paper Vogt remarks that all comparative psychology, as well as the newest results of anatomy, show that the sense of smell is phylogenetically the oldest, and in the lower vertebrata the most important of the senses. He finds that the fibres of the fornix longus and the fibres of the cingulum going to the gyrus subcallosus, as well as the middle band of Lancisi, belong to the olfactory tract.

PHYSIOLOGICAL PSYCHOLOGY.

By Havelock Ellis.

The Psychology of Pain.

The neurologist and alienist are constantly concerned with pain, yet the psychology of pain still remains very obscure. What precise pathological or physiological process do we think of when we admit the presence of pain? What is pain?

This is a question which has lately been discussed, with a certain amount of agreement, by Prof. Strong, of Chicago, Dr. Nichols, of Harvard, and Mr. G. W. A. Luckey (Strong, "Psychology of Pain;" Nichols, "Pain Nerves," "Psych. Review," July and September, 1895; Luckey, "Some Recent Studies of Pain," "American Journal of Psychology," October, 1895; Marshall, "Psych. Review," Nov. 1895).

The theories of pain may be divided into three groups: (1) Those which represent pain as a quality of sensation generally; (2) those which class pain as a distinct sensation with special nerves; (3) those which class pain as a certain degree of sensation, but not as an element of all sensation.

The first—including the *quale* theory, or aspect theory, as Strong calls it—is a very ancient one, and was substantially held by Aristotle; in more recent times by Wundt, Höffding, Külpe, Lehmann, Sully, Bradley, and especially Marshall, who has given the best exposition of it. It regards pain, as well as pleasure, merely as colouring, "feeling-tone," a manner of experiencing sensations and ideas. It is a great mistake, Marshall holds, to place in the class "sensation," a mental state which lacks one of the most marked characteristics of sensation in general, *i.e.*, special terminal organs. According to this view, pain can never be an isolated experience, but may belong to any element of consciousness; both pleasure and pain are "primitive qualities of psychic states," the first coming when the energy involved in reaction to a stimulus is greater than usual, the second when it is less. The pain sense of the skin is thus not really a pain sense, but an exaggeration of a sense whose normal product is, what Marshall calls, the cutting-pricking sensation. It is a seductive theory, but, as both Strong and Luckey point out, it cannot be

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carried into every field of sensation and it by no means explains all the pathological facts.

According to the second group of views, pain is felt because we possess specific pain nerves. The delicate investigations of Prof. von Frey, of Leipzig—showing by the application of fine hair points to the skin the separate existence of pain points and touch points—support this view, though Nagel, who has repeated these experiments, explains them differently. Dr. Herbert Nichols is a vigorous advocate of the existence of pain nerves, and regards the *quale* theory as a traditional metaphysical monstrosity. He considers pain nerves as developed for the purpose of responding to excessive stimulation; as a warning against violent and injurious influences, while the nerves of other senses (sight, sound, heat, etc.) cease acting when the stimulus becomes so intense as to be injurious. He argues that touch, heat, and cold fibres are each bound up with their own separate pain fibres—granting that these exist—and that the heat and the pain fibres have similar or identical end organs. It is a simple theory, with little against it, Nichols remarks. It seems, however, rather extraordinary on this theory, that remote pain nerves which have never had any exercise can suddenly come into such remarkably energetic action.

The theories of the third group—as expounded in Mr. Luckey's very useful paper—regard pain as an intense degree of certain classes of sensation. Thus Oppenheimer, of Heidelberg, who has made an extremely interesting investigation of the matter, considers that "the real cause of pain is a disturbance of tissue, in particular a chemical disturbance, whereby either there is excess of the normal products of destruction, or products arise through the influence of a foreign body," there being only one apparent exception, the induction current. According to this physiological theory of pain, the connection between the peripheral tissue and the nervous centres is through the vaso-constrictors, and numerous pathological and anatomical facts are brought forward in support of this view. For a full exposition of this theory the reader must be referred to Luckey or to Oppenheimer's own work, "Schmerz und Temperaturempfindung." It explains many phenomena admirably and deserves careful study.

Goldscheider's theory, to which Luckey inclines, belongs to the same group. He maintains that "the sensation of pain is peculiar to the pressure nerves and the nerves of common feeling, but fails in all other sense nerves. Sensations of other sense nerves may be unpleasant, but not really painful." Pain is thus rather an intensive degree of a sensation than a quality of it, and the pains of inflammation are due rather to increasing pressure than to chemical changes. As to the origin of pain in general, Goldscheider believes it to be due to a process of summation in the grey substance of the cord, and (with H. Head) that the real source of pain is in the spinal ganglion cells. This theory easily

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explains many pathological facts, for any lesion or lowering of the excitability of the cord would produce analgesia or anæsthesia. Although it is not yet possible to speak definitely, the theory of Goldscheider, as expounded in his latest work, "Ueber den Schmerz," is at least as promising as any.

Those who, like Nichols, argue in favour of pain nerves, are not so clear regarding the existence of pleasure nerves. Luckey emphasises the distinction between pain and discomfort, and argues that the real opposite of pleasure is not pain, but discomfort. This suggestion seems worth bearing in mind.

Reaction Time.

Mr. Bache (R. Meade Bache, "Psych. Review," September, 1895) thinks there is an impression abroad that a quick reaction time accompanies high intellectual development. Perhaps he is right, but there is no reason why such an impression should exist, for there is much evidence of various kinds tending to show that motor mental processes are slower in persons of high intellectual development. Mr. Bache has, however, done well to investigate the matter systematically. He has long since observed what seemed to be the greater automatic excellence of individuals of lower race as compared with those of higher race, and has now submitted the matter to experimental tests, with the aid of Prof. Lightner Witmer, of Pennsylvania University. Whites, Indians, and Africans, about twelve of each, mostly between the ages of 15 and 25, were tested as to their reactions to auditory, visual, and electric stimuli (presumably they were all males). The tables here given show that the Whites are relatively slow as compared with the Indians and Africans (one of the Whites was to all three tests about three times slower than one of the full-blooded Indians). But, contrary to Mr. Bache's expectations, the Indians are quicker than the Africans. He thinks this may be explained by (1) the effects of slavery, (2) a considerable admixture of white blood in the Africans examined, and (3) the special quickness required in Indian life.

Prof. Baldwin has recently reprinted from the "Psychological Review" a collection of studies from the Princetown Laboratory. One of these is of special interest in the present connection ("Types of Reaction"). In this he argues that Wundt and some other psychologists are not justified in concluding that there is only one normal type of reaction and that variations from this must be regarded as abnormal. He finds at least two kinds of motor reaction: (1) One, which he calls *kinæsthetic motor*, in which reaction is quicker when the eye is fixed on the hand which is to react; (2) *visual motor*, in which the reaction is quicker when the eyes are blind-folded and attention is concentrated on the thought. He seeks to explain this by reference to the well-known sensory and motor forms of aphasia, and the corresponding visual,

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auditory, and motor speech types. A man's reaction-time will show the influence of his memory type. The hand has, next to the tongue, the most complex movements to perform, and in hand movements the influence of the sensory or motor type is likely to persist. The general result, he concludes, is that "distinctions supposed to be established once for all by various researches must be considered as largely individual results, inasmuch as the authors have not reported on the type of the reagent. But, for that very reason, these results may have great value, as themselves indicating in each case this very thing, the type of one single reagent and in so far some of the general characteristics of that type. What we now desiderate in a great many departments, as, for example, in the treatment of school children, and in the diagnosis of complex mental troubles, is just some method of discovering the type of the individual in hand. If reactions vary in certain ways, according to the types which they illustrate, then in reaction experimentation we have a great objective method of study. But before the method can be called in any way complete, there should be a detailed reinvestigation of the whole question, with a view to the great distinctions of mental type already made out by pathologists."

In "Mind" (Oct., 1895), Dr. Titchener criticises Baldwin's view from the standpoint of the Leipzig school, and while admitting that the type theory is probably correct, does not consider the evidence as yet conclusive. Baldwin defends his views in a later paper ("Mind," Jan., 1896).

The Experimental Induction of Hallucinations.

It is generally admitted that processes similar to those that are normally accompanied by consciousness do sometimes take place without being accompanied by consciousness. These "parasitic states" may sometimes come to form a kind of sub-conscious dream, and in extreme cases become so highly organised as to form a true "secondary personality." With these phenomena, which have been specially studied by Janet and Binet, may be associated the phenomena of the so-called "subliminal self," *i.e.*, automatic writing, the induced phenomena of crystal-gazing, etc.

Prof. Newbold ("Experimental Induction of Automatic Processes," "Psych. Review," July, 1895) has recently been carrying on various experiments and observations which have led him, while not questioning the results obtained by so skilled and experienced an investigator as Janet, to throw doubt on the supposed sub-conscious origin of many such phenomena. The phantasms produced by crystal-gazing, for instance, are explained by those who believe in the existence of conscious states dissociated from the normal upper consciousness of the individual, as the product of sub-conscious automatism which the transparent

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medium brings to the ken of the upper consciousness. Newbold did not find this assumption necessary to explain the results obtained in twenty-two cases whom he investigated. He used a glass ball, though he found that a glass of water, or a mirror reflecting a white surface, would do as well, but the brighter the surface the better. After a few minutes the subject usually begins to see a cloud which develops into a picture, often brightly coloured. The medium, Newbold remarks, "gives the patient a vision of unfilled space, and its function appears to be simply that of an irritant to the highly organised visual mechanism." The visions are frequently drawn from the subject's recent experience, but are often unrecognised. Like most hallucinations they are independent of the ideas in consciousness and seldom affected by suggestion in the waking state, though readily amenable to hypnotic suggestion. Newbold sees no reason to suppose that we have here brought to view a permanent independent sub-conscious realm existing in every person. We seem usually to be dealing with a mere temporary creation, formed of more or less dissociated mental elements to which we have "set the switches." In a similar way Newbold explains the auditory hallucinations sometimes produced by a continuous but indeterminate stimulus, such as running water, or a sea-shell, or chronic inflammation of the inner ear. He is also convinced that automatic writing is in many cases produced similarly by an indeterminate stimulus to the highly organised writing mechanism, and is essentially a pure motor phenomenon. In this connection he brings forward an interesting case which he was able to watch from its earliest development. The patient was an educated man with some knowledge of psychology, and had been dabbling in spiritualistic experiments. While sitting with friends round a table, waiting to see if levitation of the table could be obtained, he felt a strange motor disturbance, first in the left, then in the right arm and hand. Paper was procured and a pencil, with which the hand pounded away without producing anything legible. Subsequently the hand learned to write, the communications professing to come from the patient's deceased friends, a claim readily disproved to the patient's satisfaction. He could always control the hand, though it seemed to be moved by a power not his own. The thoughts were very like his own, but were not consciously furnished by him. Sometimes he knew what was coming, sometimes not. The patient was naturally alarmed, especially when the contracture of arm which preceded the writing began to appear very frequently and to spread to the muscles of the other arm, the legs, and finally the face, producing a general motor hysteria. It seemed to him that he was struggling, like the possessed of old, with a secondary personality which was striving to over-master his upper self. Newbold would himself have accepted this theory had he first seen the patient at this stage. But careful analysis

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of the case, as he shows, makes this interpretation erroneous. The original invasion was probably a fatigue convulsion, due to the hands having been long outstretched on the table, such as frequently occurs (though not usually so violently) under similar conditions. The continuous but indeterminate stimulus applied to the centres produces in time a reflex response. The automatic contractions were turned in the direction of spirit-writing, simply because the subject's thoughts had been turned in that direction, and the whole process was furthered by auto-suggestion. It is noteworthy that the hand never wrote intelligibly when the subject refused to attend to the writing. Newbold does not attempt to explain the progressive central disorganisation, but it was primarily motor, and a few days' rest with antispasmodic treatment put an end to it, and all spontaneous symptoms disappeared. The case is an instructive one, and the paper altogether is suggestive in its interpretation of a large group of psychic phenomena.

The Mental and Physical Development of Children.

The precise influence of puberty on development is a matter of considerable practical importance concerning which our ignorance is still great. Dr. J. A. Gilbert has recently carried on an investigation into this matter which is of considerable value. (Studies from the "Yale Psychological Laboratory," Vol. ii., 1894.) He worked in Dr. Scripture's laboratory, taking children, boys and girls, from 6 to 17, one hundred at each age. His paper is elaborate and illustrated by some thirty charts. Among the tests chosen were muscle-sense, sensitiveness to colour-differences, force of suggestion, reaction time, voluntary motor ability, and fatigue. It is impossible to summarise his results here, but a few points may be mentioned.

In voluntary motor ability there is considerable falling off both in boys and girls from 12 to 13 (though throughout boys show a higher rate than girls). The boys regain their lost footing at 13, the girls not till 14. Gilbert considers that this contradicts the statement of Burnham that at puberty there is a great increase of vitality and energy as also greater mental activity, the former being undoubtedly true but the latter very doubtful. His curves seem to justify the opinion of Lange that physical development absorbs the strength and retards mental development. But, however that may be, the children under all his tests laboured under some disadvantage at about 13. He also finds a marked turn in a child's life at 7. In voluntary movement, boys tire more quickly than girls, but not more easily; *i.e.*, the girl's movements, though much slower, are somewhat more sustained.

Gilbert is not able to agree with Porter that the brighter the child the taller he is. Porter decided brightness by mere examination tests. Gilbert found no such relation when a wider basis

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of ability is adopted. He found that reaction time, however, is quicker in bright than in dull children, and throughout quicker in boys than in girls. The significance of this fact, if it is a fact, cannot be hastily assumed, and observers are by no means agreed. Boys are, throughout the tests, shown on the whole as superior to girls. In discrimination of colour-differences alone, girls have a slight advantage. At the age of 11 all children are on the average of about equal ability. Puberty has little disturbing influence in the development of discrimination in colour differences, but a great disturbing influence in tests involving quickness and accuracy of action. Hence, Gilbert concludes, puberty has a greater influence on the mental than on the physical development, and this is more noticeable in girls than in boys.

The Education of Muscular Control.

In the same volume of studies we find a record of some interesting experiments by Dr. Scripture, Miss T. L. Smith, and Miss E. M. Brown to ascertain the influence of practice in increasing steadiness of movement. The experiment consisted in inserting a needle into a twist drill gauge without touching the sides of the hole, any such contact being counted as an error. The results, which have some significance as regards the education of the defective classes, may here be simply recorded:—(1) Steadiness of movement may be increased by practice. (2) This increase is not limited to the control of the muscles immediately trained, but affects the muscles on the opposite side of the body also; practising the right hand develops the left also. (3) This training seems to be of a psychical rather than of a physical order and to be principally in the acquisition of steadiness of attention.

I may refer here to an interesting investigation by Mr. J. A. Hancock, of Clark University, into motor ability in children, which has led to allied results ("Pedagogical Seminary," Vol. iii., No. 1, 1894). Mr. Hancock studied a considerable number of children between the ages of five and seven in the schools at Worcester, Mass. He found that 110 children were steadier with the eyes open than closed; 48 were steadier with the eyes closed; in two there was no difference. The ataxiagraph was used. Although as children are shorter they ought to sway much less than adults, the reverse is the case. The girls are steadier than the boys (attributed to the earlier maturity of girls). Hancock found that it was impossible, however much persuasion was used, to make children hold their attention to the index finger for more than half a minute, and he points out the close connection between muscular control and attention. Sturgis's test for choreic tendencies showed that but half of 150 children tested were free from them; this he considers a point of great interest and importance. It was also found that 38 out of 150 when walking with closed eyes dragged their feet or kept them far apart. There is a general lack of con-

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trol, especially over the smaller muscles, and efforts to keep quiet produce strong symptoms of nervous irritation, the inhibition being imperfect and resulting in awkward swayings and twitchings. "Children in normal healthy growth show a lack of co-ordination and control, paralleled only by ataxic, choreic, and paralytic patients."

The Theory of Emotion.

The clear understanding of emotion is of such great importance in psychological, and especially psychiatric work that attention may be drawn to two able articles under the above title by Prof. Dewey, of Chicago University ("Psychological Review," Nov. and Jan., 1894-5). Prof. Dewey defends and expands the James-Lange theory of emotion, combining it to some extent with Darwin's view of emotion. He argues that the so-called "expression of emotion" must be accounted for by reference to movements having some use, either as direct survivals or as disturbances of teleological co-ordinations. He shows that many of the facts are utterly inexplicable on the central theory, and can only be explained on the (James-Lange) discharge theory. This point of view means that, for instance, the mere *act of seeing* a bear sets up certain other acts in us, by habit, whether inherited or acquired. "If every emotional attitude is referred to useful acts, and if the emotion is not the reflex of such acts, where does it come in, and what is its relation to the attitude?" The discharge theory "does for the emotions precisely what the theory of evolution does in biology," involving an entirely new classification; and he hangs on the theory to the old Platonic and Aristotelian idea that feeling is the internalising of activity or will, and finds a crude anticipation of James in Hegel. To sum up: "Certain movements, formerly useful in themselves, become reduced to tendencies to action, to attitudes. As such they serve, when instinctively aroused into action, as means for realising ends. But so far as there is difficulty in adjusting the organic activity represented by the attitude with that which stands for the idea or end, there is temporary struggle and partial inhibition. This is reported as *affect*, or emotional seizure. Let the co-ordination be effected in one act, instead of in a successive series of mutually exclusive stimuli, and we have interest. Let such co-ordination become thoroughly habitual and hereditary, and we have *Gefühlston* [affective tone]."

Psychological Apparatus.

Messrs. Elmer G. Willyoung and Co., of Philadelphia, U.S.A., have lately issued an illustrated catalogue of psychological instruments, which may be commended to scientific students of psychiatry. The catalogue runs to fifty pages, and describes several hundred pieces of apparatus. They have mostly been devised by well-known American teachers of psychology, such as Profs. San-

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ford, Münsterberg, and Jastrow, more especially Dr. Scripture, who is responsible for a very large number of instruments here included. Among these I may mention apparatus to illustrate the fundamental phenomena of reaction time, vision, taste, smell, etc.; a steadiness gauge to measure accuracy; a device for recording steadiness of tongue; a hypnotism apparatus for inducing the hypnotic state by strain of the eye-muscles; audiameters, dynamometers, æsthesiometers, etc.

The various instruments devised for use in the psychological laboratory by Prof. Jastrow can now be obtained from the Garden City Model Works, Chicago. They are mostly simple and practical in character, and moderate in price. They include æsthesiometers, pressure attachments (for determining the pressure-sense of the skin), test weights, speech key (for giving verbal stimuli and making verbal reactions), temperature apparatus (for testing temperature sense), memory apparatus, and the automatograph. There are also various reaction instruments, including a very simple reaction key by means of which a slight contact ensures the opening or closing of a circuit by simply touching, preventing the frequent loss of readings of the chronoscope due to failure of the subject to maintain the contact. Catalogues and particulars may be obtained from the Garden City Model Works, 124, Clark Street, Chicago, Ill., U.S.A.

ASYLUM REPORTS.

English County and Borough Asylums.

Hants.—This asylum is so overcrowded that eighteen patients sleep in the Medical Superintendent's house. Relief will soon be gained by the opening of the idiot blocks, and later on by the removal of the Isle of Wight patients to an asylum building for the island. Typhoid fever has appeared under indefinite circumstances—that is to say, cases have appeared at intervals, some in new and some in old buildings. They were all on the female side. The water, drains, and milk are above suspicion. The Commissioners remark, *inter alia*, that the warm air supplied to the wards is possibly open to contamination. The air inlet gratings are level with the ground, and the chambers beneath are lined with absorbent bricks, which may derive from the adjacent soil whatever it contains, and communicate it to the air passing over them. Whether this fact has any bearing on the cases or not, it is quite worth noting. In many of the dormitories the cubic space has been reduced by overcrowding to 350 feet per patient. This will probably account for a somewhat high death-rate from phthisis.

Kent. County.—The chief feature of that portion of the report which deals with Barming Heath is the battle royal between the

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