http://www.geology.19thcenturyscience.org/books/Bridgewater-Treatises/index.html

ticular surfaces, one on each side of the spinal canal, formed on processes corresponding to the leaves of the first cranial vertebra, and assimilating it more to a hinge joint. In birds, however, where, as we have just seen, the most extensive lateral motions are required, the plan of the ball and socket joint is again resorted to; and the occipital bone is made to turn upon the atlas by a single pivot. So great is the freedom of motion in this joint, that the bird can readily turn its head completely back upon its neck, on either side.

As spinous or transverse processes of any length would have interfered with the flexions of the neck, we find scarcely a trace of these processes in the cervical vertebræ of birds. But another, and a still more important consideration was to be attended to in the construction of this part of the spine. It must be recollected that the spinal marrow passes down along the canal formed by the arches of the vertebræ, and that any pressure applied to its tender substance would instantly paralyze the whole body, and speedily put an end to life. Some extraordinary provision was therefore required to be made, in order to guard against the possibility of this accident occurring during the many violent contortions into which the column is liable to be thrown. This is accomplished in the simplest and most effectual manner, by enlarging the diameter of the canal at the upper and lower part of each vertebra, while, at the middle, it remains of the usual size, so that the shape of the cavity, as is well seen in Fig. 225, which shows a vertical section of one of the cervical vertebræ of the ostrich, resembles that of an hour glass.* Thus, a wide space is left at the junction of each successive vertebra, allowing of very considerable flexion,

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* For the specimen from which this engraving was made, I am indebted to the kindness of Mr. Owen.