When there is a very large number of targets, such as all the drawable words in a dictionary, data are best evaluated by a special formula developed by R. A. Fisher (Carington, 1944). The baseline for chance expectation is determined by the number of responses for a word (or other item) when it was *not* the target. The method thus requires many test administrations with diverse targets, to provide a large response pool. (Having a large response pool is especially important because Carington, after years of working with the technique, found that it is advisable to use narrow categories for scoring a hit. For example, he reports a substantially higher hit ratio when "elm" was scored correct only for the target "elm" than when elm, along with oak, maple, poplar, etc., were all classed together as hits for any kind of tree.) A problem here is that any particular catalogue of response frequencies, such as the one Carington prepared, may be inappropriate for subjects drawn from a different population or tested at a different time.

Open-ended Responses. When the target is complex, no response is likely to be completely right or wrong. The standard way of scoring such data is to use blind judges who score each response against each of the targets. For example, a subject may try on ten nights to dream about whatever target picture an agent happened, that night, to select from a target pool. Then each of three blind judges (whose scores will be averaged) is presented with a 10 X 10 array. Along the top are listed the ten pictures, in random order; down the side are the dream reports. The judge rates (for example, on a scale of 0 to 100) how well the dream reports for the first night correspond to each of the ten pictures. He then continues with ratings for each of the subsequent nights. Analysis of variance of the array shows whether the ten correct target-response pairings are significantly different from the 90 incorrect pairings.

An alternative with the same general approach is to have the blind judge *rank* each response for how well it matches the various targets. With ten possibilities, he would enter into the array 1, 2, 3 . . . 10 for each response. Some experimenters choose to class all high ranks together, and all low ranks together, but such pooling of scores discards so much information that it seems inadvisable.

Similar ratings or rankings can be used to judge the accuracy of "readings" (life histories). Good research must be double blind. The person for whom the reading is held is absent. The proxy sitter (a blind notetaker) asks for the reading and records it. The best judge of the accuracy of a reading is ordinarily the absent sitter for whom the sitting was held. Each absent sitter is then presented with the entire set of readings, coded so that he does not know which was intended for him, and is asked to rate or to rank them. The experimenter puts these ratings or rankings into an array for analysis of variance: readings are the columns, and sitters' scores are the rows.

In scoring, an alternative to such global ranking or rating requires that a blind experimenter put a pair of parentheses after each scorable item in the responses. Parentheses would, for example, litter the protocol thus: "I think this is a man ( ) of about 50 or 55 ( ) who is going to have a lot of happiness in his future. He has had some troubles in his past, but things will go better for him soon. He is very close to someone named Anna ( ). He wears a green ( ) jacket ( ) with brass ( ) buttons ( )." The subject is asked to respond to each item singly, so far as possible, so that a woman of 55 who wore a red sweater with a brass clasp should respond affirmatively to the age and the brass, but not to the man, green, jacket, or buttons. Responses typically consist of entering each pair of parentheses with a check if the item is clearly right, a cross if it is wrong, and a question mark if it is ambiguous. (Subjects find this easier than entering only checks and crosses.) Checks are then summed, and the frequency of checks for each reading is entered into the protocol X subject array.

The items on any of these protocols may be subdivided, and a different array set up for each division. Dream protocols, for example, may have items evaluated separately for responses that were or were not associated with color. Readings for absent sitters may have items subdivided for personality descriptions of the sitters, references to living individuals, references to dead individuals, etc.

Open-ended Responses Scored as Forced Choice. A method for retaining both freedom in the subject's response and also the simplicity of forced-choice scoring is to use complex material for the target but take only prespecified categories as the scorable responses. Schmeidler and Lewis (1969) prepared a set of 81 pictures which showed all combinations of three levels for four variables: sex (two males, two females or one male and one female); age (young, adult but not old, old); activity (passive, normal, active); and emotion (unhappy, neutral, happy). Subjects were told that each picture showed two people; they were asked to describe the picture; and responses were scored for accuracy on the four variables. Honorton (1975) has recently prepared an assembly of 1,024 pictures which permits binary scoring (present or absent) for all combinations of ten variables.

Physiological Measures. When targets are preselected as emotionally neutral or emotionally charged, the subject's physiological changes can appropriately be used as the response measure. Tart (1963) applied painful electric shock to the agent on some trials of a GESP experiment and measured subjects' responses by GSR, EEG, plethysmograph, and key taps (conscious report). Each of the physiological measures showed a significant difference between shock and nonshock trials, but the key taps did not. Another example is research reported by Dean (1966), who made use of only a single physiological measure. In his procedure, the subject lay quietly in a darkened room. A plethysmograph record showed changes in his finger's fluid volume (a measure of autonomic activity). The agent in another room looked at names, randomly ordered, of three types: persons important to the subject but not to the experimenter; persons important to the experimenter but not to the subject; and persons known to neither. Timing was recorded on the plethysmograph record. Scoring of plethysmograph changes was blind. Dean's data, and those of several similar experiments, showed increase in autonomic activity when the agent contemplated a name personally relevant to the subject. Typically, as found by Tart, the subject reported no awareness of the target.

Other possibilities are obvious but have not as yet been adequately explored. No controlled research has been published on the wave form of the cortical evoked potential, e.g., for auditory vs. visual ESP targets. Only preliminary investigation reports similarity in the timing of alpha waves as the ESP response in paired subjects.

Selection of Appropriate ESP Targets

The experimenter, obviously, need not restrict himself to using ESP cards as targets. There is an infinite number of possibilities, and for some subjects or some hypotheses, other target possibilities are preferable to a set of five symbols. The range of choice might be suggested by the following list, culled from 5 years of reports in a single journal. The *Journal of the American Society for Psychical Research*, in 1970-1974, published ESP research with these targets: cards that were green on one side and white on the other; the inner containers that concealed these cards; ESP cards; multiple-choice questions, each consisting of four items relevant to a story that the subject had heard; elaborate pictures (usually art prints or magazine illustrations); slides of patterns and faces (including the subject's own face); names (including the subject's own name); the sex of a person in a concealed photograph; a particular square within a 5 X 5 matrix; red vs. black papers; Identi-Kit components to match the face of a target person; a multisensory environment which the subject would soon experience; erotic pictures affixed to some ESP cards; the timing of radioactive emissions from a Schmidt machine; several sets of five nature cards; the 12 positions of a clock face; audio-visual programs of slides and music; geometric symbols; the five vowels; a pool of 100 simple line drawings of objects, with their names; characteristics of the persons who would sit in specified auditorium chairs; word associates; relevant statements about individuals in concealed photographs; series of thematically related stereoscopic slides.

Selection of Appropriate Subjects

Species. Humans are not necessarily the subjects of choice. Though no systematic work has been done in comparative parapsychology, extrachance data have been reported for such diverse animals as cockroaches, lizards, rodents, cats, dogs, horses, and humans. Probably the two best directives for the resear worker are: (a) to study psi in the species where he is himself most expert as a experimentalist; and (b) to set up the laboratory conditions and reinforceme schedules which most sensitively elicit meaningful data in other types research.

Demographic Variables. Since psi has been demonstrated in young childre adolescents, and adults, in males and females, and in many races, the same dire tives apply as in the preceding paragraph. In general, the experimenter shoul work with the subjects with whom he feels most comfortable and whom he most competent to test.

Preselection of Subjects. If the experimenter wants to study the relation of p to some other variable, such as imagery, creativity, extroversion, or psychosi he may choose to use preselected criterion groups. It may be even more nece sary in psi than in other research, however, to do careful pretesting to ensur that such special conditions as the choice of targets, the setting, or the connot tions of the wording of the instructions do not in themselves have a differenti effect upon the groups.

In the more common case of preselection, the experimenter may choose to us gifted subjects. Here he can fall into a trap. The natural way to find gifted sub jects is to look for those who have shown marked psi success outside of the laboratory, but this is often counterproductive. A subject who considers himself gifted while working under his own conditions will often feel either a sullen or a fierce resentment of laboratory restrictions, and this attitude may defeat the experimenter's purpose in selecting him.

A method recently used successfully (Tart, 1976), and which may serve as a model, used two preselection steps. The first consisted of group testing by an experimenter who told his subjects that he was looking for good subjects for later work and who used rather dull targets. Subjects with promising scores were invited to come to the laboratory, where the same experimenter had them work on two types of interesting ESP machines. Those with the better scores we invited for a third session with the same experimenter, in which they work with the machine that they preferred. Their scores on the third session wer remarkably high.

The three conspicuous virtues of this approach are: (a) the subject's goal during the selection trials is to do well enough for later laboratory work, and thus the later work comes as no surprise to him; (b) the experimenter effect is controlled, since it is the experimenter for whom the subject produced earlier high scores who works with him later; and (c) test conditions become increasingly pleasant.

strong. On very high-scoring runs he showed alpha abundance before and during the actual time of guessing itself. On the chance runs he showed alpha abundance just before making his choices, but during the choosing period itself his alpha abundance dropped. This study at present is the only EEG study involving very strong psi performance by the subject. Since only one subject was used, the results may not be generalizable.

Some results are more complex. Lewis and Schmeidler (1971) found a significant positive relationship between proportion of correct choices and alpha abundance when their subjects were not aware that they were participating in an ESP test, and a significant negative relationship on those runs in which the subjects were aware that they were participating in an ESP test. Stanford (1971) and Stanford and Stanford (1969) found no significant relationship between alpha abundance and overall ESP score but did find that high ESP scores were associated with an increase in the frequency of the alpha rhythm from just before ESP symbol guessing to the guessing period itself. Other studies have not reported alpha frequency shift data. Stanford interpreted such an increase in frequency as representing a possible "coping" response in which the subject is mobilizing himself for what he construes to be a difficult task, yet at the same time he maintains a general state of relaxed awareness. Stanford's procedures in these studies were described to the subjects as being precognition procedures rather than clairvoyance, even though in fact the random numbers that would determine the targets had themselves already been selected. Most people intrinsically regard precognition as a more difficult task than clairvoyance.

Only three EEG studies involving free-response procedures have been published. Stanford and Stevenson (1973), testing Stanford, found his alpha abundance not related to his ability to describe a concealed line drawing. However, they did find that alpha frequency during a preliminary mind-clearing period was negatively related to ESP success and also found that an increase in alpha frequency from the mind-clearing period to the following period of image formation about the target drawing was associated with psi success. The two findings are not independent, of course. Rao and Feola (1973) found that a single subject familiar with biofeedback and meditation was more successful at describing concealed magazine pictures when he was asked to produce high alpha than when he was asked to produce low alpha. Stanford and Palmer (1975) found that above-chance scorers on a free verbal response task involving concealed photographs showed significantly more alpha abundance than below-chance scorers, during both a preliminary period of listening to soothing music and during the imagery period.

As a whole, the EEG results are confusing and contradictory. Part of the problem is that the procedures and methods of data analysis varied widely from study to study. The most consistent finding was that alpha abundance tended to be positively associated with high ESP scores, especially for subjects preselected for expertise at the production of one or both. The studies which found no relationship between ESP and EEG also did not find overall positive evidence for ESP. The most difficult to explain are the studies that found a significant negative relationship between alpha abundance and ESP.

Very little work has been done with other psychophysiological measurements. Tenny (1962) failed to find any relationship between galvanic skin response activity (GSR) or vasomotor activity as measured by plethysmograph, and ESP choice success, although he did obtain significantly positive ESP results. Woodruff and Dale (1952) found a positive but not quite significant relationship between GSR activity and ESP card-guessing success, in two consecutive studies. Otani (1955) found significantly more hits on ESP cards during large skin resistance changes as measured by basal skin response (BSR). This result was obtained only under a subject condition of indifference toward the results and with eyes open. Braud and Braud (1974) found that subjects who heard taped relaxation-inducing instructions scored above chance in a free response GESP test, whereas those who heard a tension-inducing tape scored at chance. A related finding was that, over all subjects, positive scoring was significantly associated with less frontalis muscle activity (measured by electromyograph or EMG) during the target impression period, and with a decrease in frontalis activity from beginning to end of the session. The Brauds hypothesized that a physiologically-definable "relaxation state" was very conducive to psi in the receiving organism. In addition to reduced muscle activity, they suggested: lowered frequency and increased amplitude of EEG; lower heart rate, blood pressure, and vasomotor activity; increased basal skin resistance; lower oxygen consumption; and reduced blood lactate level. This overall schema is also compatible with the results of White's (1964a) finding that people purported to show strong free response ESP ability consistently described themselves as entering a period of relaxation and mind-clearing at the onset.

Too little work has been done to evaluate the accuracy or generality of the Brauds' "relaxation syndrome." Certainly the negative correlations between alpha abundance and psi performance in two studies, plus the findings of Stanford that an increased alpha frequency is correlated with psi on certain psi tasks, are at odds with the Brauds' ideas. Woodruff and Dale's and Otani's results with GSR and BSR are also contrary to the implications of this syndrome. However, the Brauds did not state that relaxation was the only condition for strong psi performance. Perhaps there are complex interactive relationships among state-trait subject variables, the nature of the psi task, and the optimum physiological processing of psi information.

Psychophysiological Responses as Measures of Psi Performance

There is evidence that physiological variables are correlated in a variety of ways with psi performance and are therefore in some way involved. Manifestations of psi are often complex, confused, and probably misprocessed within the organism at some level. Perhaps therefore we should look directly at changes in psychophsiological aspects themselves as indicators of the presence of a psi message. By so doing, we may be able to look crudely at the psi information during relatively early stages of its processing within the organism. Although the data will lack the richness of experience, they may be more consistent and may additionally eventually tell us a great deal about the processing elements themselves.

Targ and Puthoff (1974) flashed a strobe in the eyes of a sender and observed the response of the receiver's occipital EEG. One agent-receiver pair was selected for more extensive work, on the basis of preliminary success plus the monochromatic EEG spectrum of the receiver. During strobe periods, the average power and peak power of the receiver's alpha rhythms significantly decreased, indicating partial alpha blockage to remote visual information. At the same time, the subject was unable to guess with any accuracy above chance which periods were strobe periods and which were control.

Tart (1963) found that subjects in a soundproof room showed a faster and more complex EEG pattern plus more active GSR and plethysmograph responses when a distant agent was receiving strong shocks than during control times. At the same time, receivers showed no behavioral evidence of responsiveness to these distant events, in terms of frequency of key presses made during shock vs. control times. Kelly and Lenz (1976) employed a similar procedure with a receiver selected for monochromatic EEG, but without an agent. The receiver relaxed, eyes closed, and simply tried to visualize the target area and whether or not the strobe was on. No attempt was made to guess when the strobe was on or off. Using a variety of preliminary procedures, they obtained suggestive evidence that the EEG responded differentially to stimulus vs. control conditions and that the nature of the response may be dependent upon such parameters as intertrial interval, body position, and so on. Duane and Behrendt (1965) found some suggestion that increasing alpha abundance in one twin led to increased alpha in a remote identical twin, but the overall results were not significant. The Research Committee of the A.S.P.R. (1959) found no significant EEG changes in receivers during times in which agents were being emotionally stimulated.

Lloyd (1973) employed an averaged cortical evoked potential as a measure of responsiveness to the sudden onset of a distant stimulus. An agent was instructed to send a visual image each time a light flashed. During a run, 60 such flashes were entered on the EEG record in such a way that the EEG output before, during, and after the flash onset could be averaged to see if a coherent signal emerged in response to the onset of the remote stimulus. By visual inspection, such a cortical response seemed to be present. Lack of a control condition prevented statistical analysis, however. Millar (1976) repeated this procedure using control periods and found no evidence for psi. An important variable in such studies is the recording site from which the EEG is taken. The best recording sites are well known for various kinds of ordinary sensory stimulation. For psi information, we have no a priori reason to assume one site more important than another. To make evoked potential studies work for psi messages, exploration of a variety of potential sites would seem to be mandatory before the effectiveness of evoked potentials as psi responses can be assessed.

Another EEG measure that could be used as an indicator of psi processing is the contingent negative variation (CNV), a negative shift in cortical potential recorded by surface electrodes from the frontal portion of the brain. Also called the expectancy wave, it is generally regarded as a sign that the organism is imminently expecting some specific form of stimulation to which it must respond. Levin and Kennedy (1975) employed a reaction-time procedure to see whether or not the presence of a CNV could serve as evidence for anticipation of a yet-to-be determined event. Subjects were told to press a key when a green light appeared but not when a red light appeared. Which light appeared was determined by an RNG immediately before the light came on. In a preliminary study, subjects' CNV's showed significantly more evidence of expectancy just before the RNG selected green, the color to which the subject was to respond, than before red. A confirmatory study produced chance results, however. This procedure is very important, nevertheless, because the CNV represents a time-locked, precise event in central nervous system information processing.

Several other studies have employed psychophysiological measures other than the EEG. Tart's GSR and plethysmograph results have already been mentioned. Dean (1965), using a dream telepathy paradigm, found that active sending on the part of an agent significantly influenced the abundance of rapid eye movements during dream periods, even on occasions in which the subject's dream descriptions were unrelated to the target.

Beloff, Cowles, and Bate (1970) found no evidence that subjects' galvanic skin responses (GSR) were affected by mildly emotionally interesting messages sent by a remote agent, nor did Barron and Mordkoff (1968), Dean (1969), or Sanjar (1969). Rice (1966) found strong GSR deflections in receivers when the agents were exposed to startling stimuli, e.g., sudden immersion of feet in cold water, or hearing a blank cartridge fired. Hettinger (1952) claims that a group of preselected sensitives showed increased GSR activity when agents several miles away were stimulated or made to exercise, but does not provide sufficient details.

Figar (1959) measured peripheral vasomotor activity with a plethysmograph and found some indication that a receiver's vasomotor activity increased when a remote agent performed mental arithmetic. Unfortunately, no real attempt was made to analyze the data blind, nor was any precise statistical evaluation carried out. Esser, Etter, and Chamberlain (1967) found some indication that receivers' vasomotor activity increased when agents attended to sentences or names of emotional importance to the receivers, as opposed to control sentences, but the authors did not attempt any statistical analysis. Dean (e.g., Dean, 1962, 1969; Dean and Nash, 1967) found additional evidence that receivers' vasomotor activity increased when agents attended to names of emotional importance either to the agent or receiver. Sanjar (1969) found no relationship between receivers' vasomotor activity as measured by plethysmograph and agent arousal by loud noises or by being put through a psychiatric interview.

These studies are of considerable potential importance and should be pursued in more detail. Of especial interest is the fact that physiological responses were often correlated with the onset of the target event, whereas the cognitively processed verbal report or behavioral output of the subject was not. Perhaps such indices do give us a more direct access to less processed (and therefore less distorted) psi messages.

SUMMARY

There is not much that can be said in summarizing this material, other than that a few scattered promising beginnings have been made in developing the methodology for relating psi functioning to our present knowledge of biological communication. There is some evidence that psi communication is not restricted to humans. Before more specific speculation on the evolution of psi and its ecological significance can be seriously considered, we need much more data on more species. We also need to find functional relationships between anpsi strength and other relevant variables such as level of arousal, need strength, and so on to feel comfortable that we are not just dealing with experimenter psi effects.

Our knowledge of psi information processing in humans is little better off. There is fairly strong evidence, however, that psi expression does interact with detectable physiological events, some of which may serve as more direct indications of psi than our cognitively elaborated responses.

In conclusion, we must greatly expand our data base before we can truly assess the extent to which psi communication interacts with our presently known biological communication channels, either at a cellular or population level or somewhere in between.

REFERENCES

American Society for Psychical Research, Research Committee. Report of the Research Committee for 1958. *Journal of the American Society for Psychical Research*, 1959, 53, 69–71.

Backster, C. Evidence of a primary perception in plant life. *International Journal of Parapsychology*, 1968, 10, 329–348.

Barnothy, M. F. (Ed.). *Biological Effects of Magnetic Fields.* New York: Plenum Press, 1964. Vols. 1 and 2.

Barron, F., and Mordkoff, A. M. An attempt to relate creativity to possible extrasensory empathy as measured by physiological arousal in identical twins. *Journal of the American Society for Psychical Research*, 1968, 62, 73–79.

Bayless, R. *Animal Ghosts*. New York: University Books, 1970.

Bechterev, V. M. "Direct influence of a person upon the behavior of animals." *Journal of Parapsychology*, 1949, 13, 166–176.

Beloff, J., Cowles, M., and Bate, D. Autonomic reactions to emotive stimuli under sensory and extrasensory conditions of presentation. *Journal of the American Society for Psychical Research*, 1970, 64, 313–319.

Bestall, C. M. An experiment in precognition in the laboratory mouse. *Journal of Parapsychology*, 1962, 26, 269.

Braud, L. W., and Braud, W. G. Further studies of relaxation as a psi-conducive state. *Journal of the American Society for Psychical Research*, 1974, 68, 229–245.

Brenner, D., Williamson, S. J., and Kaufman, L. Visually evoked magnetic fields of the human brain. *Science*, 1975, 190, 480–482.

Broughton, R., and Millar, B. An attempted confirmation of the rodent ESP findings with positive reinforcement. In J. D. Morris, W. G. Roll, and R. L. Morris (Eds.), *Research in Parapsychology 1974*, pp. 73–75. Metuchen, N.J.: Scarecrow Press, 1975.

Bullock, T. H., and Cowles, R. B. Physiology of an infrared receptor: The facial pit of vipers. *Science*, 1952, 115, 541–543.

Cadoret, R. J. An exploratory experiment: Continuous EEG recording during clairvoyant card tests. *Journal of Parapsychology*, 1964, 28, 226.

Callahan, P. S. Insects tuned in to infrared rays. *New Scientist*, 1964, 23, 137–138.

Christopher, M. *Mediums, Mystics and the Occult*. New York: Crowell, 1975.

Cohen, D. Magnetic fields of the human body. *Physics Today*, Aug. 1975, 34–43.

Craig, J. G. The effect of contingency on precognition in the rat. In W. G. Roll, R. L. Morris, and J. D. Morris (Eds.), *Research in Parapsychology 1972*, pp. 154–156. Metuchen, N.J.: Scarecrow Press, 1973.

Craig, J. G., and Treurniet, W. Precognition in rats as a function of shock and death. In W. G. Roll, R. L. Morris, and J. D. Morris (Eds.), *Research in Parapsychology 1973*, pp. 75–78. Metuchen, N.J.: Scarecrow Press, 1974.

Dean, E. D. The plethysmograph as an indicator of ESP. *Journal of the Society for Psychical Research*, 1962, 41, 351–353.

Dean, E. D. *Proceedings of the Parapsychological Association*, 1965, 2, 22–23.

Dean, E. D. Long-distance plethysmograph telepathy with agent under water. *Proceedings of the Parapsychological Association*, 1969, 6, 41–42.

Dean, E. D., and Nash, C. B. Coincident plethysmograph results under controlled conditions. *Journal of the Society for Psychical Research*, 1967, 44, 1–13.

Dijgraaf, S. The functioning and significance of the lateral-line organs. *Biological Review*, 1963, 38, 51–105.

Dröscher, V. *The Magic of the Senses*. New York: Dutton, 1969.

Duane, T., and Behrendt, T. Extrasensory electroencephalographic induction between identical twins. *Science*, 1965, 150, 367.

Duval, P., and Montredon, E. ESP experiments with mice. *Journal of Parapsychology*, 1968, 32, 153–166. (a)

Duval, P., and Montredon, E. Further psi experiments with mice. *Journal of Parapsychology*, 1968, 32, 260. (b)

Esser, A., Etter, T. L., and Chamberlain, W. B. Preliminary report: Physiological concomitants of "communication" between isolated subjects. *International Journal of Parapsychology*, 1967, 9, 53–56.

Erickson, R. Personal communication, 1969.

Eysenck, H. J. Precognition in rats. *Journal of Parapsychology*, 1975, 39, 222–227.

Figar, S. The application of plethysmography to the objective study of so-called extrasensory perception. *Journal of the Society for Psychical Research*, 1959, 38, 162–171.

associates also noted that hamsters and gerbils were unresponsive to similar use of OB experiments.

The extensive literature of psi trailing in cats and dogs, though likewise suggestive of psi, is still amenable to rival sensory, in lieu of *extra*sensory, interpretations. So is the homing behavior of salmon, pigeons, cats, and dogs. More persuasive are the older observations on dogs, reported by Bechterev (1949) and the more recent findings by White (1964). Wood and Cadoret (1958) tested clairvoyance in a man-dog relationship by adapting the ESP card-calling technique to a dog called Chris. They found evidence of ESP in the presence of the owner.

These few representative samples of animal psi should suffice in the present context. They indicate that despite the many gaps in the available evidence, the occurrence of psi from the lowliest unicellular organisms to higher vertebrates, and especially rodents, cats, and dogs, can be taken for granted. It also appears that the observable psi responses tend to increase in complexity as we move from organisms with primitive neural structures to organisms with more highly differentiated central nervous systems. It should be noted at this point, however, that psi phenomena must not be lumped together in one single undifferentiated set of organismic functions–afferent or efferent, GESP, PK, and precognitive–as the case may be. Generically they may amount to the same thing, ranging over the whole spectrum of organic nature from plants to man. But we must realize that PK responses of paramecia differ from those of a cockroach, a hamster, or a dog, much in the same way as an apple and an appleseed differ from a full-grown specimen of an apple tree. By and large, evidence of psi-determined behavior in lower animals indicates that it may occur under the auspices of what McLean described as the archaic reptilian brain. In turn, the growing incidence of psi phenomena associated with the evolutionary increase of cortical structures would point to the part played by so-called uncommitted brain regions (Penfield, 1975) in the origin of psi functions of a higher order. Yet it is needless to say that the data of animal psi do not permit a fixed cerebral localization in any specialized brain region. Further insight into the problem has to be sought by turning our attention to additional neurophysiological and clinical observations in humans.

PHYSIOLOGICAL VARIABLES

It has always been suspected that a vast number of psi incidents, spontaneous and experimental, are taking place below the threshhold of conscious awareness. They are subliminal, preconscious, or unconscious and can only be gleaned from monitoring such variables as blood pressure, pulse rate, electromyogram, EEG, and other indices.

A typical example is Dean's (1962) plethysmographic experiments in which an emotionally charged stimulus word sent by an agent elicited measurable changes in the blood supply in the finger of a percipient. In a comparable series, Tart's (1963) telepathic percipients produced subliminal physiological changes in r sponse to mild electrical stimuli delivered to an agent.

Johnson (1974) of the University of Utrecht has studied subliminality in modification of Pötzl's tachistoscopic dream experiments. He flashed "threate ing" pictures and measured the degree to which the subject's defensivene against the microtrauma affected his performance in ESP tasks. The results bo out the hypothesis that a "good" defensive posture was conducive to psi-missin

Observations of this order appear to confirm that certain elementary forms c ESP tend to bypass conscious awareness. They are not tied to processing i higher cortical centers and point to subcortical, midbrain, or limbic regions a their substrate. Experimental psychologists described sensory perceptions c this order as subceptions. Eysenck (1961), Burt (1968), Beloff (1974), an others have specifically pointed to their relationship to perceptual defense while Dixon (1971) and Beloff emphasized the close relationship of both p phenomena and subliminal perception to the reticular formation and the brai stem. Eysenck (1967) has noted, furthermore, that a high state of arousal c the cortex mediated by the ascending reticular formation is antagonistic to psi.

The EEG is particularly suited to telepathic experiments of this kind. Duan and Behrendt (1965) succeeded in inducing electroencephalographic changes i identical twins, bypassing conscious perception. Their observations have no been replicated by others. Earlier attempts by Ehrenwald, Kahn, and Ullma along the same lines were abandoned owing to inadequacies of the available in strumentation. In their article in *Nature*, Targ and Puthoff (1974) found tha systematic alteration of ongoing electric activity can be elicited by a remo photic stimulus.

Needless to say that the exact determination of the sources of the EEG activit of the brain is still problematical. By and large, the occipital lobes have bee identified as the sources of origin of alpha rhythm in certain altered states o consciousness. EEG data concerning lateralization of visually evoked potenti have been described by neurophysiologists, but no conclusive parapsychologica findings have as yet been reported.

A striking series of EEG experiments has been reported by Lloyd (1973). Hi work has been sponsored by the New Horizons Research Foundation in Toronto The Lloyd series is aimed at duplicating, by telepathic induction, the "averag evoked EEG response" elicited by an actual auditory stimulus. It is claimed tha the results indicate a direct brain response to a telepathic message, although Lloy leaves open the question whether PK may have directly affected the monitorin equipment. We are told that T. H. Lloyd is a pseudonym, but the Editor of *New Horizons* testifies to the good faith and scientific qualifications of the author Attempts at replicating the "Lloyd effect" elsewhere were unsuccessful.

The vast literature dealing with the relationship of ESP and alpha activity, and its reinforcement by diverse biofeedback methods, is described in other section of this *Handbook*.

The Brauds (1975) have focused attention on the right versus the left hemisphere, and their relevance to facilitating psi functions. Their hypothesis that inducing mental states favoring right hemispheric dominance would be psi productive was not borne out. But the expected induction of left hemispheric dominance did lead to significant psi-missing.

Andrew (1975) applied the same procedure in reference to "active" psi, that is, psychokinesis. In this series, the right hemisphere group scored significantly above chance, and the left group showed an extrachance tendency to psi-missing. Results of assessing the activity of the two hemispheres during bilateral EEG recordings are not yet available. Whitten (1974) studied the EEG record of a gifted subject, Matthew Manning, while attempting to perform specified psychokinetic tasks. In this case, a distinct wave pattern, described as the ramp function, made its appearance.

The investigations of Broughton (1976), of the University of Edinburgh, focusing on brain hemisphere specialization, were based on the same rationale. Using an ingenious experimental paradigm to separate the two hemispheres in an ESP test, he found that improved performance could be elicited when the right hemisphere responses were encouraged while at the same time loading an additional conceptual task on the left hemisphere. He concludes that the right hemisphere of the brain is better at a receptive type of ESP.

We shall see that more light on the presumed lateralization of psi phenomena can be shed by clinical observations.

NEUROPSYCHIATRIC OBSERVATIONS

In human subjects we have to rely on the occurrence of organic pathology as a substitute for surgical removal or excision techniques used in animal experiments. The frequently cited instance of the dying serving as telepathic percipients or agents can be taken as the closest approximation to states of clinical "decerebration" or organic "minus function" (Ehrenwald, 1948) in which higher cortical functions are in abeyance. Similar considerations apply to the death defying feats of some out-of-body subjects (Ehrenwald, 1974). Telepathy in sleep, dreams, and the REM state (Ullman and Krippner, with Vaughan, 1973) points in the same direction. So do the countless reports of telepathy in trance conditions, in absent-mindedness, and in diverse altered states of consciousness.

The case of Ilga K., published by von Neureiter (1935), illustrates another facet of the problem. Ilga was a mentally defective girl of 9 with a severe reading disability. The samples of her handwriting, her general demeanor, and her photograph suggest the diagnosis of mental deficiency. Yet von Neureiter reported that the child could "read" any text if and when her mother, seated in another room, was reading the same text silently to herself. Ilga's case has been subject to some controversy. Yet the crucial point is that in this instance it was her mother's powerful motivation to compensate for her offspring's specific shortcoming that was responsible for Ilga's telepathic ability. Another point to bear in mind is that her "minus function" consisted of a specific deficit on a higher cognitive level. It was of the nature of an alexia—that is, a cortical deficiency as described by Déjérine, Pötzl and others—and was not due to a peripheral sensory impairment. A similar picture was described by Drake (1938) in a mentally defective boy, little Bo, and, more recently, by Recordon, Stratton, and Peters (1968), in England. The latter case is known as that of the Cambridge Boy. Both Little Bo and the Cambridge Boy suffered from congenital spastic paralysis and were telepathically responsive to their mothers only.

The Los Angeles school psychologist Eloise Shields (1976) has investigated the psi abilities of 25 mongoloid, 25 brain-damaged, and 25 undifferentiated mentally defective children, ages 5-21. They yielded an astronomical score of $P = .00000057$ against chance under telepathic conditions. Their performance scores under clairvoyant conditions were only slightly above chance.

Another significant experimental contribution is Schmeidler's (1952) series of ESP tests of 18 hospitalized patients suffering from cerebral concussion. The clinical picture in such cases is too ill-defined to permit any neurological diagnosis beyond the conjecture that it amounts to a combination of a diffuse organic brain syndrome with some degree of psychological overlay. Using a control group of 11 hospitalized fracture patients without cerebral injury, Schmeidler found a significantly higher scoring pattern ($P = .002$) in the concussion group.

In such cases it can be argued that the postulated organic brain damage served as one of the predisposing or conditioning factors for the emergence of psi phenomena. Yet it should also be noted that lumping together forced-choice ESP responses of the card-calling type with ESP responses focusing on major targets of higher complexity, and trying to correlate the two with a supposedly all-encompassing functional deficit, "minus function," or assorted altered states of consciousness, is apt to miss the point. We shall presently see that to bring a semblance of order into the conflicting findings that have accrued on the interface between psi phenomena and neuropathology, we will have to think up a new twist to the conventional question of how a given function is supposed to be related to a specific brain region.

The new twist proposed here is to rephrase—or turn around—the usual question about the hypothetical cerebral localization of psi phenomena. Instead of wondering what neural structures or brain region is responsible for their operation *some* of the time, we have to ask: What is it that *prevents* the organism from being flooded by the influx of both sensory and extrasensory stimuli *all* of the time? By the same token, we have to ask: What is it that puts the brake on the organism's motor or psychomotor organization, that stops it from reacting (or over-reacting) to external stimulation, that stops it from exhausting its store of psychomotor energy in the process—and from spending itself in a paroxysm of