

complicated. When properly investigated, especially within the sphere which constitutes more particularly the essential characteristics of each species of animals and plants, it is likely to afford the most direct evidence of the unexpected independence of physical influences of organized beings, if I mistake not the evidence I have myself been able to collect. What can there be more characteristic of different species of animals than their motions, their plays, their affections, their sexual relations, their care of their young, the dependence of these upon their parents, their instincts, etc., etc.; and yet there is nothing in all this which depends in the slightest degree upon the nature or the influence of the physical conditions in which they live. Even their organic functions are independent of these conditions to a degree unsuspected, though this is the sphere of their existence which exhibits the closest connections with the world around.

Functions have so long been considered as the test of the character of organs, that it has almost become an axiom in comparative anatomy and physiology, that identical functions presuppose identical organs. Most of our general works upon comparative anatomy are divided into chapters according to this view. And yet there never was a more incorrect principle, leading to more injurious consequences, more generally adopted. That naturalists should not long ago have repudiated it, is the more surprising as every one must have felt again and again how unsound it is. The organs of respiration and circulation of fishes afford a striking example. How long have not their gills been considered as the equivalent of the lungs of the higher Vertebrata, merely because they are breathing organs; and yet these gills are formed in a very different way from the lungs; they bear very different relations to the vascular system; and it is now known that they may exist simultaneously with lungs, as in some full-grown Batrachians, and, in the earlier embryonic stages of development, in all Vertebrata. There can no longer be any doubt now, that they are essentially different organs, and that their functions afford no test of their nature and cannot constitute an argument in favor of their organic identity. The same may be said of the vascular system of the fishes. Cuvier¹ described their heart as representing the right auricle and the right ventricle, because it propels the blood it contains to the gills, in the same manner as the right ventricle propels the blood to the lungs of the warm blooded animals; yet embryology has taught us that such a comparison based upon the special relations of the heart of fishes, is unjustifiable. The air sacs of certain spiders have also been considered as lungs, because they perform similar respiratory functions, and yet they are only modified tracheæ,² which are constructed upon such a peculiar plan, and stand in

¹ CUVIER, (G.) Règn. Anim., 2de édit., vol. 2, p. 122.

² LEUCKARDT, (R.) Ueber den Bau und die Bedeutung der sogenannten Lungen bei den Arach-