poetic feeling and imagination, his profound sincerity and his great sympathy with nature. Here him sing at Aberdeen :—

" Alone on a hillside of heather,
I lay with dark thoughts in my mind,
In the midst of the beautiful weather,
I was deaf, I was dumb, I was blind,
I knew not the glories around me,
I counted the world as it seems,
Till a spirit of melody found me,
And taught me in visions and dreams."

" For the sound of a chorus of voices
Came gathering up from below,
And I heard how all Nature rejoices,
And moves with a musical flow.
O strange ! we are lost in delusion,
Our ways and our doings are wrong,
We are drowning in wilful confusion
The notes of that wonderful song."

To appreciate Maxwell's relation to theories of electrical action, it is desirable to take a retrospect of the views that have been held regarding its nature. Three periods in the history of these views may readily be distinguished. The first was introduced by Dr. Gilbert in 1600, and it lasted for about 225 years. The little that was known previous to Gilbert constitutes only the preface or introduction to the history proper. Nearly three-fourths of this period was utterly barren and unfruitful. It knew nothing better than unctuous effluvia and electric atmospheres. In the latter half of the period the Newtonian philosophy had become the orthodox doctrine. The great success attending the mathematical investigations, founded upon the law of inverse squares, naturally carried with it the acceptance of the underlying hypothesis of "action at a distance." There were not lacking, indeed, men of deeper philosophic insight who denied this doctrine, which they looked upon as entirely unphilosophical and which must utterly bar the way to any inquiry into the process by which the law is executed. Action at a distance by attraction or repulsion, varying inversely as the square of that distance, means an ultimate fact not admitting of further analysis.

The second period was one of contention. It began not with the important discovery of current electricity, nor of the electro-magnet, but with the philosophical methods and concepts of Faraday. The physical postulates of the mathematical school were entirely alien to the views which he adopted. "Faraday, in his mind's eye, saw lines of force traversing all space where the mathematicians saw centres of force attracting at a distance ; Faraday saw a medium where they saw nothing but distance ; Faraday sought the seat of the phenomena in real actions going on the medium, they were satisfied that they had found it in a power of action at a distance impressed on the electric fluids." * Prior to Faraday the supporters of a medium to explain electric and magnetic action were always thrown out of court for lack of evidence ; Faraday gave them a legal standing by furnishing the facts and evidence on which they could well afford to base their case.

The corpuscular theory of light, which had shown such remarkable vitality, was now in the last stages of a fatal disease, due to indigestion and lack of assimilation. Foucault finished it off in 1865 with his crucial experiment to decide upon the relative velocity of light in air and water. The undulatory theory was thus fully established, and the doctrine of radiant energy in general began to be clearly apprehended. The grand generalization of the conservation of energy was looming up all along the horizon of science, as the towers and spires of a great city appear to rise out of the sea to a traveler approaching the land. Victory was ready to perch on the banners of an army contending for the ether doctrine—not a decimated army, but one constantly augmenting in numbers by deserters from the enemy. At this period, sixteen years ago, appeared the epoch-making book of Maxwell on Electricity and Magnetism. Its author professes only to translate Faraday's ideas into mathematical language ; but he did vastly more than this. He demonstrated mathematically that the properties of the medium required to transmit electro-magnetic action are identical with those of the luminiferous ether. It would be unphilosophical, he remarks, to fill all space with a new medium whenever any new phenomenon is to be explained ; and since two branches of science had independently suggested a medium requiring the same properties to account for the same phenomena in each, the evidence for the existence of a single medium for both kinds of physical phenomena was thereby greatly strengthened. The step from identity of the medium to identity of phenomena, that is, that light itself is an electro-magnetic phenomenon, though it may now seem to be a short one, must nevertheless, upon careful consideration, always be accepted as evidence of the greatest genius. To walk in Maxwell's footsteps now and take the very steps he took is one thing, and a comparatively easy one ; but to make original explorations into unknown regions of nature, and to tread where no human being has ever before set foot is quite another thing. The electro-magnetic theory of light must be regarded as a great generalization, inferior only to that greatest one of all time—the conservation of energy.

The principal criteria upon which Maxwell relied for the confirmation of his theory may be briefly enumerated :—

1. An electro-magnetic wave or undulation is propagated through the ether with a velocity equal to the ratio of the electro-magnetic to the electrostatic unit of quantity. If light is an electro-magnetic phenomenon its velocity must also be equal to this same ratio. The very close approximation of the one to the other, as determined by a variety of methods, has been known for some time.

2. The specific inductive capacity, K, of any transparent dielectric should equal the square of its index of refraction. The discrepancies at this point are so great that all one can say in the most favorable case is that K is the most important term in the expression for the refractive index, while in other cases no confirmation whatever can be drawn from this class of evidence.

3. The magnetic and electric disturbances are both at right angles to the direction of propagation of the wave and at right angles to each other. The mathematical form of the disturbance agrees with that which constitutes light in being transverse to the direction of propagation. Further, the *electric* disturbance should be perpendicular to the plane of polarization of plane polarized light.

4. In non-conductors the disturbance should consist of electric displacements, but in conductors it should give rise both to electric displacements and electric currents by which the undulations are absorbed by the medium. Most transparent bodies, it is true, are good insulators, and all good conductors are opaque. The degree of opacity is, however, far from being proportional to the conductivity.

5. But perhaps the most important criterion of all is the one

* Maxwell's Elec. and Mag., p. x.