4. STOKES, J. H.: Modern Clinical Syphilology, 2nd ed., W. B. Saunders Co., p. 59.
5. MOORE, J. E.: *Brit. J. Ven. Dis.*, **25**: 169, 1949.
6. NELSON, R. A. AND MAYER, M. M.: *J. Exper. Med.*, **89**: 369, 1949.
7. NELSON, R. A. *et al.*: *Am. J. Syph., Gonor. & Ven. Dis.*, **34**: 101, 1950.

RÉSUMÉ

L'auteur étudie les problèmes que le médecin praticien rencontre losqu'il traite la syphilis. De plus en plus, surtout depuis l'avènement de la pénicilline, le médecin de famille a une plus grande part à jouer dans le dépistage et le traitement de cette maladie. L'auteur établit une ligne de conduite pour porter un diagnostic précis: (1) soupçonner la syphilis en tout tempts; (2) se souvenir que la syphilis est parfois difficile à diagnostiquer même pour un expert; (3) faire une épreuve sérologique. Une fois la syphilis diagnostiquée il faut retrouver les contacts, c'est là que le patient vient en aide au médecin.

Le traitement de la syphilis est bien simplifié depuis quelques années. A la base du traitement moderne se trouve la pénicilline. Actuellement la pénicilline procainée G dans l'huile avec 2% de monostéarate d'aluminium semble être le médicament de choix. La routine la plus fréquente est: 600,000 unités tous les deux jours pour dix injections. D'après Moore on peut s'attendre à 85 à 90% de succès dans la syphilis du début i.e. primaire secondaire et latente de moins de quatre ans. Les rechutes sont rares. Dans la syphilis prénatale les insuccès ne sont que de l'ordre de 1 à 2%. Dans la syphilis congénitale la pénicilline donne presque 100% de succès si le traitement est commencé avant trois mois. Dans la syphilis nerveuse les résultats sont même plus satisfaisants que dans la syphilis primaire. Dans la syphilis cardiovasculaire la pénicilline ne nuit pas et il n'y a pas de danger d'une réaction d'Herxheimer. L'auteur conseille de ne pas commencer le traitement sans avoir deux réactions sérologiques positives. Le médecin doit se faire un devoir re suivre cette ligne de conduite et surtout de rapporter les contacts donnés par le patient.

YVES PRÉVOST

THE MANAGEMENT OF DEPRESSIONS*

M. Straker, M.D.

Montreal, Que.

THE diagnosis of "depression" is generally considered to be in the province of psychiatric practice, and at once calls up the typical clinical syndrome of the depressed facies, the hopeless outlook, the self-debasing ideas, the suicidal impulse or act. However, this really describes the psychotic depression alone. Actually, the subtler manifestations of the depressed state are seen in every practitioner's office, disguised by a host of somatic symptoms which obscure the primary mood disturbance.

The chief complaints are disturbed sleep, loss of appetite and weight, fatigue and exhaustion, loss of interest in usual activities, loss of libido and pleasurable affects. The sleep disturbances may involve difficulty in falling asleep, early waking, or restlessness during sleep. Nightmares or anxiety dreams occur, and if available to recall, give useful clues about underlying conflicts. Loss of appetite is associated with loss of taste or perversions in the sense of taste, so that everything is described as bitter, flat, salty or bad tasting. Weight loss is dependent on nutritional changes which result from diminished intake of nourishment coupled with the increased energy demands in the sick person. In severely depressed patients, severe starvation effects may be seen, and tube feedings are sometimes necessary to sustain life.

Fatigue is a regular complaint. It is most marked in the early part of the day and gradually improves as the day wears on. Many patients who are mildly depressed report that they only feel "like themselves" in the evening. This type of fatigue is easily differentiated from the fatigue or organic origin by its special characteristics. Most noted in the a.m., it improves with activity and pleasant distraction, is not relieved by rest and has other associated signs of neurotic stress.

The psychological state of the patient can best be described as one of general inhibition. In the severely ill patient, the inhibition is reflected in psychomotor retardation, blocking of speech and a general poverty of thought. In the milder case, there is simply a lack of drive and initiative, listlessness, inertia and lack of enthusiasm. Usual activities or hobbies no longer interest the patient. Loss of interest in everything and withdrawal from social contacts and pleasurable activities is characteristic. Sexual drive diminishes, frequently to the impotent state. The libido shift is a reliable guide for timing of the onset of the illness and is a good signpost of the recovery process.

The affect (mood) is one of pessimism, moodiness or frank depression. The ability to laugh, smile or enjoy is lost. Brooding and easy tearfulness is noted. The depressed patient feels and behaves as though the world is desolate, and he is lost. Actually, the depressed state has been compared to the normal grief reaction seen in mourning. Here, however, the depression is pathological, either because there is no external stress obvious, or because the reaction far exceeds in severity what is expected from the bereavement or disappointment actually suffered.

Another characteristic in the depressed state is the decrease of ego strength and the (relatively) increased prominence of superego (conscience) activity. Loss of confidence, loss of efficiency, withdrawal from social contacts and

* From the Jewish General Hospital, Montreal.

activity, loss of self-esteem are noted. The superego appears to assume a critical, domineering sadistic attitude towards the ego, which is reflected by feelings of inferiority, self-depreciation and intolerable guilt, from which the patient seeks escape by expiations, self-punishments small and large, surgery (polysurgical addict) or suicide.

The superego behaves towards the "self" (ego) much as the enraged hostile parent behaves towards the guilty and offending child. The ego responds to these pressures by admission of wickedness, confession of guilt, and humble submission to censorship and punishment. The thoughts and feelings of the depressed person are self-condemnatory, with self-blame for behaviour or wishes judged to be sinful, and yet demanding love and forgiveness, in spite of "sins" which are grossly overemphasized or exist only in phantasy. The self-punitive expiatory needs are reflected further in the giving up of pleasure, in giving up of food and in various small or large tortures, or mutilations, the individual appears to compulsively seek out.

Somatic manifestations of the depressed state are reflections of the general inhibition and state of tension present. Dyspepsia, constipation, dysmenorrhœa or amenorrhœa, headaches, generalized aches and pains, fatigue and weight loss are familiar complaints. Functional complaints of every sort occur and may mask the depression. Laboratory findings are not significant in relationship to the clinical picture.

Diagnosis. — The symptom complex outlined above, *i.e.*, insomnia, loss of appetite, fatigue, loss of libido, depressed affect, diminished self-esteem represents the essential features of a depression. It must be pointed out at once, that this does not however, represent a disease, or a disease process, but rather a type of reaction, or specific kind of pathological behaviour response. It is clear that a depression may exist separate from, or coincident with, any organic disease process. The psychosomatic concept emphasizes that any illness process (organic) has its repercussions within the personality structure of the patient, and likewise that personality factors influence the natural life history of the disease. Thus the diagnosis of depression does not necessarily exclude the presence of other illness, either organic or psychological.

Depressed reactions can occur in the life history of any patient suffering from tuberculosis, heart disease, carcinoma, etc. As well, depression may arise as a reaction formation in the history of a manic depressive psychosis, a schizophrenic reaction, anxiety hysteria or obsessive compulsive neurosis. Depressions frequently occur in middle life or at the involutional period. Typically, here, the illness arises on the basis of a rigid long-standing obsessive compulsive neurosis, with gradual failure of the ego to cope with the persistent pathological demands of the neurosis in the face of decreasing physical and emotional stamina.

The precise evaluation of the depressed reaction, in its larger setting within the individual patient, becomes then an important part of diagnosis and in planning therapy.

Depressive equivalents may occur. Most common are bouts of alcoholism, periods of complete anorexia, episodes of exhaustion and nervous fatigue, or circumscribed periods of apparent hypochondriasis. A study of the patient's personality and life stresses will make clear that these symptoms are depressive equivalents.

Etiology and pathogenesis.—The present understanding of the psychological mechanisms operative in the depressed state still rests on the fundamental contributions of Abraham.[1] As a result of his psychoanalytic observations, he pointed out four factors of significance in this reaction.

1. There is a special fixation of the libido (psychic energy) at the oral level. (This refers to that stage of growth in which sucking, biting, chewing and oral pleasures are especially prominent as sources of gratification.) This fixation may be constitutional.

2. There has been a severe injury to infantile narcissism (infantile ego) brought about by successive disappointments in love. (This refers to the child at an early age feeling rejected or unloved by the valued parent, either as the result of death, separation, emotional rejection or replacement by another child for her love.)

3. This initial trauma occurs in the pre-edipal stage of development.

4. The repetition of this primary disappointment in later life acts as the precipitating element in the individual predisposed by the above factors which have distorted his personality development.

The classical stress which produces a depression is either a disappointment in love, or the loss of a loved person through death or separation. However, in predisposed persons,

other disappointments may have an equivalent meaning. Through the loss of self-esteem or personal devaluation, the individual may deem themselves unworthy to be loved, so that their loss or disappointment becomes also a threat of producing separation from those who are loved, even though no actual separation has occurred. Loss of money, failure to reach an important life objective, criticism from a person specially valued or feared, illness, etc., operate in this way as precipitating stresses.

One finds that if the individual in his early development has been thwarted in satisfying basic oral and love needs, he has strong feelings of hostility to those who have so thwarted him in his desire for gratification and love. However, with a formidable superego (conscience) the individual cannot discharge this hostility directly—it is instead redirected against the individual himself and against his introjected images of the person who is both loved and hated. Thus the self reproaches are, ultimately, in the depressed individual, a merciless criticism of the primary love object (mother or father) who first failed him. This hostility is often concealed behind a façade of passivity and submissiveness. Actually, the basic personality of the depressed patient is that of a self-centred (narcissistic) egotistical individual, extremely sensitive to criticism, disapproval or rejection, and with strongly ambivalent (mixed love and hate) feelings to everyone and everything. A life experience which is traumatic then sets all the old grievances in motion.

The following case illustrates many features of a depressed reaction.

A 49 year old male, 5 months in Canada as a displaced person, complained of depression, weeping spells, fatigue, chronic dyspepsia, inability to concentrate, poor sleep, loss of appetite and thoughts of suicide. Since arriving in Canada, he was unable to get employment because of his age, language problems and lack of demand for his type of training (whisky distiller). However, he managed hopefully on agency assistance, supplemented by his daughter's earnings, until he learned that his wife had an inoperable carcinoma of the stomach. In anticipating her death he developed the acutely depressed reaction. Physical examination revealed no pertinent abnormalities. Neurological was normal. The content of thought dealt mainly with ruminations over his impending loss, together with cries of desolation and self-pity, weeping storms and interjections of suicidal urges. He felt inferior, lacked confidence, was self-critical, avoided meeting people or venturing into the street.

Because of the practical limitations of out-patient care, and the severity of the reaction, a course of electroshock treatments was initiated. Six treatments were given with temporary improvement at first, then the improvement was consolidated after 6 more electroshock treatments. The major symptoms then subsided and he was treated subsequently with vitamins, divided doses of somnol* and psychotherapeutic interviews.

The background history indicated that his father was narrow, sadistic, strict, religiously fanatic. There was always a deep fear and hatred of his father. His mother was kinder, protecting him partly from his father's wrath, but he blamed her for not protecting him more, and for having so little to give him as the younger children were added to her burden. As a child he was timid, easily frightened, and terrified of the dark, of storms, of dogs and persistently of his father. He resented his older brother who was more successful and had privileges of the firstborn, but he hated violently his father, for his cruelty and rejection, also for his harshness towards the patient's mother. At 15 he had to leave his father's home to make his own way in the world. He was desolate, homesick, unhappy, but he could only pay his mother visits that were secret from his father. He always felt depressed and weighted whenever his father was near. In his teens, after several failures because of his querulous timidity and nervous dread of the boss, he was taught his trade by his older brother. With girls and socially, he was shy and reserved. His sexual life began late, and was filled with anxiety and associated tormenting guilt, because of his religious morality. His courtship lasted 8 years. He could not decide to marry because of his own anxiety, his mother's objections and his concern about the dowry. He finally married at the age of 28. Difficulties began at once. He had ejaculo præcox, and found his wife to be frigid and unresponsive to his excessive needs for affection. Further conflict developed with his mother-in-law: in this he felt that he had no support from his wife. He felt desolate then; he had incurred his mother's hostility by his marriage, and now his wife's love and sexual rejection. Within a month of his marriage he became deeply depressed and remained so for about 10 months. During this period he attempted suicide by slashing his throat. He only began to improve when he began psychotherapeutic interviews and separated his wife from her family and took up residence in another city. During his illness, his only child, a daughter, was born. Following his recovery he got employment and was more successful, but he remained very resentful to his wife for her inability to satisfy his love and sexual needs. He was jealous of the child behind a façade of paternal solicitude. His wife, at one point, became ill and he frankly wished her death, as he was at that time, engaged in a sexual relationship with a war widow, whom he hoped to be free to marry. His daughter was aware of this liaison, his wife was not. During the war years, he was for a time in a slave labour battalion, then was in a D.P. camp from 1946 until his immigration to Canada in April, 1949.

Concealed beneath the idealized protestations about his wife's benign and wonderful character, and the enormity of his loss in her impending death, was a welter of hostilities and resentments to her, which began to emerge in the psychotherapeutic interviews. As this material was ventilated under permissive guidance, his guilt and hostility to himself began to diminish. When his wife actually died, there was no further grief, as the mourning reaction had already been worked through in the period anticipating her death. However his search for a new object became intense, as his dependency needs had to be gratified. He complained bitterly at first of his daughter's coldness to his desperate pleas for affection—he wanted her to take his wife's (mother's) place. He reported, with anxiety, dreams in which he gave his daughter an engagement ring as a suitor, another in which sexual intercourse with her took place (factually they share the same room for sleeping quarters). His demands for help from other sources were also excessive at first, from the therapist for daily interviews, from Social Services, from the Agency. As the therapeutic relationship strengthened, and he improved, these

* Product of Messrs. Frank W. Horner Ltd., Montreal.

frantic demands diminished. At present he is working part time, his depression is lifted even though his wife's death is only 6 weeks ago, and he is generally much improved. His psychotherapeutic interviews are still essential in sustaining him and will be necessary for some time. His satisfactory transference to the therapist diminishes his excessive demands on others, particularly his daughter, with whom serious conflicts are thus being averted. He is being helped to an adjustment in the midst of a major upheaval in his life. Efforts are now directed to further diminish his guilt and to increase his ego strength so that he can become more self sustaining in the future.

In review, this case presents the typical features of a depression, and the personality of the patient and the psychological mechanisms illustrated are fairly characteristic. The patient is very narcissistic, extremely dependent on external supplies of affection and love in order to maintain equilibrium. There is the hostility and ambivalence to the parental figures. There were repeated minor depressions in early life, a major adult depression reactive to sexual frustration, and then the development of the present illness as an exaggerated anticipatory grief reaction. The actual death and the increasing emergence of hostility to her and to earlier figures in his life is coincident with steady improvement.

TREATMENT

A plan of therapy must be based on a clear evaluation of all the factors involved, including the clarification of the stress factors, and the dynamic delineation of the patient's personality structure. Therapy is directed first at the alleviation of symptoms and the protection from self-destructive drives, and secondly, by helping to restore more normal relationships, the distorted personality forces (super-ego-ego).

The first decision concerns the immediate environment of the patient. It must be determined whether therapy can be proceeded with in the home setting, or whether removal to a relative, a hospital or nursing home is necessary to reduce conflicts and tensions, or to anticipate suicidal drives. Should the patient be treated at home, an assessment of the charged relationships in the home is at once necessary, in order to instruct the family what to do, what to avoid. This is no simple task, as it often turns out that each one has his own beliefs about behaviour causation in general and this illness in particular. Tactful firmness is necessary right from the start. An unhealthy setting which cannot be modified necessitates removal to a general hospital or a suitable nursing home. Commitment is necessary in the presence of serious suicidal threats or when the patient because of agitation or other reasons, requires mental hospital care. Sometimes, with special supervision, even a critical illness period can be managed without commitment.

Drug therapy.—Many agents are used symptomatically in depressions. Tonics, vitamins, insulin subcoma and nutritional adjuncts may be useful in specific cases. Generally, however, these measures are of no value. Appetite, weakness, weight loss do not respond until the primary mood disturbance is treated. Hormone therapy is used in depression at the climacteric or involutional period. The dosage is much larger than when used for menopausal states without the additional depression. Hormone therapy fails to restore the libido in the presence of persistent depression. The problem is one of psychological imbalance rather than of glandular imbalance. Sedation is used to alleviate tension and agitation, and to make sleep possible. Satisfactory oral sedation is provided by the rapid acting barbiturates given in divided doses. Sodium amytal gr. 1 or gr. 2, t.i.d. is helpful. Somnol in divided doses is also useful. Parenteral sedation, by the intramuscular or intravenous route serves multiple purposes. In addition to giving some relief and relaxation to the patient, it permits the therapist to reduce the inhibited state and allows catharsis and ventilation to take place. Intravenous sodium amytal in experienced hands is especially useful. As a matter of fact, it is recommended as a therapeutic test, and a prognostic guide to the efficacy of electroshock therapy. Satisfactory relaxation and an elevation of mood are good signs. It should be pointed out that sedatives should be under the supervision of a responsible person and not given to the depressed patient directly or in quantity. The temptation to suicide is always to be remembered in the management of the case.

Stimulants, at whatever level they act on the nervous system, are disappointing. Benzedrine or dexedrine compounds help reduce fatigue occasionally, but seem otherwise valueless in the patient who is really depressed. Desoxy-ephedrine hydrochloride (methedrine pervitin) has recently been described as an intravenous agent to combat tension and de-

pression, and aid catharsis. It is promising and merits further investigation. A combination of sedatives and stimulants (sodium amytal plus benzedrine) has been useful at times when agitation and depression are both present. Benzebar* is after the same order.

Psychotherapy.—The depressed patient presents special problems. In a deeply depressed state, too early analysis of the disturbing factors, and confrontation and hurried interpretation can be extremely disturbing, and, in unwary hands, may provoke a suicidal attempt.

The main need at first is to establish rapport, and provide constant reassurance of recovery, the feeling of sympathetic interest and protection from the therapist, and gentle probing to bring to light the basic hostilities and to reduce guilt. The therapist may need temporarily to function passively as a substitute for the individual who has been lost to the patient. Once rapport is strong enough, the primary problem is to help the patient redirect his hostility from himself (in the depressed state) to external objects once more. In further therapy, the superego is gradually modified in its function, and the ego strengthened so that future stress can be better tolerated.

In a deeply depressed state, the patient can be so regressed psychologically as to be inaccessible to the doctor. Then it is, that other measures are useful to reduce barriers blocking the psychotherapeutic relationship.

Electroshock therapy.—Electroshock therapy can rapidly terminate the depressed state, effectively and safely in a high proportion of cases. Since the introduction of shock therapies, numberless patients have been saved from commitments, suicide or a lengthy period of misery. At first only used in mental hospitals, in recent years ambulatory E.S.T. has been successfully introduced at this hospital and others. Strauss and Macphail,[2] Impastato,[3] Zeifert,[4] Feldman[5] and others have reported on various aspects of the ambulatory treatment of both inpatients and outpatients at the general hospital level. Fetterman[6] lists the advantages of ambulatory E.S.T. as saving in time, in expense, in hospital beds, avoiding the stigma of institutionalization, and helping towards more rapid recovery. The disadvantages are the increased responsibility placed upon the family, and the increased opportunity for suicidal acts. The careful selection of patients is imperative. The severity of the reaction, the duration of the illness, the age and physical status of the patient are important factors. The excessive caution regarding physical contraindications to treatment which existed soon after the introduction of convulsive therapies, has, to some extent been allayed.[7] Each patient has a careful physical examination, with x-rays of the spine and E.C.G. when indicated. The usual complication is a post-treatment memory defect which clears spontaneously after a few months. In our series, of a total of 1,669 treatments given, there were, in 3 cases compression fractures of a lumbar vertebra, without severe symptoms, and, in 1 case a fracture of the scapula. Nowinger and Huddelson[8] reported that the cortical changes, revealed by E.E.G. changes after E.S.T. are reversible. Huston and Strother[9] concluded that—"E.S.T. does not produce any significant impairment of mental efficiency after an interval of 6 months". It may be stated that in experienced hands and with careful precautions, the dangers are minimal.

Diagnosis	*No. receiving treatment*	*Recovered*
Primary depression (Involutional)	145	113 (78%)
Schizophrenic reactions	11	3 (27%)
Manic	7	5 (71%)
Paranoid reactions	6	3 (50%)
Psychoneurotic reactions	9	2 (22%)
Undiagnosed	5	2 (40%)

Ambulatory E.S.T. has been carried out at this hospital during the past 30 months. A total of 183 patients have received treatment, and a total of 1,669 treatments have been administered. Of this group, 125 were female, 58 male. By diagnosis, 145 were primary depressions or involutional melancholias (79% of total), 11 schizophrenic, 7 manic, 6 paranoid reactions, 9 anxiety states and 5 undiagnosed. The average number of treatments given per series was 7. Some patients received repeated series, either for relapse or new attacks of illness: 18 patients (10%) relapsed. A recent follow-up inquiry has been carried out, and enables an evaluation of the results to be made. The overall picture is found to be encouraging: 134 patients (73% of total) reported themselves completely recovered or much improved; 18 patients relapsed, either getting further E.S.T. or other treatment (commitment, etc.),

* Product of Messrs. Smith, Kline & French, Philadelphia.

22 patients reported no improvement; 9 others discontinued therapy or were unavailable for follow up. Of these diagnosed depressions, 113 (78%) reported recovery. Manic showed a good response also.

SUMMARY

1. The signs and symptoms of depressions have been outlined, and the diagnostic implications discussed.

2. Precipitating factors, pathogenesis, and the interplay between environmental stress and the vulnerable personality have been described, and clarified by the presentation of a case.

3. Management of the depressed patient has been considered under the headings of manipulation of the environment, drug therapy, psychotherapy and electroshock therapy.

4. The results of ambulatory electroshock at this hospital are presented.

REFERENCES

1. ABRAHAMS, K.: Selected Papers on Psycho Analysis. No. 13. International Psycho-Analytical Library, Hogarth Press.
2. STRAUSS, E. B. AND MACPHAIL, A.: *Brit. M. J.*, **2**: 779, 1940.
3. IMPASTATO, D. J., FROSCH, J., ALMANSI, R. J. AND WORTIS, S. B.: *New York State J. Med.*, **45**: 179.
4. ZEIFFERT, M. COL.: *Dis. Nerv. System*, **7**: 112, 1946.
5. FELDMAN, F., GOMBERT, E. AND BARRERA, S. E.: *J. Nerv. & Ment. Dis.*, **105**: 171, 1947.
6. FETTERMAN, J. L.: *Dis. Nerv. System*, **8**: 5, 1947.
7. STRAKER, M.: *J. Ment. Sc.*, **90**: 780, 1944.
8. LOWINGER, L. AND HUDDLESTON, J. H.: *Am. J. Psychiat.*, **102**: 594, 1946.
9. HUSTON, P. E. AND STROTHER, C. R.: *Am. J. Psychiat.*, **102**: 594, 1946.

METABOLIC DISINTEGRATIONS*

John Beattie, M.D., D.Sc.

Bernhard Baron Research Professor,
Royal College of Surgeons of England,
London, Eng.

TWO approaches to the problems of human metabolism have contributed largely—possibly predominantly—to our understanding of this subject. The use of the respiratory exchange and of nitrogen balance as indices of the success or failure of the organism to maintain a state of metabolic integration, and the observation of disease states where metabolic disturbances are the main feature, are both classical methods. Less interest has been shown in those *transitory* derangements of metabolism which occur frequently during the course of an illness but which are of only minor importance. Yet the very fact that such disturbances are not clinically very important suggests that they differ from the normal in degree rather than in kind and are therefore worthy of particular attention. During and after the war my colleagues and I had some opportunities to observe many different examples of this type of metabolic disturbance. It seemed appropriate to present an account of our work and to show how our findings did not always coincide with classical metabolic concepts.

Alterations in metabolism, whether of rate or direction, must result ultimately, with minor exceptions, from changes affecting enzyme systems of the body. These changes may arise within the organism or may be caused by some change in the environment. Research in physiology and biochemistry today is concerned increasingly with the mechanisms whereby the organism relates the speed of specific enzymic reactions to its continually changing environment. If these reactions were not co-ordinated and integrated, cellular existence would cease. Many of the sequences of intermediary metabolism are now known in detail, but the problem of how these multitudinous enzyme systems are integratively controlled is today only just being posed. This changing emphasis from the analysis of individual enzyme systems to the problems of their integration one with another stimulates renewed interest in the classical work on the metabolism of the intact organism. Many of the theoretical concepts with which we approach such problems today are derived from these early experiments, and it is fitting that we should re-examine them in the light of our present knowledge of intermediary metabolism and nutrition.

The heat production of intact animals is a good index of the intensity of the metabolic processes, but the direct measurement of it demands an elaborate apparatus which is impracticable for clinical work. When Benedict and Joslin[1] showed that under standard basal conditions it was possible to obtain good agreement between direct determination of the heat production and heat production calculated from the amount of oxygen consumed over a known period, it became possible to use the indirect method in routine clinical studies. The adoption of Rubner's concept[2] that the heat production per unit surface area was constant for a given species enabled comparisons of heat productions of different individuals to be made

* The Banting Memorial Lecture, University of Toronto, February 14, 1949.