Table 10. Comparative Account of Hearts of Vertebrate Types.

Characters	FISH Dogfish *(Scoliodon)*	AMPHIBIA Frog *(Rana)*	REPTILIA Lizard *(Uromastix)*	AVES Pigeon *(Columba)*	MAMMALIA Rabbit *(Oryctolagus)*
1. Position of heart in body	Heart lies mid-ventrally beneath pharynx in pericardial cavity separated from peritoneal cavity by a partition, called *septum transversum*, perforated by a *pericardio-peritoneal canal.*	Heart lies mid-ventrally beneath oesophagus in thoracic cavity. Septum transversum is absent.	Heart lies mid-ventrally above sternum in thoracic cavity. There is no septum transversum.	Heart lies mid-ventrally in thoracic cavity surrounded by lobes of liver.	Heart lies enclosed in a median pericardial cavity of thorax, between the pleural cavities containing lungs.
2. Pericardium	Heart lies protected within a 2-layered membranous *pericardium.*	Heart lies enclosed by a thin, transparent, 2-layered sac, the *pericardium.*	Heart lies protected within a 2-layered, thin, transparent sac, the *pericardium.*	Heart enclosed by a thin, 2-layered, transparent, membranous sac, the *pericardium.*	Heart completely surrounded by a 2-layered membranous sac, the *pericardium.*
3. Size, shape and colour	Small, S-shaped, dorso-ventrally bent and raddish brown.	Small, somewhat conical or triangular and reddish in colour.	Small, roughly triangular and reddish in colour.	Comparatively larger, conical in shape and reddish in colour.	Larger pear-shaped and reddish in colour.
4. Chambers	Consists of a linear series of 4 chambers : sinus venosus, auricle, ventricle and conus, all distinguished externally. But only auricle and ventricle are true chambers, hence *2-chambered.*	*3-chambered*, made of 2 auricles and 1 ventricle. Auricles not demarcated externally. Besides, sinus venosus and truncus arteriosus also present.	*3-chambered*, made of 2 auricles and one incompletely divided ventricle, all faintly demarcated externally. Sinus venosus also present.	*4-chambered*, made of 2 auricles and 2 ventricles. Ventricles not distinguishable externally.	*4-chambered*, made of 2 auricles and 2 ventricles, all distinguishable externally.
5. Sinus venosus	Triangular, extending transversely over posterior region of ventricle and fused with pericardial wall. Receives venous blood from body by two *ducti Cuvieri* laterally and two *hepatic sinuses* posteriorly.	Triangular, dark coloured, attached dorsally over auricles and ventricles. Receives venus blood by 3 venae cavae : two anterior *precavals* and one posterior *postcaval*, joining at its angles.	Sinus venosus is large, bilobed, attached transversely to dorsal surface of auricles. Formed by the union of 2 *precavals* and 1 *postcaval.*	Sinus venosus absent, said to be incorporated into right auricle. Thus 3 caval veins open directly into right auricle.	Sinus venosus absent and merged into right auricle. Their union marked externally by a groove, *sulcus terminalis*, and internally by a muscular ridge, crista terminalis. 3 venae cavae open directly into right auricle.
6. Sinus-atrial aperture	Sinus opens into posterior end of auricle by a sinuatrial aperture guarded by a pair of membranous *valves.*	Sinus opens into dorsal wall of auricle by a large, oval, sinu-atrial aperture guarded by a pair of flaplike *valves.*	Sinus opens into right auricle through an oval aperture with muscular *lips* and *without valves* according to Bhatia. (1929).	Sinus venosus absent. However, opening of postcaval into right auricle guarded by a muscular *Eustachian valve.*	Sinus venosus absent. However, opening of postcaval into right auricle guarded by a rudimentary *Eustachian valve.*
7. Atria or auricles	Atrium or auricle somewhat triangular. Undivided internally due to lack of an *interauricular* septum.	Auricles somewhat rectangular. Do not form auricular appendages. Internally divided completely into right and left auricles by an *interauricular septum.*	Two auricles divided completely by an *inter-auricular septum.* Right auricle gives off a small *diverticulum* from its dorsal antero-medial surface.	Two auricles divided by an *inter-auricular septum.* Dorsal anteromedial diverticulum absent.	Two auricles completely separated by an *inter auricular septum.* Right auricle without diverticulum.

(Contd.)

Characters	Dogfish (*Scoliodon*)	Frog (*Rana*)	Lizard (*Uromastix*)	Pigeon (*Columba*)	Rabbit (*Oryctolagus*)
8. Atrial wall	Thin-walled, spongy, moderately muscular.	Thin walled, without muscular processes.	Thin-walled, inner lining forming a network of low muscular ridges.	Comparatively thick-walled with inner surface raised into muscular ridges.	Comparatively thick walled. Inner surface raised into a network of muscular ridges called *musculi pectinati*.
9. Auricular appendix	Each auricle laterally projects beyond ventricle as ear like *auricular appendages*.	Absent	Absent	Absent	Each auricle produced behind into a swollen flap, the *auricular appendix*, slightly covering the ventricle of its side.
10. Pulmonary veins	Absent and therefore do not open into auricle.	A common pulmonary vein opens into left auricle.	A common pulmonary vein opens into left auricle	Four pulmonary veins open by a common aperture into left auricle.	Two pulmonary veins open by a common opening into left auricle.
11. Auriculo-ventricular aperture & valves	Atrium opens into ventricle through its dorsal wall by a single auriculo-ventricular aperture guarded by a pair of membranous valves.	Both auricles open into ventricle posteriorly through a common large auriculo-ventricular aperture guarded by 2 pairs of flaplike valves.	Both auricles communicate behind with ventricle through separate right and left auriculo-ventricular apertures due to backward extension of interauricular septum into ventricle, each guarded by a valve of one semilunar flap.	There are two separate circular auriculo-ventricular apertures. Right valve is made of a large muscular fold, while left valve is *bicuspid*, made of two membranous flaps.	There are two separate auriculo-ventricular apertures. Right aperture is guarded by a *tricuspid valve* made of 3 triangular flaps or cusps, while left *bicuspid* or *mitral valve* consists of 2 flaps only.
12. Ventricles	Small, pearshaped thickwalled undivided chamber lying ventral to sinus and auricle. *Interventricular septum* not found.	Small, conical, thick-walled undivided chamber lying posterior to auricles. No *interventricular septum*.	Small, conical thickwalled chamber lying behind auricles. Incompletely divided by a prominent oblique *muscular ridge* or septum into a larger dorsal part, *cavum dorsale*, and a smaller ventral part, *cavum pulmonale*.	Two right and left, large, thick-walled ventricles, completely separated by a vertical *interventricular* septum.	Two large and thick-walled right and left ventricles completely separated by a vertical *interventricular septum*.
13. Chordae tendineae	Cavity of ventricle traversed by numerous muscular strands, *chordae tendineae*, giving it a spongy texture.	Flaps of auriculo - ventricular valve attached to wall of ventricle by thread like *chordae tendineae*.	Free edges of auriculo – ventricular valves attached to inner wall of ventricle by firm cords, the *chordae tendineae*.	Flaps of auriculo - ventricular valves attached to papillary muscles by *chordae tendineae*	Free edges of valvular flaps connected to papillary muscles by long, tough connective tissue strands, *chordae tendineae*.
14. Columnae carneae	Absent	Irregular strands or ridges given from inner wall of ventricle.	Prominent ridges raised from inner surface of wall of verticle.	Bars of muscles traversing cavities of ventricles.	Small irregular muscular ridges projecting from wall of ventricles.
15. Papillary muscles	Absent	Absent	Absent	These are prominent muscular projections from inner wall of ventricles.	These are large, conical, nipple-shaped muscular elevations from inner wall of ventricles.

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16. Conus or truncus arteriosus	Conus arteriosus is a stout, undivided, muscular tube given anteriorly by ventricle. Its cavity contains 2 rows of 5 a semilunar valves each, 3 larger and 2 smaller. *Spiral valve* absent.	Truncus arteriosus is a pear-shaped tube arising anteriorly from right ventral side of ventricle. It's cavity is divided by 3 semilunar valves into a distal chamber, *synangium* and a proximal chamber, *pylangium*. Latter is further divided by a *spiral valve* into *cavum pulmocutaneum* and *cavum aorticum*.	Conus or truncus arteriosus absent.	Conus or truncus arteriosus absent.	Conus or truncus arteriosus absent.
17. Aortic arches	Conus leads anteriorly into a *ventral aorta* which gives off 5 pairs of lateral arotic arches.	Truncus bifurcates anteriorly into right and left trunks each dividing into 3 aortic arches : *common carotid*, *systemic* and *pulmocutaneous*. Ventral aorta absent.	Ventral aorta absent. 3 aortic arches arise directly from ventricle : *pulmonary* from cavum pulmonale and *right* and *left systemic* from cavum dorsale.	Ventral aorta absent. Only 2 aortic arches arise : *pulmonary* from right ventricle and *right systemic* leaving left ventricle.	Ventral aorta absent. Only 2 aortic arches present : *pulmonary* arising from right ventricle and *left systemic* from left ventricle.
18. Foramen Panizzae	Absent	Absent	Present at the point of contact where two systemic arches cross each other.	Absent.	Absent
19. Working	Heart receives only venous blood from body and sends it to gills only for aeration. Called *venous heart* with a *single circulation*.	Heart receives venous as well as oxygenated bloods. It supplies mixed blood to different regions of body. Called *transitional heart* with a *single circulation*.	Mixing of venous and oxygenated bloods occurs in incompletely divided ventricle. Hence *transitional heart* with *single circulation* and less efficient.	Heart completely 4-chambered without mixing of venous and oxygenated bloods. Hence with *double circulation* and more efficient.	Heart 4-chambered as in birds. Hence with *double circulation*, venous blood going to lungs and oxygenated blood to body, and more efficient.