

namely, that close investigation will reveal very characteristic differences in the action of different heterochromatic segments in the same species, and between species. It is perhaps due to the fact that so much use has been made of *Drosophila* for the investigation of heterochromatin that this possibility has been overlooked (but see Demerec<sup>27</sup>).

This brings us to speculate upon the origin of heterochromatin. It is implicit in the view expressed here that a heterochromatic segment should arise every time that a minute euchromatic region undergoes repeated reduplications in the genotype and the replicas remain adjacent to each other on the chromosome. Models of some such process are known, and there is every reason to believe that, once a first replica has become established, the mechanical and genetical possibilities of its being repeated are enhanced. The finding by Harland<sup>21</sup> that the same function may be performed in one species by a single gene and in a related species by many is perhaps an example of the genetical consequences of this process. There is, thus, plenty of scope for new heterochromatic blocks to be formed, for old ones to be eliminated, and for variations in size. Furthermore, inversions and other appropriate structural changes may break up an originally compact heterochromatic segment into many small ones interspersed among euchromatin (cf. Kaufmann<sup>22</sup>). Natural selection and accidental variation seem to have a number of possibilities here.

As stressed by Wharton<sup>23</sup> and by White<sup>24</sup>, among others, heterochromatin certainly plays an important part in speciation. This part stands out in terms of Mather's<sup>25</sup> theory of polygenic variation. Mather has studied the function of linkage between 'polygenes' (definable perhaps as genes existing in repeated replicas in the genotype) as a basis on which the evolutionary plasticity of a species is founded; he has now reached the conclusion that heterochromatin is made up of polygenes<sup>25</sup>. We see that the formation of new heterochromatic segments, their loss or dispersion and their variation, by the process adumbrated above, are all mechanisms whereby polygenes may arise and linkage between them may be created and varied.

<sup>1</sup> Stedman, E., and Stedman, E., *NATURE*, **152**, 267 (1943).

<sup>2</sup> Darlington, C. D., *NATURE*, **149**, 66 (1942).

<sup>3</sup> Darlington, C. D., and La Cour, L., *J. Genet.*, **40**, 185 (1940).

<sup>4</sup> White, M. J. D., *J. Genet.*, **40**, 67 (1940).

<sup>5</sup> Callan, H. G., *Proc. Roy. Soc.*, B, **130**, 324 (1941).

<sup>6</sup> Pontecorvo, G., *Proc. Roy. Soc. Edin.*, B, **62**, 32 (1943).

<sup>7</sup> Muller, H. J., and Painter, T. S., *Z. indukt. Abst.-u. Vererb. Lehre*, **62**, 316 (1932).

<sup>8</sup> Heitz, E., *Z. indukt. Abst.-u. Vererb. Lehre*, **70**, 402 (1935).

<sup>9</sup> Summary in: Caspersson, T., and Santesson, L., *Acta Radiol.*, **64**, 105 (1942).

<sup>10</sup> Painter, T. S., *Cold Spring Harbor Symp. Quant. Biol.*, **9**, 47 (1941).

<sup>11</sup> Darlington, C. D., and Thomas, P. T., *Proc. Roy. Soc.*, B, **130**, 127 (1941).

<sup>12</sup> Darlington, C. D., and Upcott, M. B., *J. Genet.*, **41**, 275 (1941).

<sup>13</sup> Slack, H. D., *Chromosoma*, **1**, 104 (1939).

<sup>14</sup> Mather, K., *NATURE*, **151**, 68 (1943).

<sup>15</sup> Mather, K., *Proc. Roy. Soc.*, B, (1944) (in the Press).

<sup>16</sup> Bauer, H., *Proc. Nat. Acad. Sci.*, **22**, 216 (1936).

<sup>17</sup> Prokovjeva, A., *C.R. Acad. Sci. U.S.S.R.*, **2**, 499 (1935).

<sup>18</sup> Muller, H. J., "The New Systematics" (edit. J. Huxley), 185 (Oxford, 1940).

<sup>19</sup> Summary in: Schultz, J., *Proc. 7th Int. Cong. Genet.*, 257 (1939), and *Cold Spring Harbor Symp. Quant. Biol.*, **9**, 55 (1941).

<sup>20</sup> Koller, P. C., *NATURE*, **151**, 244 (1943).

<sup>21</sup> Summary in: Harland, S. C., *Proc. 7th Int. Cong. Genet.*, 138 (1939).

<sup>22</sup> Kaufmann, B. P., *Proc. Nat. Acad. Sci.*, **25**, 571 (1939).

<sup>23</sup> Wharton, L. T., *Univ. Texas Pub.*, **4313**, 282 (1943).

<sup>24</sup> White, M. J. D., *NATURE*, **152**, 536 (1943).

<sup>25</sup> Mather, K., *Biol. Rev.*, **18**, 32 (1942).

<sup>26</sup> Darlington, C. D., *J. Genet.*, **39**, 101 (1939).

<sup>27</sup> Demerec, M., *Genetics*, **25**, 618 (1940).

## WORDSWORTH AND SCIENCE

By DR. V. B. WIGGLESWORTH, F.R.S.

To the solid ground  
Of nature trusts the Mind that builds for aye ;  
Convinced that there, there only, she can lay  
Secure foundations.

FOR seventy-five years the first lines of this quotation have appeared on the cover of *NATURE*. For long enough the quotation was inaccurate; not until 1929 and 1934 were the errors brought to the notice of the Editor and put right. When the lines first appeared in this setting, Wordsworth had been dead for nearly twenty years. Had he been alive he could scarcely have approved the use to which his words were put. To the scientific reader of *NATURE* (after he has permitted himself perhaps a fleeting smile at the *double entendre*) the words may well convey a sentiment gratifying to his self-esteem. But there is little in the sonnet from which they are taken to justify that feeling, and less in Wordsworth's writings as a whole.

In a moment of enthusiasm in 1833, writing of "Steamboats, Viaducts and Railways", Wordsworth cries :

Nature doth embrace  
Her lawful offspring in Man's art ; and Time,  
Pleased with your triumphs o'er his brother Space,  
Accepts from your bold hands the proffered crown  
Of hope . . .

By 1844, when the railway threatens Kendal and Windermere, the tone has changed :

Is then no nook of English ground secure  
From rash assault ?

He "scorns a false utilitarian lure".

But it is Wordsworth's abstract reflections on science, when writing at the height of his powers, that we shall take more seriously. His attitude to science is almost uniformly hostile. "All heaven-born instincts shun the touch of vulgar sense." In 1806 he writes of the "Star-gazers", the public in Leicester Square who, for the price of one penny, are permitted to glimpse the heavens through a telescope. It is a parable on the ultimate dissatisfaction of those who "pry and pore". The same feelings about science find their most unbridled expression in "A Poet's Epitaph" (1799), where men of many sorts in turn approach the poet's grave. The man of science is greeted thus :

Physician art thou ?—one, all eyes,  
Philosopher ! a fingering slave,  
One that would peep and botanise  
Upon his mother's grave ?

He is besought to take his "ever-dwindling soul, away !"

A more considered variant on this recurrent theme is to be found in Book IV of "The Excursion" (1810-20). Shall those "ambitious spirits" who "have solved the elements, or analysed the thinking principle . . . prove a degraded Race ?"—"Oh ! there is laughter at their work in heaven !"

. . . go, demand  
Of mighty Nature, if 'twas ever meant  
That we should pry far off yet be unraised ;  
That we should pore, and dwindle as we pore,

Viewing all objects unremittingly  
In disconnection dead and spiritless ;  
And still dividing, and dividing still,  
Break down all grandeur . . .

. . . And if indeed there be  
An all-pervading Spirit, upon whom  
Our dark foundations rest, could he design  
That this magnificent effect of power,  
The earth we tread, the sky that we behold  
By day, and all the pomp which night reveals ;  
That these—and that superior mystery  
Our vital frame, so fearfully devised,  
And the dread soul within it—should exist  
Only to be examined, pondered, searched,  
Probed, vexed, and criticised ?

His spirit revolts at the ways of men of science, who  
prize the human soul and the transcendent universe

No more than as a mirror that reflects  
To proud Self-love her own intelligence.

In one passage only, of which I am aware, and that  
still later in "The Excursion", does Wordsworth admit  
that science may find "its most noble use . . . in  
furnishing clear guidance to the mind's *excursive*  
power" and "then, and only then, be worthy of her  
name" :

For then her heart shall kindle ; her dull eye,  
Dull and inanimate, no more shall hang  
Chained to its object in brute slavery.

Ought we then :

To reinstate wild Fancy, would we hide  
Truths whose thick veil Science has drawn aside ?

No ! No matter how high we rate "the thirst that  
wrought man's fall" . . . "the universe is infinitely  
wide" and reason will ever meet "some new wall or  
gulf of mystery" which nothing but "Imaginative  
Faith" can overleap.

The fact is that Nature for Wordsworth has so  
deep a meaning.

The sounding cataract

Haunted me like a passion : the tall rock,  
The mountain, and the deep and gloomy wood,  
Their colours and their forms, were then to me  
An appetite.

Perhaps that is as far as most votaries of Nature get.  
But in these lines Wordsworth, "so long a worshipper  
of Nature" (and if Wordsworth says "worshipper"  
he means it) is looking back to his "thoughtless  
youth" before he had learned to hear in Nature  
"the still sad music of humanity" and had gained  
"a sense sublime of something far more deeply  
interfused . . .", the "soul of all my moral being".  
Indeed, he goes on almost to reproach his sister that  
"in the shooting lights" of her "wild eyes" he can  
read only those more superficial joys. She lacked as  
yet :

. . . the spirit of religious love  
In which I walked with Nature.

It is true that, for a time, depressed and bewildered  
by the excesses of the Revolution in France and the  
reactions it provoked, he "turned to abstract science"  
and there sought

Work for the reasoning faculty enthroned  
Where the disturbances of space and time,  
. . . find no admission.

But he was soon recalled by Dorothy and "preserved  
a Poet" to "seek beneath that name alone" his  
"office upon earth" and to derive "genuine know-  
ledge" from "sweet counsels between head and heart".

Such is a fair picture of Wordsworth's view of  
science. Whether the poet would have deemed it an  
act of piety to con and sift his writings in this way,  
to the sorry detriment of his grand use of words, is  
open to doubt. He might well have cried :

Our meddling intellect  
Mis-shapes the beauteous forms of things :—  
We murder to dissect.

To-day, when physics ends in the mists of mystic-  
ism, it may be that science might claim kinship with  
Wordsworth the poet. But science now claims all  
society as her province, and Wordsworth the prophet  
and reformer would fit less awkwardly into the pages  
of NATURE. The Wordsworth who, standing at the  
threshold of the Industrial Revolution, with a mind  
not warped by politics, can compare with truly  
scientific objectivity, though with all a poet's feeling,  
the evil of the factory child with the grinding penury  
of rural England and the ignorance and degradation  
of the children on the land. The Wordsworth who  
can describe the factories wherein "little children,  
boys and girls" enter and

where is offered up  
To Gain, the master idol of the realm,  
Perpetual sacrifice,

and who can yet rejoice

(Measuring the force of those gigantic powers  
That, by the thinking mind, have been compelled  
To serve the will of feeble-bodied Man)

in the conviction that late or soon man will learn  
that "physical science is unable to support itself"  
and that

. . . all true glory rests,  
All praise, all safety, and all happiness  
Upon the moral law.

The Wordsworth who, surveying all these evils  
present and to come, finds a solution and a hope  
(this in 1810) in "a System of National Education  
established universally by Government" and urges  
that such a system be begun at once even "when  
oppression, like the Egyptian plague of darkness" is  
"stretched o'er guilty Europe". For then

Change wide, and deep, and silently performed,  
This Land shall witness.

## OBITUARIES

Mr. J. Reid Moir, F.R.S.

I FIRST met Reid Moir so long ago as 1911. Rumours  
had been flying about that it had been demonstrated  
without cavil that the Garden of Eden had been close  
to Ipswich, that mankind's birthday had been thrown  
back millions of years, that the 'missing link' had  
been at last found ; that all these startling new dis-  
coveries were the result of a Mr. Moir's finds in a  
gravel pit near Ipswich. The facts were that Moir,  
in business in Ipswich, instead of playing golf in his  
spare time, spent all his leisure in the gravel pits  
near his home in the hope of discovering the relics of