EMOTION AND BLOOD-PRESSURE

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THE general aim of the experiment was to discover whether, during an interview directed at discussing the patient's life, there was any significant alteration of blood-pressure, heart rate or brain waves in association with emotional content; as it turned out, changes in blood-pressure proved to be the most rewarding field for study and in consequence this aspect was accorded more attention.

Although some work has already been carried out in this field both in the United States and in this country (Gold, 1943; Hambling, 1952; Moses *et al.*, 1956; Palmer, 1950; Wolf *et al.*, 1948), it was thought that the techniques employed were not sufficiently rigorous to allow of any exact correlations being made between emotional states on the one hand and physical changes on the other. It has of course long been known that life situations and emotional states have some general bearing on physical changes, particularly in autonomic function, but it was felt that causal relationships had so far been only tenuously established mainly because a considerable interval of time usually elapses between the alleged causative emotional states and the consequent physical changes. Accordingly it was thought that a clearer idea of causal interrelationship between emotional and physical states could be gained by carrying out contemporaneous observations of both under special test conditions. It was also thought that any recording, either of emotional content or of physical changes, should be of a permanent nature and if possible susceptible to exact measurement.

This investigation, which was pursued fairly intensively over a period of two years, produced a great deal of data which will be reported elsewhere. However, for the purposes of the present paper, only the salient points have been noted and all tabular material has been omitted. Unless it is stated to the contrary, it may be taken that all findings are statistically significant, at the 0·05 level of confidence.

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TECHNIQUE

The Interview. All subjects were given straightforward "psychiatric" interviews of a biographical kind, that is to say, the following aspects were covered in all cases but in no standardized or rigid order—Present Health; Past Health; Personal History (including early childhood, schooling, occupation, marital, domestic and recreational life); Personality (including special interests, attitudes, ambitions, temperament), and Family History. All interviews, with the exception of those involved in the Special Investigation reported later, were conducted by the same physician (M.V.) according to this pattern.

The interviews varied in length but usually lasted 20-30 minutes; some interviews in which subjects seemed eager to discuss their problems at greater length lasted for up to one hour. The interview was conducted with the patient lying relaxed on a couch after a rest period of 10-15 minutes. Usually the interviewer did not enter the room, where the subject had been resting and attached to the apparatus, until the actual interview was about to begin.

The interview room was one of a suite of two rooms divided by a partition of "one-way" glass. The room itself had the appearance of a formal consulting-room, all recording apparatus being located in the adjoining room on the other side of the glass screen. The leads connecting the patient to the recording apparatus were channelled through the wall in as unobtrusive a manner as possible.

Most subjects were interviewed on one occasion only, but in five cases a series of interviews was conducted. One of those patients, who showed marked fluctuations in blood-pressure, was made the subject of a special investigation and interviewed on 24 occasions.

RECORDING APPARATUS

Sphygmomanometer. The method adopted was an adaptation of the standard clinical procedure. A cuff round the patient's left arm was connected through the wall to a 7-inch (175 mm.) aneroid sphygmomanometer, and a large cylinder of compressed air operating through a reducing valve produced a smooth and rapid build-up of pressure in the cuff. The flow of air was cut off, and pressure reduced, by an orthodox needle valve. A flat stethoscope chest-piece made of "coldlite" was fixed over the brachial artery at the elbow by adhesive tape and held in place by an elastic cotton bandage: the sounds were conducted to a conventional stethoscope headset by a length of wide calibre pressure-tubing which passed through the wall. Readings were made at intervals of 30 seconds; the regularly repeated smooth inflation of the cuff did not damage the patient's arm nor prove uncomfortable during interview. The same operator recorded the readings throughout each individual session and indeed the vast majority of all recordings in the entire project were carried out by one person (G.I.). The interview was recorded throughout on a high-fidelity tape recorder: this recording was later transcribed by a secretary on to specially designed sheets showing the time relation of the interview material to the physical variables, in 30-second epochs (see Figure 1).

Heart Rate. This was obtained from a Lead II electrocardiogram recorded on one channel of a four-channel pen oscillograph which ran continuously. The number of beats and fractions of a beat were counted in each 10-second epoch, and expressed as a rate per minute.

Electroencephalogram. The EEG was recorded from two small silver-silver chloride button electrodes attached by collodion to the scalp over the left

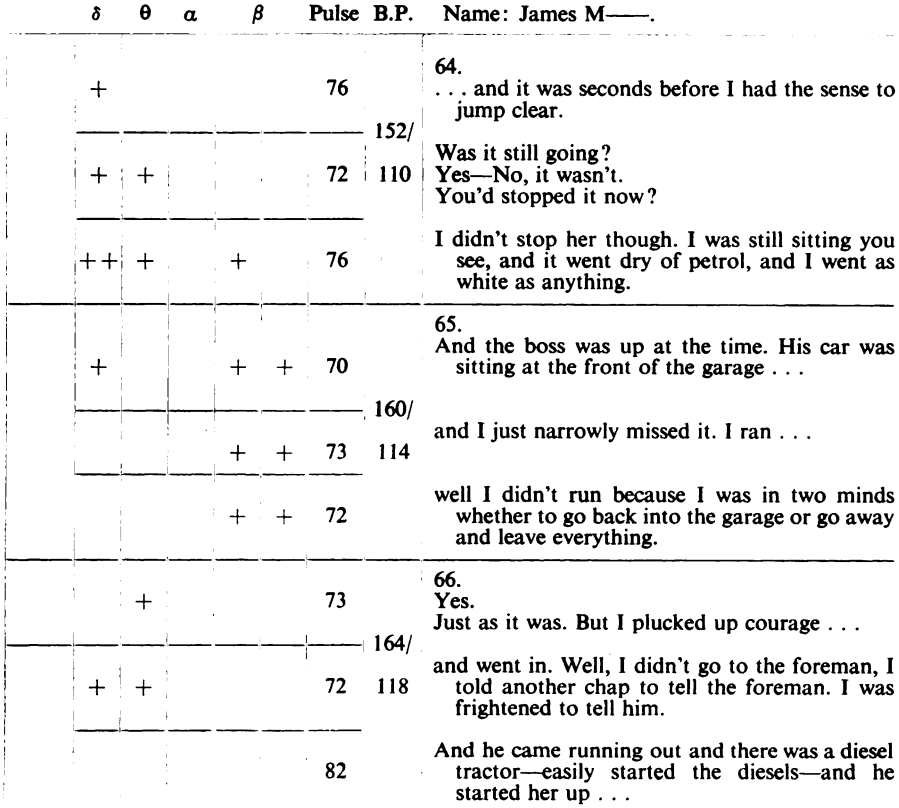

FIG. 1.—Sample of recording sheet.

temporal lobe; bipolar recording technique was used, with the ear as the earthing point. The primary trace was recorded on the pen oscillograph and the signals were also fed to an Ediswan Wave Analyser. The temporal lobe was selected on the basis of existing work (Chapman *et al.*, 1950) as one of the areas most likely to demonstrate any possible change in connection with emotional alterations.

Synchronization. In order to synchronize the interview material with the recorded variables, two microphones in parallel were employed; one in the interview room, the other in the observation room. The main function of the latter was to record the passage of each 30 seconds by a low-pitched buzz, and the 10-second and 20-second intervals by a high-pitched buzz: these were superimposed on the tape while the interview was being recorded from the other microphone.

In addition, the time marker actuating the 30-second buzzer also activated a marker pen on the oscillograph trace, and an electromagnetic counter. The start of each 30-second epoch, therefore, was demarcated by (1) a buzzer note on the tape recording, (2) a signal on the marker-pen of the trace, and (3) a serial epoch number on the counter.

The observer who was taking the blood-pressure readings called out the figures to an assistant who noted them on the oscillograph trace, together with the epoch number, at the point where the signal marker was actuated; these verbal observations were of course also superimposed on the tape recording via the parallel microphone.

Additional Investigations

The Breath-holding Test. Devised by Ayman and Goldshine (1939), this test depends on the assumption that hypertensive subjects are sensitive to stimuli such as oxygen lack or to increased carbon dioxide, and a higher mean rise in pressure was found by the authors in hypertensives. In the present simplified modification of this test, the subject was asked at the conclusion of the interview to take in a breath and hold it for 30 seconds; the blood-pressure was measured just before inhalation and at the end of the 30-second interval.

Minnesota Multiphasic Personality Inventory. This standard psychological test consists of 550 cards bearing statements of various sorts. The subject is asked to place each card into one of three categories—*True*, *False* or *Cannot Say*, as he thinks they apply to himself. On analysis, the test gives a score of ten personality variables—hypochondriasis, depression, hysteria, psychopathic deviation, masculine/feminine balance, paranoid traits, obsessionalism, schizophrenia, mania and anxiety. Weighted scores of up to 70 for each factor (that is, within 2 standard deviations from the mean of 50) are accepted as within normal limits, but higher scores must be treated with suspicion and are probable indications of personality abnormality.

Mental Arithmetic. Introduced at first as an intended "control" for intellectual stimulation, the task of mental arithmetic was found in a number of subjects to be in fact a powerful pressor stimulus. Set the task of serial subtraction of 7 from 100 (93, 86, 79, 72 . . . etc.) two hypertensive subjects for example showed increases of blood-pressure as follows:

from 146/92 to 186/104
from 180/120 to 216/136

As an aside, we may mention another pressor stimulus which, although described before (Bordley and Eichna, 1938) was not known to us at the outset. This is the desire to micturate; in one hypertensive patient, for example, the blood-pressure climbed steadily throughout interview from 214/124 to 260/134, before we realized that he was experiencing urinary urgency. After relieving himself, the pressure (despite the effort of getting up and walking along the corridor) fell again to the original value of 212/126.

Plethysmograph. In the latter part of the project a number of subjects were given finger plethysmograph recordings during the course of the procedures outlined above. The right index finger was held in a perspex cylinder with as little "dead space" as possible, and the cylinder was joined by 1½ metres of fine polythene tubing to a tambour bearing a small surface-silvered mirror. A slit lamp, focused on the mirror, gave a fine beam which was reflected and, after a total throw of 3 metres, registered on a Cambridge recording camera. This apparatus proved sufficiently sensitive to give a good outline of pulse waves, but for prolonged recording the film speed had to be reduced and only finger volume and pulse amplitude were considered. No attempt was made in this study to control temperature or other random variables.

Constitution of Control and Experimental Groups

Control Group. This was composed of 40 female subjects drawn from the population of Aberdeen Royal Maternity Hospital: all were at the sixth day following delivery of a healthy live child. The group forms a fairly

representative sample of healthy young women in the region, all social classes being represented. Cases having complications, past or present, were accepted provided the patient was sufficiently fit to be up and about on the sixth day. The mean age of the group was 25·9 years.

Hypertension of Pregnancy Group. This group was composed of 25 female subjects, again drawn from the population of the Aberdeen Royal Maternity Hospital; all had in common a rise of blood-pressure in the course of pregnancy. In some, this might have been the only toxic feature, but others showed some or all of the following disturbances—marked weight gain, oedema, headaches, visual symptoms, or albuminuria. All subjects had a variable period of bed rest before taking part in the experiment, and all were permitted at least minimum activity in hospital. The mean age of the group was 26·4 years.

Psychoneurotic Group. This was made up of 13 individuals under psychiatric treatment for neurotic disorders. Some were known to have labile blood-pressure, but this was not a criterion for selection and several subjects were normotensive. There were 8 male and 5 female subjects, the mean age being 32·4 years.

Hypertensive Group. These were patients under treatment for known hypertension, including patients under care in medical wards, patients with hypertension which was discovered in the course of investigation in the psychiatric units, and hypertensive subjects attending the Blood Transfusion Service as donors. There were 7 males, 22 females; the average age was 53·9 years.

Plethysmograph Group. This was a small group of 4 psychoneurotics and 4 hypertensives who were interviewed during the latter part of the research.

Results

General. While it was clearly demonstrated in all groups that variations in blood-pressure and pulse rate occurred during interview, and while it was assumed that the immediate conditions of interview situation must have been responsible for these variations, it was by no means easy to determine the nature of the factors responsible. In line with other researches into this problem, it was thought that a promising approach might be to analyse the emotional significance of the various internal and external events in the interview situation which appeared to be correlated with physical changes.

Interview Content Analysis. Previous attempts to describe the events taking place in an interview have been of two sorts—the analysis of topics (such as home life, a love affair, a quarrel, etc.) and second, the analysis of emotions and their control mechanisms (such as rage, fear, repressed anger, etc.).

Early attempts in this study employed methods described by other workers, but no consistent and reliable technique was discovered. For example, each 10-second epoch was graded on a 5-point scale in respect of two variables —"emotional strength", and "degree of repression"; it was hypothesized that higher blood-pressure readings would be positively correlated with "increased emotional strength" and "increased repression". In fact, statistical analysis disclosed no correlation of any sort, and it could not be established that the emotions of rage, anger and fear were positively correlated with pressor responses. However, there was a slight positive correlation between the pressor response and the discussion of the husband by female subjects, and likewise

there was a tendency for the discussion of illness to be associated with raised values.

Overt displays of anxiety or anger during interview were not clearly pressor in effect; and depressive themes (such as the discussion of a bereavement), which might be expected to produce some lowering of values, were not in any way consistent in their effects.

Some observations suggested that the sheer novelty of a topic might produce a pressor response, regardless of its feeling-tone in respect of pleasure or pain. This might indicate that the mechanism at work is *alerting* in nature, and non-specific.

In a more extensive study, all the epochs which were hypertensive (the "peak" epochs), were compared and contrasted for interview content with all the epochs that were hypotensive ("trough" epochs). No clear distinctions were brought out between these two types of epoch in respect of topic, nature of emotional mode of expression, or other psychological variable. However, it was discovered that "peak" epochs contained a significantly greater number of *self-references* ("I", "me", "my", etc.) than the "trough" epochs. The same distinction was found to obtain in the case of the *number of syllables spoken* per epoch, pressor responses being positively correlated with a greater output of syllables per 10 seconds.

The difficulties of correlating "content" with blood-pressure changes are shown in a typical example from a labile subject in Figure 2. Some of the variations are no doubt corrective swings carried out by the homeostatic mechanisms attempting to keep blood-pressure reasonably stable, so it is

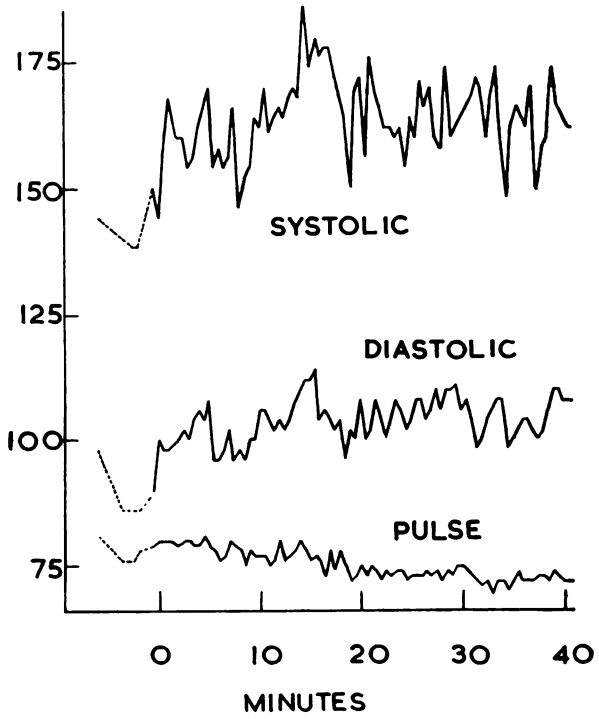

FIG. 2.—Half-minute readings of systolic and diastolic blood-pressure, and pulse rate, recorded from a labile subject.

hard to tell which excursions are primarily responses to an emotional situation and which may be purely physiological.

This particular difficulty, however, was mitigated by our practice of making a smoothed curve of blood-pressure readings; that is, each reading was averaged with the one before and the one after. When the same interview data is redrawn using this technique, as in Figure 3, the trend is more apparent.

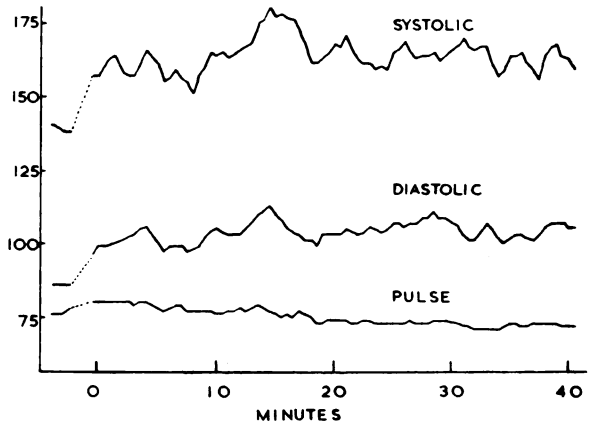

FIG. 3.—The same data as Figure 2, re-drawn as a smoothed graph.

At the start of the major rise the patient was talking about his frustrations and humiliations at work, which had led up to a suicidal gesture.

Content analysis, therefore, remains a formidable task, and no entirely satisfactory method has so far been worked out. One explanation for this is that the *significance* of any given event, whether internal or external, physical or psychological, is highly individual or idiosyncratic in character and cannot readily be equated with factors common to all subjects and exerting similar and predeterminable effects.

Blood-pressure. The individuals within each group differed markedly in their response to the interview situation, but nevertheless there are also well-marked group differences.

The Control group showed an almost symmetrical rise and fall in response to the stress of the interview. Figure 4 shows the mean values: the relatively low resting pressure, the increase at the start of interview, the gradual fall as interview progresses, and the return to a low resting value again after its conclusion. It is of interest that the diastolic pressure is comparably affected; in fact, *if considered as a percentage increase, the diastolic response is actually greater than the systolic.*

The Hypertension of Pregnancy group shows an equally symmetrical rise and fall, but all pressures are at a higher level.

The psychoneurotic group shows about the same degree of pressure elevation as the Hypertension of Pregnancy subjects, but the rise in pressure during interview tends to be more sustained and there is not the same symmetrical reversion to normal as was found in the two previous groups.

The Hypertension group operates, of course, at a very much higher level of pressure, and here the tendency to *sustained elevation* is again marked; maximum values are not reached until 20 minutes after the start of the interview, and the resting values after interview remain very high. Taking cases

with interviews of more than 35 minutes duration, it is noted that the rise in pressure is maintained until the end of the interview; and after the interview is discontinued, the resting value then obtained is considerably higher than the one recorded before the start of interview. There is a similarity of behaviour, therefore, in the Psychoneurotic and Hypertensive groups insofar as pressure, once elevated, tends to remain high throughout the interview, and indeed afterwards.

In each case, in every group, there was some rise in blood-pressure at the start of interview; sometimes this rise might be only slight, but increases of more than 30 mm. within the first minute were recorded. Even in the Control group—although some subjects were very stable throughout, others showed fluctuations during the course of the interview of as much as 40 mm.

Pulse Rate. The heart rate was found also to vary greatly during the course of interview, and in general it was found that a rise in blood-pressure was accompanied by an increase in heart rate. An indication of the mean results for the Control group is seen in Figure 4, where the pulse rate figures are displayed along with the blood-pressure changes.

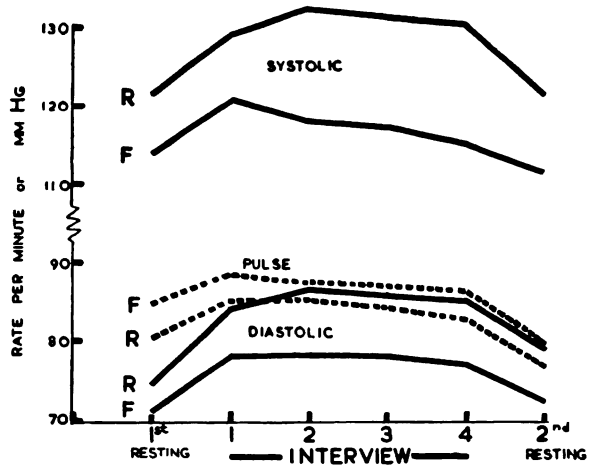

FIG. 4.—Control Group. Mean blood-pressure and pulse rate for the rest periods before and after interview, and for each quarter of the interview.

However, when the mean values for each individual interview were compared, it was found that in each group there tended to be an inverse correlation between the pulse rate and the blood-pressure. That is, *the subjects with the higher blood-pressures tend to have slow pulse rates; but under interview stress, both values tend to increase.*

As regards the mean pulse rate, the Controls take up an intermediate position, the Psychoneurotic group having the slowest pulse rate and the Hypertension of Pregnancy group the fastest. There is some increase in pulse rate in pregnancy in any case, so it is difficult to assess what effect the accompanying hypertension may have had on the pulse rate in these patients. Incidentally, the Hypertension of Pregnancy group was the only one which showed a tendency to continued increase of pulse rate as the interview progressed; in all others it tended to decrease after the initial rise.

Another point was that subjects could be classified according to whether the blood-pressure, during the second quarter of the interview, showed a fall

thereafter or a continued rise. Study of the "fall" and "rise" subgroups showed that there was a significantly higher pulse rate in the "fall" group.

Electroencephalogram. This was concerned with detecting any possible EEG changes associated with pressor responses. When the subject reacts to part of the interview with emotional tension and a pressor response, this is presumably organized somewhere in the central nervous system. Is this response, then, capable of being correlated with any detectable change in the EEG as recorded by surface electrodes?

In the records obtained from the Control group there was no consistent change of frequency associated with peaks or troughs in the blood-pressure estimations, but there was a tendency for pressor periods to be associated with the appearance of slow rhythms. However, there is no certainty that these were of true cerebral origin, and they could have been due to artefacts such as movement or sweating, only indirectly linked up with the pressor response. Again, no consistent change was seen in the records of Hypertension patients which were found suitable for analysing; no increase in slow rhythms was observed during pressor epochs and there was no sign of a suppression of alpha activity (as compared with a control group), as has been described elsewhere (Subbotnik and Shpil'berg, 1953: Ackner and Pampiglione, 1957). Similarly no consistent findings, or correlation with pressor epochs, were discovered in the Psychoneurotic group: one subject in this group had EEG records from four separate interviews, and even in this case no characteristic common features were found in the response to stress.

Breath-holding Test. This test is considered to show perhaps the highest pressor response which can be produced by deliberate physiological stress. However, in all four groups the mean breath-holding level was exceeded by the mean highest readings found in the course of interview. The highest interview blood-pressure readings represent a percentage increase over the breath-holding values as follows—Controls, 3·9 per cent.: Hypertension of Pregnancy, 4·1 per cent.: Hypertension, 4·9 per cent.: Psychoneurosis, 7·5 per cent.

It seems therefore that the random emotional stresses imposed by interview possess a greater pressor effect than the deliberate physiological stress invoked by breath-holding; and that the Psychoneurotic group demonstrate the greatest lability of blood-pressure to such interview stresses.

Personality Inventory. The mean scores returned by the Control group for each personality factor lie within normal limits. The five Control cases with the highest mean systolic pressure during interview were compared with the five cases with the lowest systolic pressures; the subjects with low pressures showed scores which were slightly (but not significantly) higher on the obsessional and anxiety ratings. Similar results were found in the Hypertension of Pregnancy group.

The Hypertension group also had normal mean scores throughout, but they tended to score a little higher than the previous groups on the vectors for hypochondriasis, depression and hysteria.

As was to be expected, only the Psychoneurosis group returned abnormal mean scores (on the depressive and obsessional vectors), but their scores on all vectors were high in comparison with the results of the other groups.

Plethysmograph. The plethysmograph study was limited to 4 hypertensive and 4 psychoneurotic cases, in addition to one case which was made the subject of a special investigation and interviewed on 24 occasions.

In all cases there was a marked vasoconstrictor response as soon as the interviewer entered the room, and this was associated with an increase in blood-

pressure. As the interview progressed there was, in general, a gradual increase in the pulse amplitude, but the blood-pressure remained at the higher level. *In many of the interviews there were several short periods (up to about half a minute) when vasoconstriction appeared, and these were invariably associated with peaks in the blood-pressure* (see Figure 5). At the end of the interview there

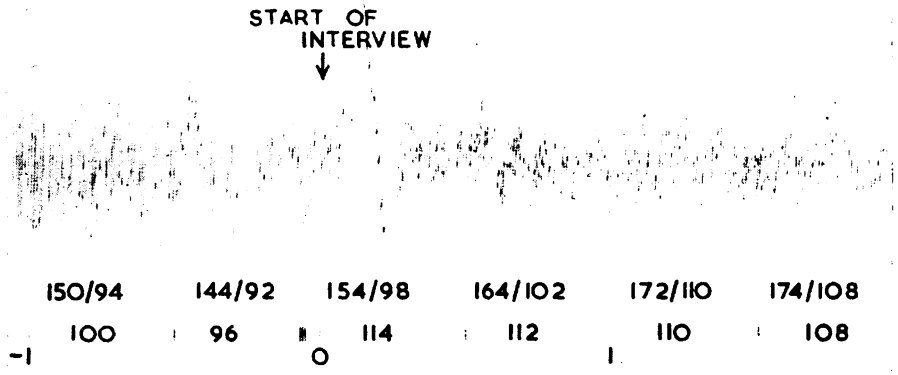

FIG. 5.—Sample of plethysmograph showing vasoconstriction accompanied by rise in blood-pressure.

was always an increase of the amplitude of the pulse waves—representing a vasodilatation—and this was associated with a decrease in the blood-pressure.

These changes might be explained in terms of the following hypothesis.

Sympathetic stimulation at the start of the interview results in secretion of adrenaline from the adrenals and nor-adrenaline from the nerve endings. The nor-adrenaline acts first producing a vaso-constriction and increase in blood-pressure for a certain time, before the concentration of adrenaline builds up in the circulation. Thus the high blood-pressure is maintained while vaso-constriction decreases—but only relatively slightly. Whenever there is a fresh stimulus this sequence of events is repeated. At the end of the interview there is a decrease in both adrenaline and nor-adrenaline.

SPECIAL INVESTIGATION

The subject of this study was a woman aged 38 with hysterical symptoms, who was found at routine medical examination to have high blood-pressure readings. In all, she was seen on 24 occasions and usually by the same doctor (W.M.M.), but an interview was not carried out every visit. She showed marked differences in blood-pressure from session to session, the mean resting values prior to interview varying from 125/82 mm. to 172/111 mm., and the mean values for the interviews varying from 152/102 mm. to 201/135 mm.

The first visit was mainly for the purpose of introducing the patient to the experimental set-up, but she had an abbreviated interview with one of the doctors (G.I.) and was given several short intelligence tests. These were found to produce an increase in blood-pressure, as did the breath-holding test.

The next six interviews were carried out by another physician (W.M.M.), the first being diagnostic in type, followed by two sessions of free association, then two of free association plus reassurance, and one of free association plus some "insight" interpretation. During all these interviews there were marked blood-pressure variations, but no single subject of discussion was consistently found to produce a pressor response.

In the eighth interview two selected short passages from previous interviews were replayed to the patient: the first was selected because at the original interview it had evoked a relatively hypotensive response, whereas the second had produced a marked rise in blood-pressure. These passages from the recorded interview were replayed to the patient on an A-B-A-B-A pattern with a few minutes rest between each section. Both passages produced an increase in blood-pressure at the first replay, and the response to the "hypertensive" passage was the higher although it did not reach the level of the original interview. Further repetitions had only a slight effect on the blood-pressure.

The next interview consisted of free association plus "transference" interpretation, and this was followed by a session when the patient was shown *Thematic Apperception Test* cards. In this test the patient is shown pictures of various possibly stress-inducing situations and has to tell a story about each one. All pictures produced a marked increase in blood-pressure, and about this time it began to be noted that there was a definite positive correlation between the height of the blood-pressure and the number of syllables spoken by the patient in a given time. No matter the subject of the conversation, the more the patient spoke the higher were the blood-pressure readings. This finding was later confirmed in all the interviews which followed.

The next two sessions (the 11th and 12th) were conducted by another doctor (G.I.) and the patient was asked to read passages from various books, some thought to be perhaps stressful. There was an increase of blood-pressure during the reading, but no significant differences according to the content. The resting blood-pressure values at the 11th interview were the lowest found on any occasion; the physician (W.M.M.) had started the patient on meprobamate before going on vacation.

The physician (W.M.M.) returned for the 13th interview and discussed with the patient her progress in general terms; this was followed by another session of free association and "transference" interpretation. In the course of the next 4 interviews intravenous sodium amytal was given (7 ml. of 2·5 per cent. solution injected at the rate of 1 ml. per minute). On all occasions the blood-pressure fell during the injection to approximately the resting value for that interview, but rose again as soon as the injection was discontinued.

The 19th interview was again on the lines of "transference" interpretation. The 20th session gave resting and interview blood-pressures higher than on any previous occasion (up to 220/150 mm.), and the patient had obviously been greatly distressed by reading in a Sunday paper that *"The Doctor"* had said that variable blood-pressure was more serious than sustained high pressure.

The 21st interview was interesting in that the physician was delayed by a minor accident. The patient was seen instead by another doctor (G.I.), who gave her the details of this accident without producing any elevation in blood-pressure. Some "sound-effect" records were then played to her, again with no pressor effect, but the unexpected entrance of the physician (W.M.M.) produced a rise of pressure from 152/100 mm. to 192/116 mm. within half a minute.

In all sessions the entrance of the interviewer produced a rise in pressure and pulse rate, associated with evidence of vasoconstriction as discussed previously; but all these changes were more marked when the physician (W.M.M.) was present than with other members of the staff.

The pulse rate was fastest at the start of the interview and gradually tended to become slower as the interview progressed; the pulse rate of the rest period after interview was invariably slower than the value for the rest period

before interview. No such consistent pattern was observed with the systolic or diastolic blood-pressures. It was found, however, that when the resting period before interview was considered, the variations in blood-pressure were as great from one occasion to another, as from the lowest to the highest values in any individual interview.

From this it may be concluded that significant alterations in blood-pressure occur in response to sustained events in the life situation, as much as to transient emotional causes arising during the interview. It is therefore possible that two types of pressor factors are at work in the emotional sphere—one which is *sustained*, and pervasive throughout the life situation for hours, days, or longer; and another which is *transient*, a response to brief episodes probably of an unexpected nature, and producing a rapid alerting reaction. If so, then our observations suggest that both factors are of approximately equal potency.

Summary

In an investigation of blood-pressure changes during interview, it was found that random emotional stresses were uncovered which had potent pressor effects in normal controls, in hypertensives and in neurotics. It was notable that the diastolic increases were proportionately greater than the systolic, and that those random emotional stresses on average possessed more pressor effect than a deliberately imposed physiological stress such as breath-holding. Certain individuals also showed marked pressor responses to varied stimuli such as being asked to do mental arithmetic, or the desire to micturate.

All subjects showed an increase in systolic and diastolic pressures at the start of interview; in the control group this tended to level off symmetrically as the interview closed, but the hypertensive and neurotic groups showed a sustained rise of pressure and the resting levels after interview did not fall as low as the pre-interview resting values.

No consistent topics were found to be pressor in effect, but it appeared that pressor responses occurred (1) with novel or "alerting" stimuli; (2) when the subject talked about herself, about illness or about her husband; (3) when the subject's verbal output increased.

The heart rate tended to increase along with the blood-pressure, but subjects having higher blood-pressure levels tended to have slower heart rates.

Finger plethysmography showed that peripheral vasoconstriction accompanied pressor responses, and vasodilatation occurred as blood-pressure fell.

A neurotic patient with labile blood-pressure was interviewed on 24 occasions, and several unusual features are described.

No constant or reliable association was discovered to exist between the temporal electro-encephalogram and the blood-pressure changes.

It is concluded that two types of emotionally-caused pressor responses may exist; one which may be keyed to the life-situation and is sustained in effect over a period of hours or days or longer, and another which is more transient and may represent a non-specific alerting reaction.

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