

## Kinetic Theory of Gases

ON page 300 of the second edition of Maxwell's excellent little text-book on the "Theory of Heat," it is stated, as a result of the kinetic theory of gases therein set forth, that "gravity produces no effect in making the bottom of the column" (of gas) "hotter or colder than the top."

I cannot see how this result follows from the kinetic theory of gases. On the contrary, it seems obvious that thermal equilibrium can only subsist according to the kinetic theory, where the molecules encounter each other with equal average amounts of *work* or *vis viva*, and in order that this may be the case, the velocity of the molecules (and consequent temperature) of any upper layer must be less than that of the molecules in the layer next below; since, in order to encounter each other, the former must descend, and acquire velocity, while the latter must ascend and lose it. This would establish a diminution of temperature from the bottom to the top of a column of air at the rate (in the absence of any counteracting cause) of  $1^{\circ}$  F. for 113 ft. of height, as can easily be verified from the fact that on account of the specific heat of air 1 lb. requires 183 foot-pounds to raise its temperature  $1^{\circ}$  F. Radiation may diminish this and tend to produce equilibrium, but nevertheless it seems obvious from these two opposing tendencies a residual inequality of thermal condition would result, and that the top of a column would be cooler than the bottom. That this would be the case if the air were in general motion in the form of upward and downward currents, will not, I presume, be disputed; and surely molecular is on the same footing. If the particles of air are moving in every direction with great absolute velocity, in what respect does this differ from air currents? In fact, all the particles which at any epoch of time are moving in any given direction constitute an air-current in that direction, mingled, it is true, with currents in other directions, but moving with accelerated velocity if descending, and with retarded velocity if ascending, and thus always tending to produce a diminution of temperature with height as a condition of gaseous thermal equilibrium.

J. GUTHRIE

Graaf Reinett, Cape Colony, April 2

## Kerguelen Cabbage

I WOULD like to know, through your paper, whether the naturalists of the *Challenger* have orders to attempt to collect the seeds of the Kerguelen Land cabbage (*Pringlea antiscorbutica*). It has often occurred to me that the attempt ought to be made to introduce this plant on the seashores of Northern Europe and America.

JOHN R. JONES

Milwaukee, Wisconsin, U.S. April 14

## Yorkshire Terrier Story

THE anecdote of the instinct of dogs given in the number of NATURE, May 1, p. 6, is identical with one to be found in Bewick's "History of Quadrupeds," p. 367, 1800, which he calls the well-known story of the "Dog at St. Alban's."

The same story precisely, with some dramatic embellishments and names, occurs in "Bingley's Animal Biography," vol. 1, p. 223.

Dorking

## BICHROMATE PHOTOGRAPHS

A SINGULAR discovery has recently been made touching the action of light upon substances rendered sensitive by the bichromates of potash and ammonia, which threatens to revolutionise photographic printing altogether, at any rate so far as the production of permanent prints is concerned. The printing by means of silver salts in the ordinary way, which is still in vogue with nearly all portrait photographers, will always find application, by reason of the simplicity of the manipulations and the delicate and pleasing nature of the results, albeit all silver photographs enjoy the unenviable notoriety of being perishable. First of all, they lose their pristine brilliancy and freshness, then a sickly yellowness gives place to the glossy whites of the picture, and finally the deep bronze shadows become of a flat brownish tint,

which grows weaker and weaker as time goes on. To secure permanent photographs, which shall possess all the beauty and detail exhibited by silver prints, has been for many years the aim of photographic experimenters, and it was not until Swan and Johnson had contributed their well-known improvements that the production of a delicate photograph in permanent pigments became at all possible. Mechanical photographic processes, where the pictures are printed off in a press, are still beset with many difficulties of a practical nature, the most perfect of them—Woodburytype—requiring further elaboration before perfect prints of large dimensions can be secured.

Pigment photographs, or carbon prints, as they are generally termed, require three elements for their production—a pigment (such as Indian-ink, lamp-black, or some such substance), gelatine, and bichromate of potash, or ammonia. A compound of these three substances is spread upon paper, and termed pigment or carbon tissue. This tissue is printed under a transparent negative in the sun, the light acting more or less energetically upon the sensitive pigment, and rendering it insoluble in parts, so that when it is immersed subsequently in warm water certain portions refuse to wash away, and these form the image; during the exposure of the tissue to light, these parts have in fact become fixed by its action. This, as we all know, is what takes place in the formation of a carbon print.

It has been found that the action of light upon a bichromate film is very different in its nature to the result produced by the sun upon iodide of silver. A film of pure iodide of silver, as Dr. Reissig and Mr. Carey Lea have abundantly shown, may be impressed with an image which will fade out altogether if the film is afterwards preserved for a sufficient time screened from light. Indeed it is possible to impress iodide of silver with an image, allow the same to fade away in darkness, and then impress the film with a second and different picture. The photographic image, therefore, on iodide of silver is of an evanescent nature, becoming weaker and weaker, and, if preserved for any time, ultimately fading away altogether. Now, with a photograph upon a bichromate film, the reverse is the case. If an impression of the slightest kind is produced upon a film of gelatine sensitised with bichromate, and put away in the dark, the action of the light still goes on, and progresses until the image has become a perfect and vigorous one. This continuation of the solar action has been turned to good account by carbon printers, who in winter time and busy moments have printed their photographs in darkness instead of light; that is to say, in lieu of exposing their sensitive tissue in the sun under a negative for hours and hours, they merely do so for a few minutes, the slight image thus impressed being allowed to gain in vigour subsequently by preservation for some time—half-a-day or so—in darkness, before development in warm water. In the ordinary way only half-a-dozen copies can be obtained from one negative during the day, if all of them are fully printed in the sun, whilst if only incipient prints are produced, a score of impressions may easily be secured.

Within the last few days we have progressed a step further in carbon printing. M. Marion of Paris has discovered that if you take a bichromate image printed in the sun, and put it into contact with another bichromate surface, you produce upon the latter a similar impression. You can in fact take a carbon picture fresh from the frame and employ it as a printing block, from which any number of impressions are procurable. It is a most singular fact that a solarised surface should be capable of setting up an action upon another sensitive surface placed in contact with it. But so it is. The impression made by light upon a bichromate film is capable of transmission to another surface of like nature merely pressed against it. We have, as it were, stored up in the original print a quantity of sunlight which has been