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Notes on the Structure of the Japanese Newt, *Cynopus Pyrrhogaster*, I

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ABSTRUCT—The newt, *Cynopus pyrrhogaster*, is the common Japanese species of salamander that can live both on land and in water. This species inhabits in pond or on low land with pools of water, and eats insects and tainted flesh of dead animals. *Cynopus* can easily be reared in the laboratory conditions, feeding on hackled fragments of meats twice a week. Accordingly, this species has been a useful animal for biological experiments, above all for the analysis of development and anatomy.

Since most of the analysis has been based upon the informations on the comparative morphological viewpoints, it is understandable that the emphasis must be laid on the structure and constitution of the body form as a standard of the experiment. For this purpose, the writers wish to describe the internal structure and the constitution of the Japanese newt, *Cynopus pyrrhogaster*, as one of the basic studies of the Urodeles.

INTRODUCTION

Japanese newt, *Cynopus pyrrhogaster*, is the most common pond inhabitant of the amphibians, having a short head, a slender body, four extremities and a long tapering tail. *C. pyrrhogaster* is common species and very widely distributed in ponds and pools found all over Japan except in Hokkaido. They are denominated in some places of Japane as 'Imori' or 'Akahara', the meanings of which are derived from the mode of living or the special colour of their abdomen, namely, 'the well dweller' or 'the burning belly'. The correct position of the *Cynopus pyrrhogaster* belongs to the Family *Salamandidae* included in the Order *Urodeloa*, Class *Amphibia*, Phyllum *Vertebrata*.

Urodels including the newt are thought to be the descendant of the *Stegocephalians*, the first dry land quadrupeds found in the upper Devonian strata (Romer 1962).

The individuals of this species are easily reared in the water tank, feeding merely on pieces of meat. They can survive several years under careful laboratory controls. In moderate condition, the fertilized eggs are readily obtained, and the larvae are reared through the complete development on diet. Accordingly, they have been used in various laboratory experiments in anatomy, histology and embryology. Moreover, in the writers' previous

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experiment (1968 & 1969), the dimensions of the cells are comparably large, hence *Cynopus* is thought to be the convenient material even in the fields of cytology.

The amphibian eggs, especially frogs and newts, have been used for analysis of development such as the mechanism of fertilization (Fankhauser 1948), cleavage (Dan, 1963), organogenesis (Spemann 1938) and regeneration (Singer, 1961 and Inoue 1988). For this reasons, the writers wish to describe the major structure and the constitution of several internal organs, using *Cynopus pyrrhogaster* for the researcher's reference.

The writers are aware of the fact that there are few researchers concerning the general remarks on the body structure and the constitution of *Cynopus pyrrhogaster*. The writers would like to clarify the general anatomy and histology as one of the teaching material. Since the writers' present research involves a number of illustrations, this paper will present brief notes concerning the outlines of the structures of several main organs on account of space consideration. Some of the writers' illustrations were made with reference to the works done by Inaba *et al* (1971). As to the histological research, the writers would like to describe in the next paper.

Before going further, the writers wish to express their cordial thanks to Mr. Shosuke Takahashi, The Chief Reserchер of the Educational Committee, Akita Pref., and Misses Shizuko Matsui, Toshiko Sato and Eri Shimoda, under whose cooperations these experiments were carried out.

MATERIAL AND METHOD

The material used in the present experiment was the Japanese newt, *Cynopus pyrrhogaster*, collected in the secluded ponds in the vicinity of Yuzawa City, Akita Pref. The animals were maintained in the laboratory tanks, and fed on a piece of frozen cattle liver twice a week.

Before dissection, the animal was anesthetized with chloroform for about ten minutes. Under the application of amphibian Ringer solution, the animal was first dissected along the midline of abdomen. The incision was extended straight to the upper part of the chest from the cloacal region. At this time the caution was taken not to cut off the branches of the anterior mesenteric artery, found in the surface of the peritoneum. After the dissection, the constitution of the various internal organs was observed, then the structure of every organ systems was examined separately.

OBSERVATIONS AND DISCUSSION

Digestive Organ System

1. Esophagus. The esophagus is a small canal following to the stomodaeum, to which the food passes from the pharynx to the stomach. At the proximal end of the pharynx, the orifice of the trachea can be clearly recognizable.

2. Stomach. The stomach appears as a oval dilation of the alimentary tract for the storage of food under digestion. Its long axis runs almost parallel to the body axis, continuing

to the duodenum. The cepharic end of the stomach to which the distal end of the pharynx opens, is denominated as the cardiac part of the stomack, and the caudal end continuing to the duodenum, the pyroric part. The spleen appears at the left upper side of the abdomen as the red brown coloured oval form adjacent to the stomach. Both the stomach and the spleen are buried in the peritoneum named as the dorsal mesogastrium. In the above stated membranous peritoneum, the splenic artery and the veins are clearly recognizable.

3. Duodenum. The small canal following the stomach is called the duodenum, because of the correspondence of such a digestive tract found in the higher animals. For the sake of appearance that it has no special features comparing with the successive intestinal parts, however it connects to the pancreas with the small duct. The pancreas is the small organ in yellowish brown color, holding its body close to the inside of the bending region of the duodenum. Without cautious obserbations, it is liable to be overlooked because of its small size and the unobtrusive color. The role of the pancreas is known to produce the enzymes for the digestion, and the secretion of hormones, playing to the regulation of the blood sugar content.

4. Small intestine. The small intestine is the long crooked canals consisting of the intestinal loop, starting from the point of the orifice of the bile duct in the duodenum, and terminating to the larger intestin. They are suspended from the dorsal abdominal mesentery where the branches of the mesenteric artery and the vein were found. The former is derived from the descending dorsal aorta and the latter runs into the anterior abdominal vein.

EXPLANATION OF THE FIGURE

Plate 1. Fig. A. Drawing of a male Japanese newt, *Cynopus pyrrhogaster*. Fig. A. I, II and III, lateral, dorsal and ventral views, respectively. Fig. B. Diagram showing the constitution of several internal organs in the body, ventral view. Fig. C. Diagram after the removal of the liver.

Figure A. The external appearance of *C. pyrrhogaster* (♂). イモリ(♂)の外形
I. 腹面 (The abdominal view), II. 背面 (The dorsal view), III. 側面 (The lateral view)

Figure B. The internal organs of *C. pyrrhogaster* (♂), ventral view. イモリ(♂)の内臓腹面

1. 動脈幹 (Arterial trunk), 2. 動脈円錐 (Conus arteriosus), 3. 心室 (Ventricle), 4. 肝臓 (Liver), 5. 脂肪体 (Fat body), 6. 精巣 (Testis), 7. 前腹静脈 (Preabdominal vein), 8. 膀胱 (Urinary bladder), 9. 総排泄腔 (Cloaca), 10. 左心房 (Left auricle), 11. 右心房 (Right auricle), 12. 肺 (Lung), 13. 脾臓 (Spleen), 14. 胃 (Stomach), 15. ミウレル氏管 (Müllerians duct), 16. 腎臓 (Kidney), 17. 腎細管 (Renal tubule), 18. 直腸 (Rectum)

Figure C. The internal organ of *C. pyrrhogaster* (♂) after removal of the liver, ventral view. イモリ(♂)の内臓腹面, 肝臓摘出後

1. 動脈幹 (Arterial trunk), 2. 心室 (Ventricle), 3. 下大静脈 (Inferior vena cave), 4. 下行大静脈 (Descending aorta), 5. 後主静脈 (V. posterior), 6. 精巣 (Testis), 7. 脂肪体 (Fat body), 8. 前腹静脈 (Preabdominal vein), 9. 膀胱 (Urinary bladder), 10. 肺動脈

(Pulmonary aorta), 11. 肺静脈 (Pulmonary vein), 12. 肺 (Lung), 13. 脾臓 (Spleen), 14. 胃 (Stomach), 15. ミウレル氏管 (Müllerians duct), 16. 腎臓 (Kidney), 17. 腎細管 (Renal tubule), 18. 総排泄腔 (Cloaca)

Plate 2. Fig. A. Drawings of a female Japanese newt, *Cynopus pyrrhogaster*. Fig. A. I, II and III, Ventral, dorsal and rateral views, respectively. Fig. B. Diagram showing the constitution of the several internal organs in the body, ventral view. Fig. C. Diagram, same as B, after the removal of the liver.

Figure A. The external appearance of *C. pyrrhogaster* (♀). イモリ(♀)の外形
I. 腹面 (The abdominal view), II. 背面 (The dorsal view), III. 側面 (The lateral view)

Figure B. The internal organs of *C. pyrrhogaster* (♀), ventral view. イモリ(♀)の内臓腹面

1. 動脈幹 (Arterial trunk), 2. 動脈円錐 (Conus arteriosus), 3. 心室 (Ventricle), 4. 肝臓 (Liver), 5. 脂肪体 (Fat body), 6. 卵巣 (Ovary), 7. 前腹静脈 (Preabdominal vein), 8. 膀胱 (Urinary bladder), 9. 総排泄腔 (Cloaca), 10. 左心房 (Left auricle), 11. 右心房 (Right auricle), 12. 静脈洞 (Sinus venosus), 13. 肺 (Lung), 14. 脾臓 (Spleen), 15. 胃 (Stomach), 16. 卵管 (Oviduct), 17. 小腸 (Small intestine), 18. 直腸 (Rectum)

Figure C. The internal organs of *C. pyrrhogaster* (♀) after removal of the liver, ventral view. イモリ(♀)の内臓腹面, 肝臓摘出後

1. 動脈幹 (Arterial trunk), 2. 心室 (Ventricle), 3. 下大動脈 (Inferior vena cava), 4. 後主静脈 (V. posterior), 5. 肺 (Lung), 6. 十二指腸 (Duodenum), 7. 卵管 (Oviduct), 8. 前腹静脈 (Preabdominal vein), 9. 膀胱 (Urinary bladder), 10. 肺動脈 (Pulmonary aorta), 11. 肺静脈 (Pulmonary vein), 12. 下行大動脈 (Descending aorta), 13. 食道 (Oesophagus), 14. 胃(Stomach), 15. 脾臓(Spleen), 16. 卵巣(Ovary), 17. 脂肪体(Fat body), 18. 直腸 (Rectum)

Plate 3. Fig. A. The respiratory system showing the lobes of the lung, ventral view. Figs. B and C. Ventral and dorsal views of the heart. Fig. D. Diagram showing the vascular system around the heart. Fig. E. Venous system around the mesentery.

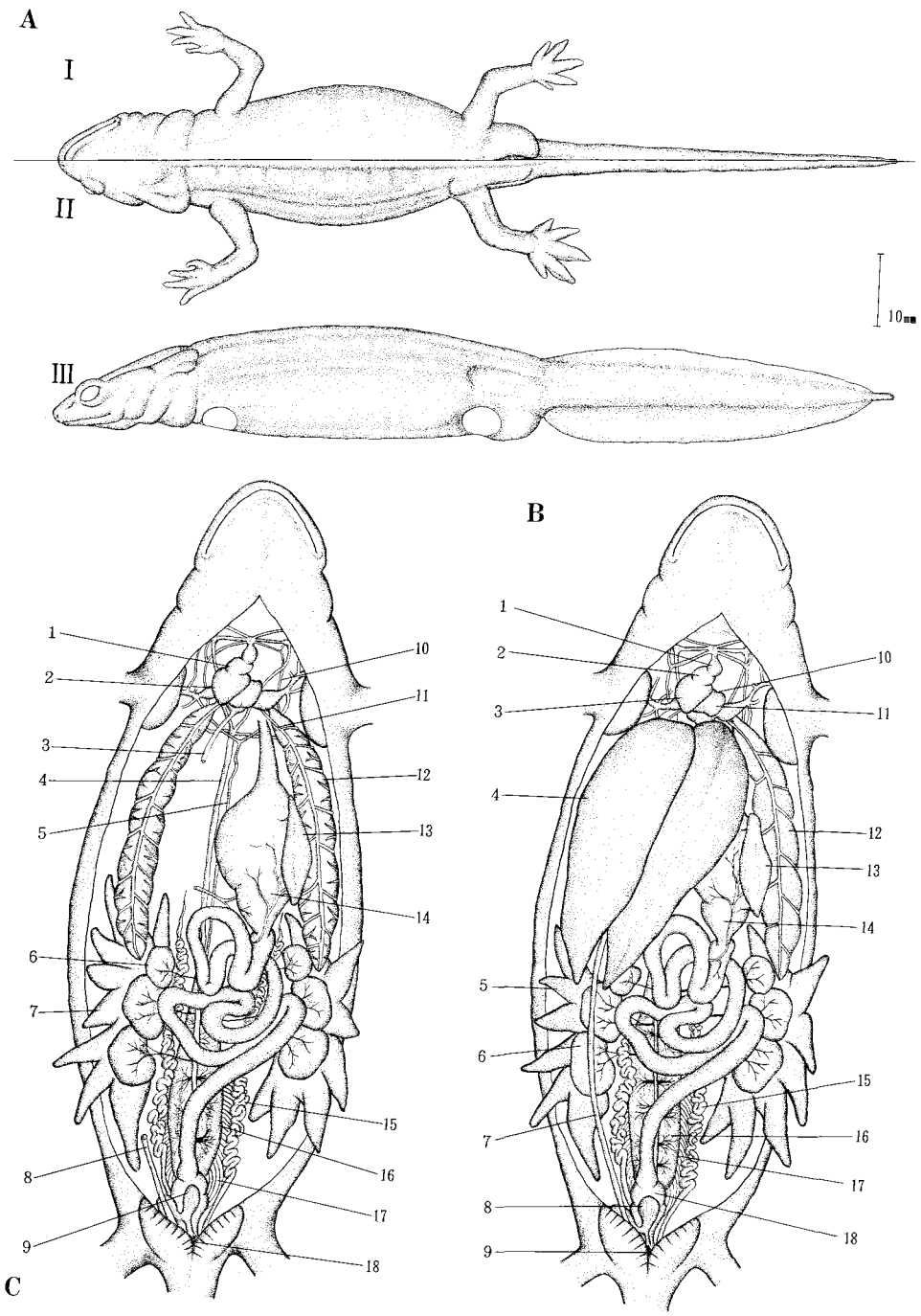
Figure A. The external appearance of the right and left lungs of *C. pyrrhogaster*, the abdominal view. イモリの左右の肺外観, 腹面図

1. 気管 (Trachea), 2. 肺動脈 (Pulmonary artery), 3. 気管支 (Bronchus), 4. 肺静脈 (Pulmonary vein)

Figure B. and Figure C. The external appearance of the heart of *C. pyrrhogaster*. イモリの心臓外観

B. 腹面(The abdominal view)及び C. 背面(The dorsal view) 1. 第一動脈弓(First arterial arch), 2. 第二動脈弓 (Second arterial arch), 3. 第四動脈弓 (Forth arterial arch), 4. 心室(Ventricle), 5. 上大動脈(Precaval vein), 6. 肝静脈(Hepatic vein), 7. 動脈幹(Arterial

PLATE 1



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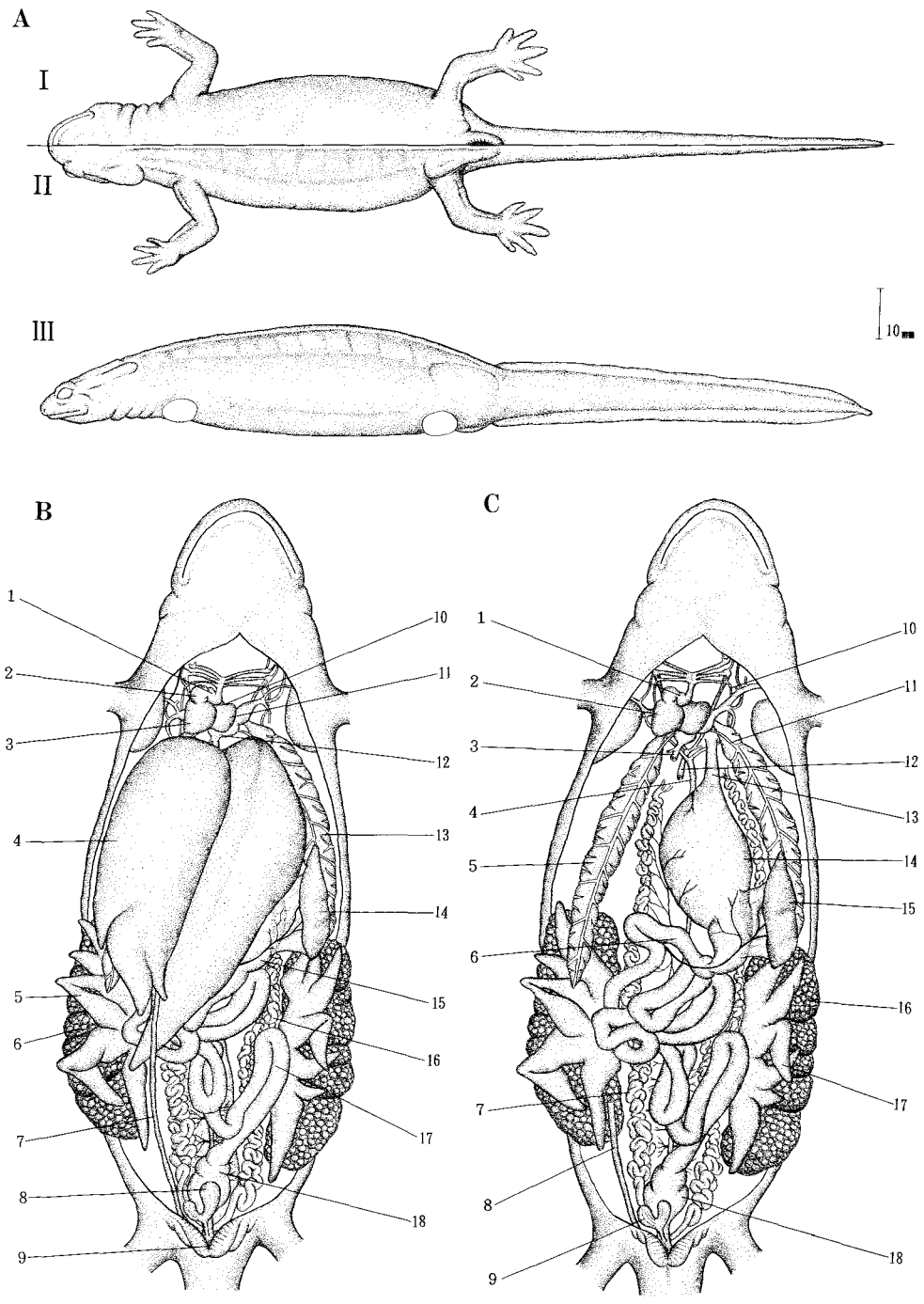


PLATE 3

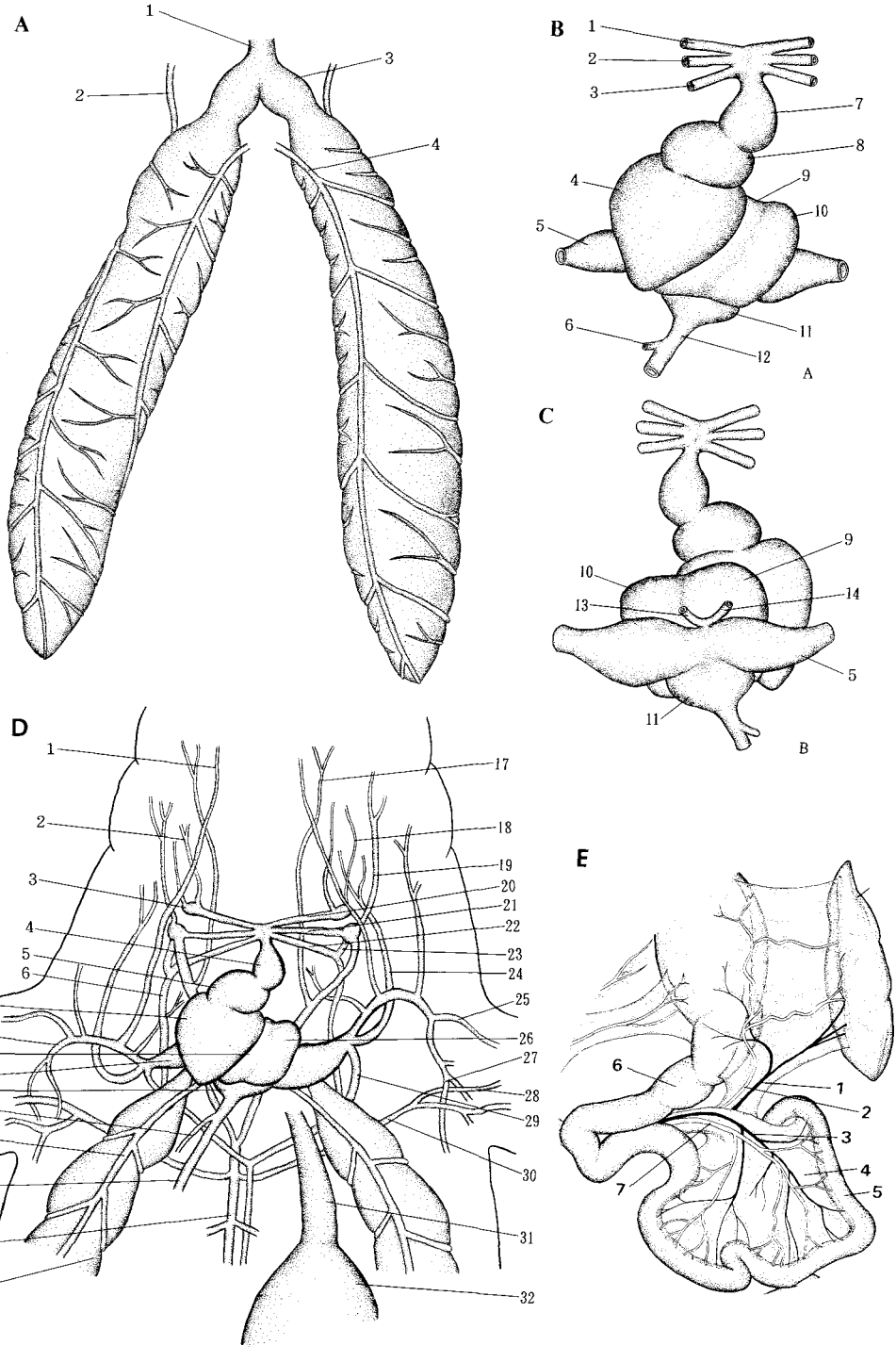
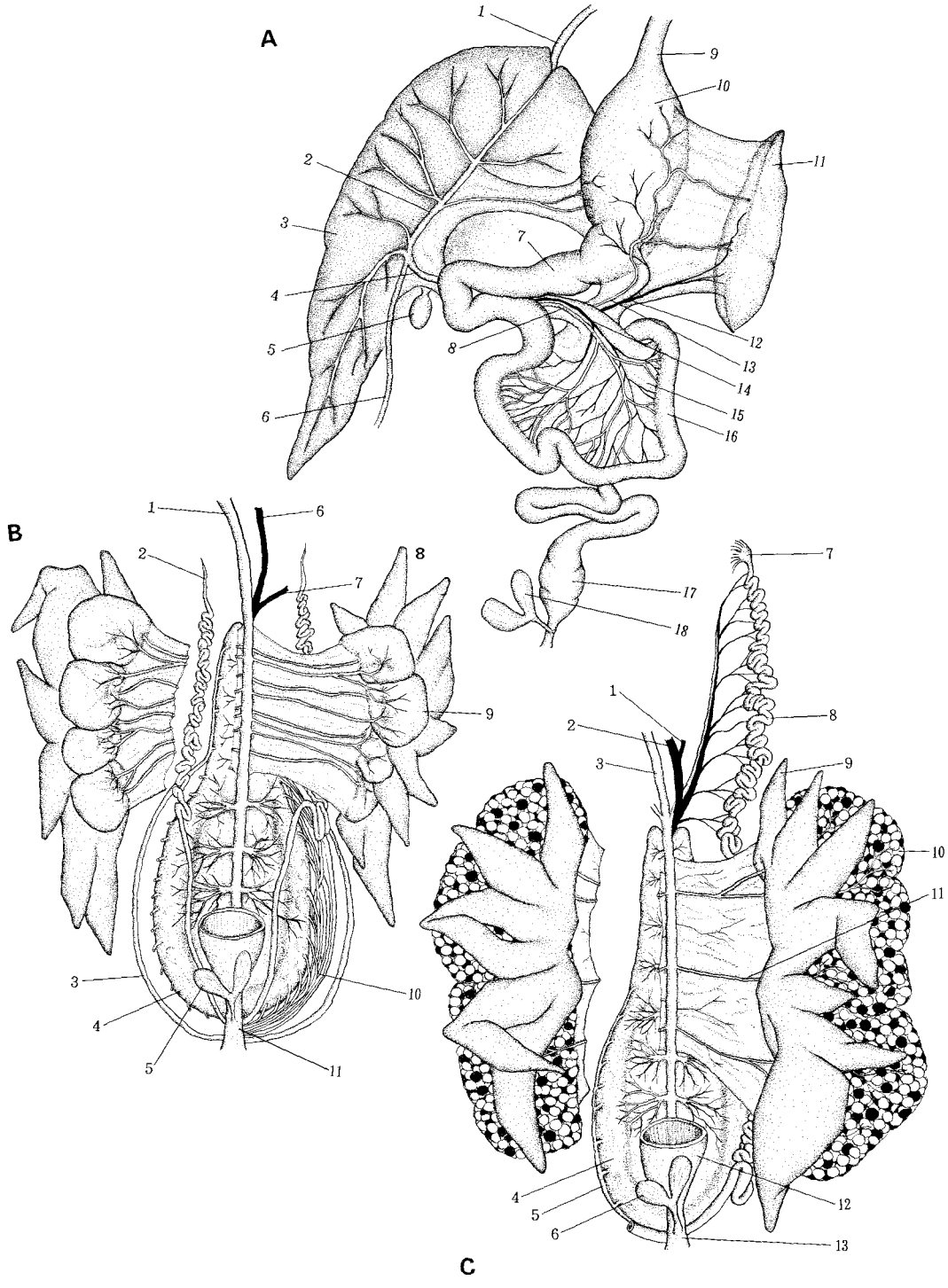


PLATE 4



trunk), 8. 動脈円錐 (Conus arteriosus), 9. 左心房 (Left auricle), 10. 右心房 (Right auricle), 11. 静脈洞 (Sinus venosus), 12. 下大動脈 (Postcaval vein), 13. 右肺静脈 (Right pulmonary vein), 14. 左肺静脈 (Left pulmonary vein)

Figure D. The circulatory system around the heart of *C. pyrrhogaster*, with partial reference to Inaba and Ikeda's publication 1971. イモリの心臓周辺の循環系

1. 外頸静脈 (External jugular vein), 2. 外頸動脈 (External carotid artery), 3. 頸動脈腺 (Carotid gland), 4. 動脈幹 (Arterial trunk), 5. 動脈円錐 (Conus arteriosus), 6. 肺動脈 (Pulmonary artery), 7. 心室 (Ventricle), 8. 鎖骨下静脈 (Subclavian vein), 9. 左心房 (Left auricle), 10. 上大静脈 (Precaval vein), 11. 静脈洞 (Sinus venosus), 12. 肝静脈 (Hepatic vein), 13. 肺静脈 (Pulmonary vein), 14. 下大静脈 (Postcaval vein), 15. 下行大動脈 (Descending aorta), 16. 肺 (Lung), 17. 口蓋鼻動脈 (A. palatinonasalis), 18. 内頸動脈 (Internal carotid artery), 19. 上行咽頭動脈 (A. pharyngea ascendens), 20. 第一動脈弓 (First arterial arch), 21. 第二動脈弓 (Second arterial arch), 22. 第四動脈弓 (Forth arterial arch), 23. ボタル氏管 (Botallo's duct), 24. 内頸静脈 (Internal jugular vein), 25. 側上腕静脈 (Lateral brachial vein), 26. 右心房 (Right auricle), 27. 肩甲部回旋静脈叢 (Plexus circumscapularis), 28. 上腕動脈 (Brachial artery), 29. 後主静脈 (V. posterior), 30. 鎖骨下動脈 (Subclavian artery), 31. 食道 (Oesophagus), 32. 胃 (Stomach)

Figure E. The circulatory system around the digestive system of *C. pyrrhogaster*. イモリの消化器官周辺の循環系

1. 脾胃動脈 (Lienogastric aorta), 2. 脾胃静脈 (Lienogastric vein), 3. 腸間膜動脈 (Mesenteric artery), 4. 腸間膜 (Mesentery), 5. 小腸 (Small intestine), 6. 十二指腸 (Duodenum), 7. 腸間膜静脈 (Mesenteric vein)

Plate 4. Fig. A. Digestive organ system. Fig. B. Urinogenital system in the male. Fig. C. Urinogenital system in the female.

Figure A. The digestive organ system of *C. pyrrhogaster*. イモリの消化器官系

1. 下大静脈 (Inferior vena cava), 2. 肝静脈 (Hepatic vein), 3. 肝臓 (Liver), 4. 肝門脈 (Hepatic portal vein), 5. 胆嚢 (Gall bladder), 6. 前腹静脈 (Preabdominal vein), 7. 十二指腸 (Duodenum), 8. 腸間膜静脈 (Mesenteric vein), 9. 食道 (Oesophagus), 10. 胃 (Stomach), 11. 脾臓 (Spleen), 12. 脾胃動脈 (Lienogastric aorta), 13. 脾胃静脈 (Lienogastric vein), 14. 腸間膜動脈 (Mesenteric artery), 15. 腸間膜 (Mesentery), 16. 小腸 (Small intestine), 17. 直腸 (Rectum), 18. 膀胱 (Urinary bladder)

Figure B. The urinogenital organ system of *C. pyrrhogaster* (♂). イモリ (♂) の泌尿生殖器官系

1. 下大静脈 (Inferior vena cava), 2. ミウレル氏管 (Müllerian duct), 3. 輸精管 (Vas deferens), 4. 腎臓 (Kidney), 5. 膀胱 (Urinary bladder), 6. 下行大動脈 (Descending aorta), 7. 腸間膜動脈 (Mesenteric artery), 8. 脂肪体 (Fat body), 9. 精巣 (Testis), 10. 腎細管 (Renal tubule), 11. 総排泄腔 (Cloaca)

Figure C. The urinogenital organ system of *C. pyrrhogaster* (♀). イモリ(♀)の泌尿生殖器官系

1. 腸間膜動脈(Mesenteric artery), 2. 下行大動脈(Descending aorta), 3. 下大静脈(Inferior vena cava), 4. 腎臓 (Kidney), 5. 輸尿管 (Ureter), 6. 膀胱 (Urinary bladder), 7. 卵管腹腔口 (Ostium abdominale tuba uterinae), 8. 卵管 (Oviduct), 9. 脂肪体 (Fat body), 10. 卵巣(Ovary), 11. 卵巣静脈(Ovarian vein), 12. 直腸(Rectum), 13. 総排泄腔(Cloaca)

5. Large intestine. Apart from the intestine, then extends somewhat dilated alimentary tract, called the large intestine. It extends from the terminal portion of the intestine to the cloacal region. It is divisible into the colon and the rectum. The large intestine in the writers' present species, shows very simple columnar structure without constitution of three major portions, the ascending, transverse and descending colons found in the animals in the higher vertebrate. It extends downward and terminates to the cloacal canal, where the orifice of the excretory system is found.

6. Liver. The liver is the biggest glandular organ found in the upper ventral part of the abdomen. It occupies almost about the half of the body cavity. The liver of this species consists of two lobes, accompanying the small green sac like structure named as the gall bladder.

The blood, transported from the digestive organ, flows into the liver via the hepatic portal vein. The other major blood vessels concentrated into the liver, are the inferior vena cava, the hepatic artery and the hepatic vein and so on.

The bile flows out from the liver by way of the hepatic duct. The cystic duct from the gall bladder joins the hepatic duct to form the bile duct. Accordingly, the bile enters the duodenum via three tubules, the hepatic, the cystic and the bile ducts.

Vascular System

1. Heart. The heart, located in the upper part of the abdominal cavity, is the main organ for the cardiovascular system. By the rhythmic shrinkage of the heart, the blood pumps out toward the arteries, and flows back into the heart from the veins. The heart is thought to derive from the partial dilations of the blood vessel, accompanying with the development of the muscular coat around the heart. The heart of the *Cynopus pyrrhogaster* consists of three chambers, one is the ventricle and the other two, the auricles. The ventricle is larger and remarkably muscular comparing to the other two auricles. At the anterior end of the ventricle, there exists some muscular dilated portion of the arterial vessel named conus arteriosus, connecting ahead with the arterial trunk.

The auricle receives blood from the veins and communicates to the ventricle. The wall of the auricles is conspicuously thin when compares it with the ventricle. Therefore, the auricles are thought to be the cavities of the blood reservoir. In the *Cynopus*, the left auricle is somewhat smaller than the right one. Being adjacent to the dorsal side of the heart, the sinus venosus, the large channel for the venous blood flow is seen. The sinus venosus is a point of fusion of several veins such as the anterior and inferior vena cavae including the hepatic vein. The palpitation starts from the point of the sinus venosus, and propagates toward the auricles until it reaches

to the ventricle.

The arterial trunk spreads upward the branches of the several arteries, the first, the second and the fourth arterial arches into cephalocaudal direction. In the adult, they constitute the carotid, systemic and pulmonary arches, respectively.

2. Arterial and Venous System. At the end of the arterial trunk, the pair of the first arterial arch arises bilaterally, and then each of the arch divides to form the external and the internal carotid arteries on each side of the head. They carry the blood into the cepharic region. At the point of bifurcation of the two arteries, there exists the small dilation of the vessel, named carotid gland, which is thought to play the important roles for the regulation of blood oxygen content as in the case of the higher animals.

Each of the second arterial arch (systemic arch) bifurcates to form the ascending pharyngeal artery and the root of the dorsal aorta. The former extends anteriory toward the nasal portion of the head, the palatinonasal artery. With the descent of the roots of the left and the right dorsal aortae, they extend medially and finally fuse with each other. After the confluence from both sides, the arterial vessel thus formed is named as the descending aorta, the main artery of the vertebrate. It extends caudally along the mid dorsal line of the body trunk, and courses finally in the mediocaudal direction, the name of which is the caudal artery. During the passage of the descending aorta, many arteries arise. These arteries include the renal, the iliac and the coeliac arteries. The coeliac artery is one of the most conspicuous artery of the mesenteric artery that carries the blood into the abdomen.

Each vessel of the fourth aortic arch bifrucates to form the pulmonary artery and the Botall's duct. The former goes on toward the thoracic region and comunicates to the number of capillaries distributing in the lungs. The Botallo's duct communicates the distal end of the second aortic arch in the place where bifrucation occurrs.

We now turn to the constitution of the veins in the vascular system. The sinus venosus is the membranous dilation of the veins, where the inferior vena cava including the hepatic vein and the pair of the anterior vena cavae (precaval veins) flow in. The preabdominal and the hepatic veins join and flow into the inferior vena cava. The pair of the posterior cardinal veins join the precaval veins from the left and the right sides, and carry the blood together toward the sinus venosus. The external and internal jugular veins also flow into the precaval vein. The pulmonary vein is thought to enter the proximal end of the precaval vein where the two precaval veins unite. The detailed constitution of the vascular system of the *Cynopus pysshogaster* is shown in Plate 3, Figs. B, C and D.

Respiratory System

The respiratory system of this animal consists of the trachea, bronchus and the left and the right lobes of the lung. The trachea bifurcates from the esophagus, and descends along the ventral side of the pharynx. At the terminal point of the trachea, it divides to form the left and the right bronchi. The repeatedly bifurcated extremities of the bronchi reach directly the lung interior. They serve as the receptacles of the air from the outside. The structure of the lung of this species is very simple as compaired to that of the other higher animals. The lung

consists merely of the membranous sac without equipping any septums and air chambers inside. Owing to the simplicity, the efficiency of the oxygen consumption is insufficient, so that the cutaneous respiration develops as found in the other amphibians.

The constitution of the venous system in the respiratory system of this species is primitive. Namely, the blood capillaries distributing into the lungs are comb-shaped, not vascular as found in the *Anura*. They are restricted around the surface of the lung.

Urinary System

The urinary and the genital system of the *Cynopus pyrrhogaster* are intimately interwoven. Embryologically, they are thought to be derived from the same origin. The excretory ducts of the two systems enter the cloaca.

1. Kidney. The kidney is constituted by the long columnar shaped glandular organ, situated on either sides of the lumber vertebra, closely apposing to the roof of the body cavity. It is the main organ for the excretion that filtrates the blood and removes the waste substances including nitrogen and the others into the urine. On both sides of the medial margin of the columnar shaped kidneys, the inferior vena cava descends along the mid dorsal line of the body cavity. The kidney receives the arterial supply by way of the pelvic branches from the aorta, which are denominated as the renal artery. The refreshed blood after passing through the kidney, drains back to the inferior vena cava by way of the paired renal veins, running parallel with the renal arteries described before.

The external lateral margin of the kidney is convex formed, from which many renal tubules project outward. They descend caudally and transport urine toward the cloaca. The medial border of the kidney is somehow concave where many branches of the renal arteries and veins flow in and out.

Embryologically, the kidney is thought to be derived from the pronephros and the metanephros in the amphibians. However, in the adult, the main organ for the excretion is the metanephros. The pronephros functions as a passage way of the seminiferous tubules in the male of this species.

The suprarenal bodies are a complex of the several endocrine glands, and are not related to the excretion. They form a number of cell masses burried partially into the ventral surface of the kidney. They are usually called as the adrenal gland, and thought to play a important role for the regulation of the content of the blood sugar.

2. Urinary bladder. The urinary bladder lies anteriorly to the terminal portion of the alimentary tract. It consists of two lobes. They are connected with each other into the common orifice, the urethra, at their bases. The orifice opens in the cloacal cavity without communicating to any of the excretory tubules from the kidney. The excretory tubules, the renal tubules, in the *Cynopus pyrrhogaster* are communicating directry with the cloaca in a point apart from the orifice of the urinary bladder.

3. Fat body. At the time of the dissection, many yellowish bodies are observed around the urogenital organs. These are the fat bodies. In the male they lie posteriorly to the testes, holding closely to the wall of the testicular surface. In the female, the remarkably developed

fat bodies are found around the ovary as seen in the Plate 4, Fig. C.

Robert Rugh (1951), the famous embryologist on the development of the amphibian eggs described, that the fat body is the storage masses built up during the hot summer in anticipation of hibernation, and prepared for the subsequent spring breeding period of time. Therefore, the conspicuous large and matured fat bodies seen in the present experiment are thought to be formed during the late summer.

Reproductive System

1. Male genital organ. The testis of the *Cynopus pyrrhogaster* consists of the two or four pairs of lobes, standing in the row in a cephalocaudal direction. They are located both lateral sides of the convex margin of the kidney. The row of the testicular lobes is suspended to the dorsal body wall by a double folded peritoneum called the mesochium. One or small numbers of the tubules, vas efferentia, arise from each testis projecting outward, and communicate to the kidney. After passing through the kidney, the tubules join to form a main collecting duct, the vas deferens. It extends caudally and transports seminal fluid into the cloaca.

The paired vestigial homologues of the ducts seen in the female individual, the Müllerian duct, are observed running parallel to the positions of two vas deferens. Each of the Müllerian duct starts from the region near the stomach in the upper pleural body cavity, and extends caudally along the outer lateral side of the kidney toward the cloaca. It follows the tortuous tubular course in the upper half of the total length of the Müllerian duct.

2. Female genital organ. The ovary that contains a number of oocytes, the main reproductive organ in the female, consists of a group of the several saclike lobes. It is located in the abdominal cavity on each side of the kidney. Each ovary is suspended by the membranous peritoneum, the mesovarium, from the mid dorsal line of the abdomen. The oogenesis begins just after the ovulation and continues by the end of the October. The ova prepair themselves to the next spawning season through the long period of hibernation. The details of their formation and the development in the ovary will be written in the next paper.

The blood vessels carrying oxygen, nutrients and several substances containing excretory units to and from the ovaries are the pairs of the ovarian arteries and the veins, running over the surface of the mesovarium. Moreover, the much coiled oviduct is found along the lateral side of the ovary. It is suspended to the dorsal body wall by a membranous peritoneum. At the proximal end of the duct, the osteal opening, the abdominal ostium of the oviduct accompanying with the fimbriae, is recognized on both sides of the upper part of the stomach. After ovulation, the ova are said to be carried toward the ostium by the ciliary movement of the fine hairs growing on the surface of the various viscera of the female indivisuals. As soon as the ova enter the oviduct, they begin to the second half of meiosis, and acquire a jelly covering around them. Through these changes, the ova propel down the oviduct toward the cloacal region.

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