individuals have persisted in doing well over five years and have not left treatment for some new fancy. Children, again, are less suggestible than adults. Distilled water injected with all the ritual of adrenaline does not abort an attack in them (nor does it often in an adult), and the treatment has as much effect on the phlegmatic child as the most valetudinarian adult. Two failures with children became successes with increased dosage. Further, what psychological mechanism can be found for those two cases who suffered from serum sickness? There was no breath of suggestion that Case II should lapse into his terrifying coma. Finally, I cannot help being strongly influenced by the observation that the deeper the pigmentation obtained the longer the immunity conferred.

How, then, does it act? It must act obviously through changes brought about in the epithelial tissues, the capillary blood, or the superficial nerves. While admittedly the integrity of the axon reflex may be necessary for erythema production,¹ claims put forward for both raising and lowering the sympathetic tone by irradiation seem equally groundless. Although waves of 3,400 to 3,900 reach and are stopped by the blood,² I can find no convincing evidence of significant beneficial action thereon. It is evident that erythema is produced and maintained by some substance formed in the epithelial tissues. Can

histamine or H-substance be the agent? Absorbed into the general circulation it would increase vagotonus, even to the point of surgical shock. This would supply an explanation for the vagary of Case II, except that it happened once only, and no other such cases were seen. To cover all the clinical observations it would be necessary to postulate that normally the H-substance activates an over-compensatory flow of an antagonist—say adrenaline—to which the relief is due, but that on one occasion there was not enough adrenaline immediately available to compensate. Certainly a cat injected with histamine responds with an increased output of adrenaline; with the suprarenal medulla destroyed, a thirtieth of its normal lethal dose causes irremediable collapse.³

Turning to the underlying allergic nature of asthma, one cannot help being attracted by Hindley-Smith's hypothesis.⁴ He suggests that exposures to ultra-violet rays are in effect mild "protein shocks" which gradually desensitize the individual. This means the formation and liberation of a protein normally foreign to the tissues. Though clinically there is similarity between the end-results, my objection to this theory is that neither the two patients who received overdoses nor in any of the others was there produced anything resembling protein shock reaction. Effective protein therapy should provoke a reaction after each injection, sometimes slight, sometimes severe. Ultra-violet ray exposures, producing no such reactionary phenomena, nevertheless give the same relief and immunity. I therefore suggest the following mechanism, which involves the relation between melanin and adrenaline.

It is notorious that a sudden shock, such as is experienced in a narrowly averted accident, will cut short an asthmatic attack, presumably by a sudden flooding of adrenaline into the circulation. On the other hand, we know that prolonged strain, caused by heavy exertion, or even by business worries, such as might drain the suprarenals of their secretion, is often followed by an asthmatic attack. Also prolonged strain, worry, or a septic focus will cause a more rapid loss of pigmentation than normal.

Can ultra-violet rays have any action on the adrenaline content of the blood? Adrenaline itself cannot be formed in the epithelial tissues near the capillaries, or it would cause vaso-constriction, whereas in fact erythema obtains. Let us assume that the parent substance of both adrenaline and melanin (which we will call dopa-substance⁵) originates in the epithelial cells, and that the action of ultra-violet light stimulates the production of this dopa-substance. It is carried in the blood stream to the suprarenals, where part is converted into adrenaline, which proceeds to maintain sympathetic tone. Excess of the dopa-substance is converted and fixed by the oxidase in the epithelial cells to form melanin granules, which are thus a store of potential adrenaline. We might even imagine the melanin granules, by their shading effect, easing off the production of dopa-substance. When the body's call for adrenaline lowers the dopa-substance content, as in conditions of strain, fatigue, and sepsis, melanin is reconverted into dopa-substance and the suprarenals are supplied with more raw material. Also, the disappearance of pigment allows increased production of dopa-substance by the action of light. With disease of the suprarenals we should expect more dopa-substance in the blood stream than they could convert to adrenaline, and this excess would be stored as pigment.

This mechanism would account for the comparatively poor results in the case of blond patients, and for the long immunity enjoyed by the well pigmented. Also, it might be invoked to account for the immunity experienced at high altitudes, not on the grounds that the air there is allergen-free (for it is not, neither is the food), but by

reason of the greater wealth of ultra-violet rays in the solar spectrum at those heights. Unfortunately, even this mechanism fails to explain all the clinical phenomena. For example, Case I, during his asthmatic attack, was apparently suffering from acute suprarenal dysfunction; which means either that there was an inadequacy of dopa-substance, or else that the suprarenals were failing to convert it to adrenaline. The fact that he did not pigment in an Addisonian manner does not necessarily indicate the latter; it may have been too slight to be noticeable. He was given suprarenal extract (empirically) by mouth, and this was followed by improvement. But we do not know the real effect of suprarenal extract given by mouth. It may be the adrenaline content that is absorbed, or a ferment—in which the suprarenals are temporarily deficient—for converting dopa-substance into adrenaline. Whichever it may be, the whole scheme breaks down when the patient—on regaining his suprarenal function and normal blood pressure—develops an attack of asthma. One would have expected him to do this earlier, when his adrenaline production was at a low ebb. The only possible (and to my mind rather weak) plea is that he may not have had the allergic provocation

during that time. Then the coma by which Case II distinguished himself cannot be explained by this mechanism.

Summary

1. The beneficial effects of actinotherapy in cases of asthma cannot be attributed alone to the suggestibility of the patient.
2. At present no theory can be propounded which covers all the clinical observations.
3. The most striking clinical observation—that is, the relation between immunity and pigmentation—leads me to propound a theory involving the relation of adrenaline and melanin.
4. It is perhaps noteworthy that in none of these twelve asthmatic patients or in any of the fifty to sixty patients treated by ultra-violet rays for other conditions has pulmonary tuberculosis manifested itself either during treatment or subsequently.

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SPINAL ANAESTHESIA*

BY

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What are the advantages of spinal anaesthesia that we are here discussing it when we have so many other anaesthetic methods? Its main advantage, in addition to analgesia of the operative field, is that it provides a complete relaxation of the abdominal muscles and blocks all passage of nervous impulses from the operation area to the cerebrum. Thus it allows an operation to take place painlessly and without shock, and facilitates the work of the operator by eliminating any possible trouble from straining muscles and from bowel intruding into the area.

This argument in favour of spinal anaesthesia is really sounder than it appears. We are all aware that the patient is the person of first importance in an operating theatre, and that everything done there should be for his benefit alone. It is a perversion of this reasoning that makes many say that spinal anaesthesia is for the benefit of the surgeon alone, and that his convenience has not to be studied before that of the patient. If this train of thought were complete the argument would be unanswerable, for statistics (reliability not guaranteed) can be produced to prove that spinal anaesthesia is a slightly more dangerous form of anaesthesia than gas or ether. However, the extent to which the surgeon's work is facilitated is the extent to which the performance of the operation is rendered easier, and the patient is the one who gets the most benefit out of this.

If a major operation with a definite mortality is rendered easier to an extent which can be measured in fractions of a hundred by the use of an anaesthetic, the danger of which can only be measured in fractions of a thousand, the percentage increase in safety of the operation more than offsets any decimal percentage increase in the danger of the anaesthetic. My argument is that one should not consider the mortality rates of the anaesthetic and the operation separately, but rather in combination.

* Read in opening a discussion in the Section of Pharmacology, Therapeutics, and Anaesthesia at the Annual Meeting of the British Medical Association, Melbourne, 1935.

I am quite sure that in any two series of one major operation performed by one surgeon, one under spinal anaesthesia and the other under general anaesthesia, the spinal anaesthesia series would be better, both as regards immediate and late mortality and as regards smoothness of post-operative course. When it is realized that, in addition to this, there is a complete abolition of the flow of painful shock producing stimuli from the operation area to the cerebrum, then it must be concluded that the use of spinal anaesthesia has much to commend it.

Contraindications

It is convenient to recall first that the contraindications may be classified under the following headings: (1) *cardio-vascular*, low blood pressure and anaemia, angina, and coronary thrombosis; (2) *nervous*, whether organic or functional; and (3) *general*, including septic conditions of the spine and the height of the operative field.

In the presence of some of the above-mentioned conditions—for example, coronary thrombosis, spinal sepsis, and vascular or inflammatory disease of the spinal cord—spinal anaesthesia is absolutely contraindicated. In the presence of the other conditions mentioned it must be used only after the closest consideration, and only if the use of the other forms of anaesthesia available would seem to be fraught with more danger than spinal anaesthesia.

General Indications

The general indications for spinal anaesthesia are any operation below the umbilicus which, by reason of its severity, is likely to produce a condition of surgical shock in the patient, or any such operation in a patient to whom, for any reason, the administration of general anaesthesia of any sort is likely to lead to pulmonary, cardiac, or renal complications. The absolute indication for spinal anaesthesia is an operation taking place below the umbilicus and being of such nature as to involve the possibility of surgical shock or a long operation which would threaten pulmonary complications from protracted inhalation anaesthesia.

Optional Indications

The absolute indications for spinal anaesthesia practically make themselves, and most thinking surgeons will