tastes and aptitudes. In the biographies of great men it often appears that escape from their early environment was their only means of finding self-expression for their inherited mental qualities.

From the point of view I am expressing, mental inheritance is just as real as physical inheritance, and a suitable mental environment is just as necessary for the development of mental characters as a suitable physical environment is for the development of physical characters. Further, the mental environment is extremely complex and intimate in the way it impinges upon the developing individual. One of the remarkable things about organisms, however, is the stability they often show under altered conditions of development, and this appears to be as true of mental as of physical characters. Mental tests apparently show that inherent intelligence, for example, does not develop or grow with the growth of the individual.

Another method by which mental inheritance has been studied is by the comparison of the mentality of identical twins. Galton, the pioneer in this field, cites many remarkable cases of such similarity, in some of which the twins were separated. More recently, many cases have been studied in some of which the separation took place at an early age, making it possible to study the effects of differences in upbringing upon the mental development and the innate abilities. While the mental environment is by no means negligible, and is often profound in its effects on the early development of the mentality, yet it seems clear that innate, *i.e.* inherited, differences persist, which are little if at all affected by the circumstances of life.

There is another matter which, I believe, adds greatly to the complexity of human behaviour. In 1923 I first suggested that when the individual is germinally heterozygous for a pair of contrasted character traits, they may both come into expression in his activities at different times. Indeed, this appears more likely than that there should be complete dominance of a mental character over its allelomorph. I am now looking upon traits of character as different methods of reacting in given circumstances. Since every one is doubtless heterozygous for many such character differences, this would help to account for some of the complexities as well as inconsistencies in human behaviour. Cases of multiple personality are possibly to be explained as more extreme examples of the same kind.

Finally, I should like to reiterate that what is most required now in the study of mental inheritance is an analysis of the mind by psychologists from an inheritance point of view. Psychologists have been so engrossed with the mind as such in its manifold activities that they appear to have neglected the kind of comparative psychology of individuals which is necessary for this purpose.

The Relation between Velocity of Wind and Wave.

By Dr. VAUGHAN CORNISH.

MANY years ago an investigation was begun by me to determine the relative velocity of wind and wave in deep water when the former has operated for a sufficient time to produce a constant condition, and with sufficient sea-room. The results are given in the *Quarterly Journal of the Royal Meteorological Society* for April last, and, at the invitation of the Editor of NATURE, some of the points of interest are brought together in this article.

The relation between velocity and period of deep-sea waves given by the ordinary formula for waves of infinitesimal height, namely, velocity in statute miles per hour = period in seconds multiplied by 3·493 agrees with that observed for ocean waves of conspicuous dimensions [1] sufficiently for the discussion of phenomena so numerous and irregular.

By timing the rise and fall of spots of spent foam upon the water, it is possible to determine from on board ship the period of both the wind-waves and of swell running at the time, whether crossing or concurrent. Employing this method I have never recorded waves with a speed greater than that of the wind, as has been done by other observers, an anomalous result which I attribute to mistaking a heavy swell for the wave when they are concurrent. Observations on a river at turn of tide, when the foam-spots were carried by the current first down-wind and then up-wind, have shown that their wind-drift is small relatively to the other magnitudes concerned.[2]

[1] See the author in *Jour. Roy. Soc. Arts*, Nov. 1, 1912, "Ocean Waves," and the *Field*, Feb. 13 and 27, 1915, "The Measurement of Waves at Sea."
[2] See papers by the author, British Association Report, Section A, Birmingham meeting, 1913, "On a Simple Method of Determining the Period of Waves at Sea," and *Q. J. Roy. Met. Soc.*, Apr. 1926, "Observations of Wind, Wave and Swell on the North Atlantic Ocean."

In the course of a voyage between Trinidad and Ushant, in very deep water all the time and free from considerable currents on every day but one, the speed of the waves was compared with the average speed maintained by the wind *for one hour or more*, as recorded by a Robinson anemometer fully exposed upon the bridge. When there was no crossing swell to interfere with the development of the waves, their speed was only 1·85 statute miles per hour less than that of wind, which had a sustained average velocity of 20 miles per hour. Thus there was blowing over the wave-crests only a 'light air,' the 'force 1' of Beaufort's scale, sufficient to drift the smoke issuing from a chimney but not strong enough to give direction to a wind-vane.

When hove-to in the Bay of Biscay in the storm of December 21, 1911, I determined the speed of the waves as 47·15 miles per hour, when the velocity of the wind, according to the logged Beaufort number, was 52·5 m.p.h. During the exceptionally stormy winter of 1898–99, when I was living within sight of the beach of Bournemouth Bay, the greatest period of a long-sustained series of breakers was 19 seconds, corresponding to a speed in deep water of 66·4 m.p.h. This was recorded on the afternoon of December 29. Gales in the North Atlantic from December 25 to December 29 were logged at 11 and 12 of Beaufort's scale, which correspond to wind velocity of 68 and greater than 75 miles per hour respectively. The greatest wind velocity on land during this winter, as recorded by instruments, was 70-76 miles per hour sustained for one hour.

The breakers above referred to, which were 139 in number and occupied three-quarters of an hour in arrival, were preceded in the morning by five groups of a few breakers with longer period, corresponding to a deep-water speed of 69·5 m.p.h. The interval between the beginning of the first and the end of the last was 52 minutes, which strongly suggests that they were waves from the squall-struck portions of the stormy sea which outran their neighbours. The time occupied in arrival by the individual groups was from 1 to 2 minutes, which is normal for the duration of a short squall. The figures so far given suggest that the maximum speed of waves is somewhere about $\frac{8}{10}$ths that of the wind as maintained for one hour, and that a squall lasting for a minute or two can speed-up waves which have already been developed. Once when the waves were flattening down in a dying storm in the North Atlantic, I actually saw a travelling squall increase by some feet the height of the few waves subject to its force.

The observations during the fine-weather voyage on which an anemometer was used provide important evidence of the effect of crossing swell in hampering the development of waves by wind. The restriction of height was palpable to the eye. The restriction of speed was measured. With no swell, or with a concurrent swell, as in the Trades, the speed of the wave was only 1·85 m.p.h. less than that of the wind, but with a swell following obliquely the difference was 3·725 m.p.h., and when crossing at right angles or meeting the waves, 7·2 miles per hour.

A result of practical importance to seamen and meteorologists emerged from the observations on days of crossing swell. When this was oblique to the waves the curl, or break, on the water was considerably deflected and therefore ceased to be a trustworthy indication of the direction of the wind.

The following explanation is suggested of the effect of swell to hinder the wave-making action of wind. When there is no swell and the waves have attained considerable steepness a series of travelling eddies is established in the adjacent air with permanent undulations above, and this arrangement nurses the waves. If, however, a swell be also running, the pattern of the inequalities changes all the time, continually deforming the superimposed air, and making its action irregular. If the swell meet the waves, the pattern undergoes rapid change, and the rhythmic action of the wind is greatly hindered; if it follow the waves their pattern changes slowly and the rhythmic action of the wind is less impaired. When the swell cuts squarely across the waves the surface is patterned in cups and cupolas instead of ridges and furrows, which tends to set up air-whirls with vertical instead of horizontal axis, a condition which imposes an additional hindrance to wave-making.

The extent to which swell kept down the waves when crossing obliquely or squarely suggests that the rapid rise of waves on large lakes is not solely due to peculiarities of local winds but is aided by the fact that no residual swell hampers the action of the wind, as usually happens when it comes on to blow at sea. There is one condition at sea, however, when the development of waves is more rapid than in lakes, namely, when it comes on to blow in the direction of the swell already running and with a speed greater than that of the swell. This was the condition which so quickly created the huge regular waves of December 21, 1911, in the Bay of Biscay.

OBSERVATIONS BETWEEN TRINIDAD AND USHANT.

(Speed of wind as maintained for about one hour measured by Robinson anemometer.)

DIFFERENCES OF SPEED BETWEEN WIND AND WAVE, GROUPED ACCORDING TO DIRECTION OF SWELL.

Direction of swell.	Character of swell.	Date of observation (1914).	Amount by which speed of wind exceeded that of wave.	Average difference of speed in statute miles per hour.
Concurrent with waves	High, quick period, slow progression	Feb. 18 ,, 19	1·2 2·5	1·85
	Quick period, slow progression	,, 20 ,, 21	3·9 3·3	3·725
Following the waves obliquely	Slow period, quick progression	,, 28 (P.M.) Mar. 1	3·3 4·4	
One concurrent, one at right angles	That at right angles very slight	Feb. 23	3·1	3·1
One following obliquely, one at right angles	That at right angles very slight	,, 22	6·3	6·3
Swell at right angles, or meeting obliquely	High, with slow period and swift progression	,, 26 ,, 27 ,, 28 (A.M.)	6·0 7·7 7·9	7·2

Mars in 1926.

By Dr. W. H. STEAVENSON.

THE present apparition of Mars is, for observers in the northern hemisphere, the most favourable that has occurred for many years. The planet, which was at opposition on November 4, made its closest approach to the earth on October 27, on which date its distance was approximately 42,600,000 miles and its apparent diameter 20″·4. On August 22, 1924, the distance was 8,000,000 miles less and the apparent diameter so great as 25″·1 (practically the maximum possible), but on this date the planet, at its greatest altitude, was not more than 21° above the horizon of London; whereas, on October 27, 1926, it crossed the meridian at an altitude of 53°. This increase of 32° was more than sufficient to make up for the shrinkage in apparent diameter, with the result that observers in Great Britain have, in general, been able to obtain more satisfactory views than at the closer approach of two years ago. Not until 1941 will there occur an equally favourable combination of altitude and apparent diameter.

In 1926, as in 1924, it is the southern hemisphere of Mars that is presented most favourably for observation, and this always happens at close oppositions of the planet. The Martian season at the time of opposition was not, however, quite the same on each occasion. In 1924 the planet was most favourably placed for observation during the early summer of its southern hemisphere, whereas in 1926 the summer solstice of this hemisphere occurred more than two months before opposition, so that we have a satisfactory seasonal overlap in the observations made in the two years.

The results of this overlap have been very evident