ANATOMY OF THE UMBRELLA COCKATOO

ACETATE OVERLAY STRUCTURE IDENTIFICATION SYSTEM

from

AVIAN MEDICINE:
PRINCIPLES AND APPLICATION

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Anatomy of the Umbrella Cockatoo

Anatomic Illustrations by
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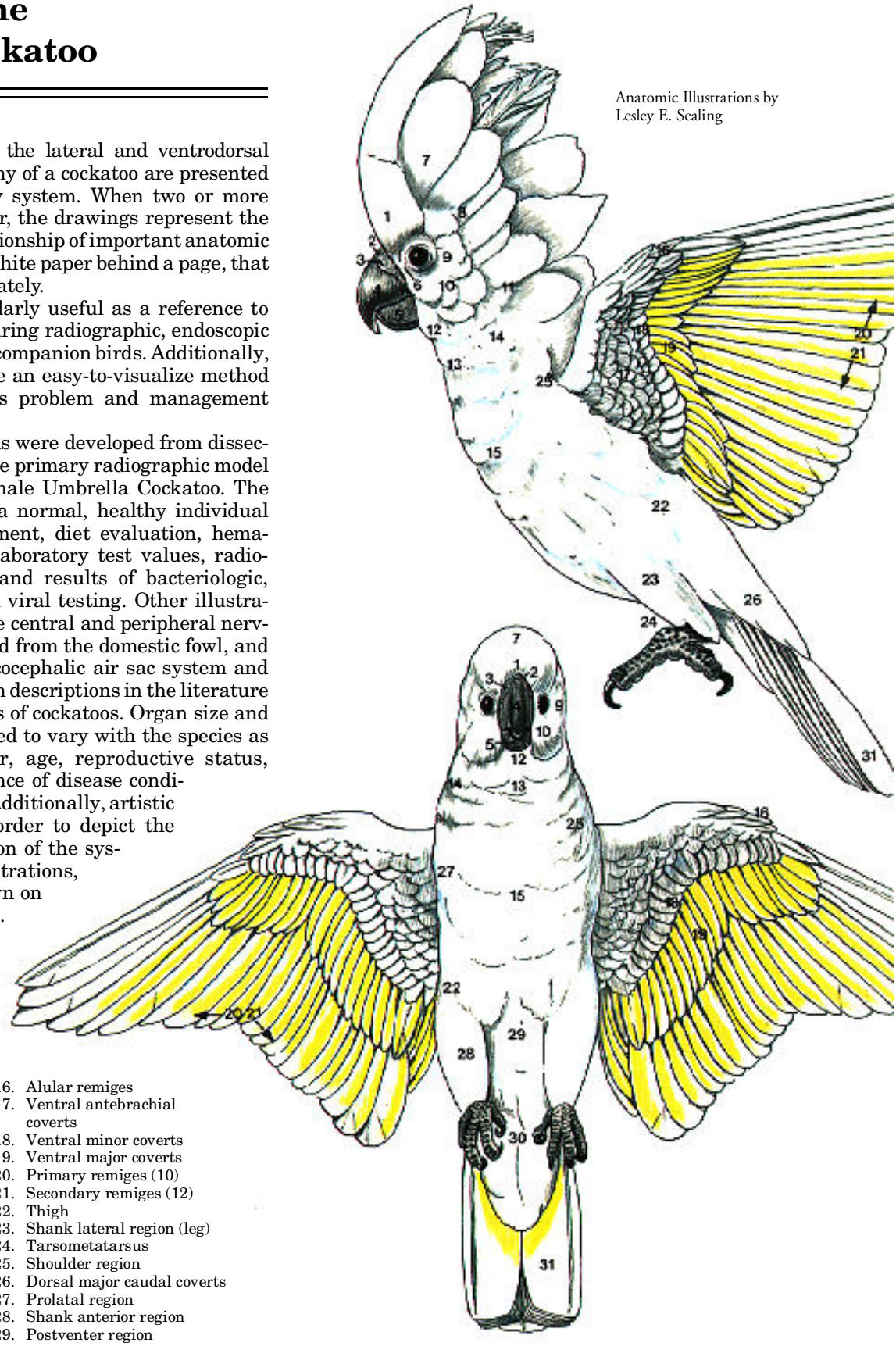
An artist's concept of the lateral and ventrodorsal views of the anatomy of a cockatoo are presented in a clear overlay system. When two or more pages are viewed together, the drawings represent the relative position and relationship of important anatomic structures. By inserting white paper behind a page, that page can be viewed separately.

This format is particularly useful as a reference to general anatomic sites during radiographic, endoscopic or necropsy evaluation of companion birds. Additionally, the format should provide an easy-to-visualize method for discussing a patient's problem and management techniques with clients.

Most of the illustrations were developed from dissections and radiographs. The primary radiographic model was an average-sized female Umbrella Cockatoo. The bird was believed to be a normal, healthy individual based on clinical assessment, diet evaluation, hematologic and biochemical laboratory test values, radiographic interpretations and results of bacteriologic, parasitic, chlamydial and viral testing. Other illustrations, such as those of the central and peripheral nervous systems, were adapted from the domestic fowl, and parameters for the cervicocephalic air sac system and sinuses were adapted from descriptions in the literature combined with dissections of cockatoos. Organ size and location should be expected to vary with the species as well as with the gender, age, reproductive status, prandial state and presence of disease conditions in individual birds. Additionally, artistic liberties were taken in order to depict the most logical representation of the systems. To simplify the illustrations, some body parts are shown on only one side of the figure.



1. Forehead
2. Cere
3. Naris
4. Rhinotheca
5. Gnathotheca
6. Lore
7. Crest
8. Crown
9. Postorbital region
10. Maxillary and mandibular malar region (cheek)
11. Dorsal neck region
12. Submalar region (chin)
13. Ventral neck region (throat)
14. Lateral neck region
15. Proventer region (breast)
16. Alular remiges
17. Ventral antebrachial coverts
18. Ventral minor coverts
19. Ventral major coverts
20. Primary remiges (10)
21. Secondary remiges (12)
22. Thigh
23. Shank lateral region (leg)
24. Tarsometatarsus
25. Shoulder region
26. Dorsal major caudal coverts
27. Prolatal region
28. Shank anterior region
29. Postventer region
30. Tail, ventral region
31. Rectrices

Lateral View

Muscular System

1. M. orbicularis palpebrarum
2. Sclerotic ossicle
3. M. adductor mandibulae externus
4. External ear canal
5. M. branchiomandibularis
6. M. intermandibularis ventralis (mylohyoideus)
7. Zygomatic arch
8. M. rectus capitis ventralis pars lateralis
9. M. rectus capitis ventralis pars medialis
10. M. longus colli ventralis
11. M. sternohyoideus
12. M. biventor cervicis
13. M. tensor propatagialis
14. M. flexor alulae
15. M. abductor alulae
16. M. adductor alulae
17. Radius
18. M. flexor digitorum superficialis
19. M. flexor digitorum profundus
20. Ulna
21. M. interosseus ventralis
22. Fascial plane overlying M. flexor digiti minoris
23. M. ulnometacarpalis dorsalis
24. M. ulnometacarpalis ventralis
25. M. extensor longus digiti majoris
26. M. extensor metacarpi radialis
27. M. pronator profundus
28. M. pronator superficialis
29. M. flexor carpi ulnaris
30. M. brachialis
31. A. radialis
32. A. ulnaris
33. V. basilica
34. M. triceps brachii
35. M. biceps brachii
36. Medianoulnaris nerve
37. Clavicle (furcula)
38. M. pectoralis superficialis
39. Keel projecting from sternum
40. M. serratus superficialis
41. M. intercostales externi
42. M. latissimus dorsi
43. M. expansor secundariorum
44. M. iliofibularis
45. M. levator caudae
46. M. flexor cruris medialis
47. M. depressor caudae
48. M. iliotibialis cranialis
49. M. iliotibialis lateralis
50. M. pubo-ischio-femoralis pars lateralis
51. M. tibialis cranialis
52. M. fibularis longus
53. M. flexor perforans et perforatus digiti III
54. M. flexor perforans et perforatus digiti II
55. M. extensor digitorum longus
56. Digit 1
57. Digit 2
58. Digit 3
59. Digit 4
60. A. and V. metatarsalis dorsalis
61. M. gastrocnemius pars lateralis

Inset: Infraorbital Sinus and Cervicocephalic Air Sac

62. Nares
63. Rostral diverticulum of infraorbital sinus (IS)
64. Maxillary chamber of IS
65. Preorbital diverticulum of IS
66. Infraorbital diverticulum of IS
67. Suborbital chamber of IS
68. Postorbital diverticulum of IS
69. Preauditory diverticulum of IS
70. Mandibular diverticulum of IS
71. Cranial portion cervicocephalic air sac
72. Cervical portion cervicocephalic air sac

Respiratory System

73. Larynx
74. Laryngeal mound
75. Cervical air sac
76. Trachea
77. Pneumatic diverticulum of clavicular air sac into clavicle
78. Pneumatic diverticulum of clavicular air sac into scapula
79. Pneumatic diverticulum of clavicular air sac into coracoid
80. Pneumatic diverticulum of clavicular air sac into humerus (light blue)
81. Clavicular air sac (blue)
82. Pneumatic diverticulum of clavicular air sac into sternum (light blue)
83. Cranial thoracic air sac (striated)
84. Caudal thoracic air sac (light blue)
85. Ventral hepatic peritoneal cavity (stippled)
86. Pneumatic diverticulum of abdominal air sac into femur (light blue)
87. Abdominal air sac (blue)
88. Lung (impression of 6th rib)
89. Syrinx

Inset: Cut-away of Skull

90. Cere
91. Nasal cavity
92. M. genioglossus
93. Cranial nerve II (optic)
94. Antevestibular recess

Circulatory System

95. Left internal carotid artery
96. Left external carotid artery
97. Left jugular vein
98. Left brachiocephalic trunk
99. Left subclavian artery
100. Left axillary artery and vein
101. Brachial artery
102. Superficial ulnar artery
103. Radial artery
104. Recurrent ulnar artery
105. Ulnar artery
106. Left thyroid gland
107. Left parathyroid gland
108. Left ultimobranchial gland
109. Right brachiocephalic trunk
110. Area of pectoralis muscle
111. Left cranial vena cava
112. Pulmonary trunk
113. Auricle of left atrium
114. Left pulmonary veins
115. Left pulmonary arteries
116. Right hepatic portal veins
117. Left lobe of liver
118. Thoracic aorta
119. Left pectoral artery and vein
120. Intercostal arteries
121. Celiac artery
122. Cranial mesenteric artery
123. Caudal vena cava
124. Left external iliac artery
125. Left femoral artery
126. Left internal iliac artery
127. Median caudal artery
128. Left external iliac vein
129. Left ischiatic vein
130. Left ischiatic artery
131. Left internal iliac vein
132. Left caudal tibial artery
133. Left cranial tibial artery
134. Left dorsal metatarsal artery

Inset: Digestive Portion of Head

135. Palatine salivary glands (medial)
136. Angularis oris salivary glands
137. Maxillary salivary glands
138. Roof of oropharynx
139. Tongue
140. Rostral mandibular salivary glands
141. Lingual salivary glands
142. Caudal mandibulary salivary glands
143. Choanae (not seen)
144. Sphenopterygoid salivary glands
145. Esophageal opening
146. Cricoarytenoid salivary glands
147. Esophagus

Central Nervous System and Digestive System

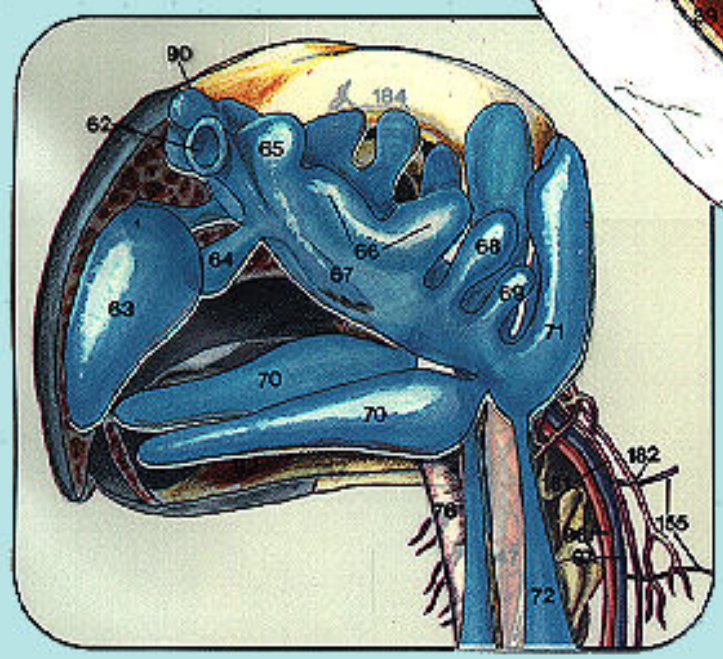
148. Cerebral hemisphere
149. Optic lobe
150. Cerebellum
151. Medulla oblongata
152. Cranial nerve I
153. Pituitary gland
154. Spinal cord
155. Cervical spinal nerve
156. Cervical esophagus
157. Crop
158. Brachial plexus
159. N. radialis
160. Thoracic esophagus
161. Intercostal spinal nerve
162. Proventriculus
163. Isthmus
164. Ventriculus
165. Medianoulnar nerve
166. Lumbar plexus
167. Sacral plexus
168. Pudendal plexus
169. Caudal plexus
170. Ischiatic nerve (branches to fibular and tibial nerves)
171. Intestines
172. Pancreas
173. Obturator nerve
174. Femoral nerve

Inset: Cut-away of Skull

175. Cranial nerve III
176. Cranial nerve IV
177. Cranial nerve V
178. Cranial nerve VI
179. Cranial nerve VII
180. Cranial nerve IX
181. Cranial nerve X
182. Cranial nerve XI
183. Cranial nerve XII
184. Supraorbital nerve
185. Lacrimal gland nerve
186. Sphenopalatine ganglion
187. Chorda tympani
188. Nasopalatine nerve

Skeletal and Urogenital System

189. Vertebral canal
190. Cervical vertebra
191. Clavicle
192. Radial carpal bone
193. Alular digit
194. Major metacarpal bone
195. Minor metacarpal bone
196. Major digit
197. P1
198. P2
199. Minor digit
200. Ulnar carpal bone
201. Humerus (partially shown)
202. Thoracic vertebra
203. Synsacrum
204. Cranial division of kidney
205. Middle division of kidney
206. Caudal division of kidney
207. Vertebral ribs
208. Uncinate process
209. Sternal ribs
210. Caudal vertebrae
211. Pygostyle
212. Cloaca
213. Rectum
214. Left adrenal gland
215. Left testicle
216. Ductus deferens
217. Cranial cnemial crest
218. Ischium
219. Fibula
220. Tibiotarsus
221. Pubis
222. Tarsometatarsal 2,3,4
223. P1
224. P2
225. P3
226. P4
227. P5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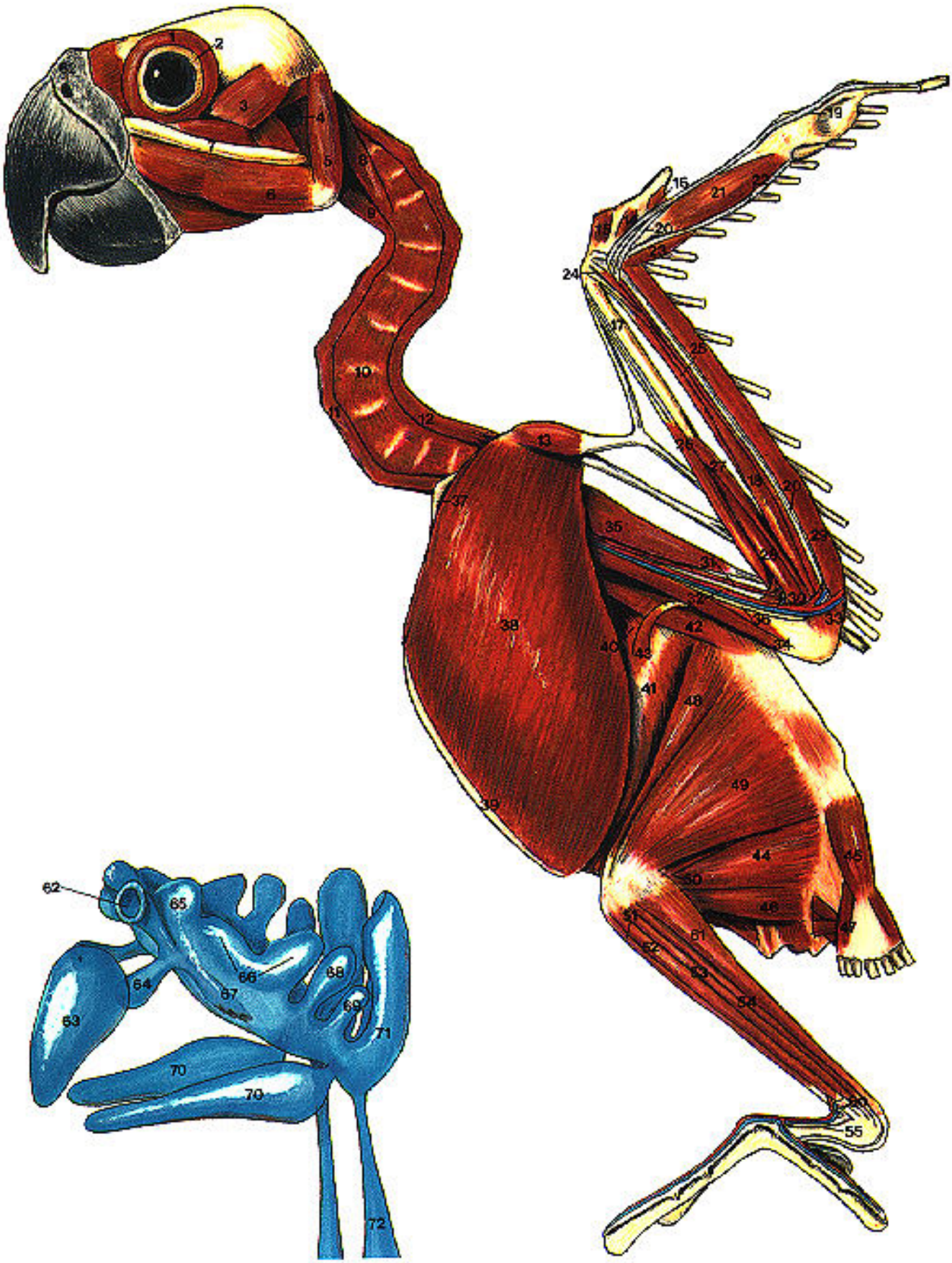
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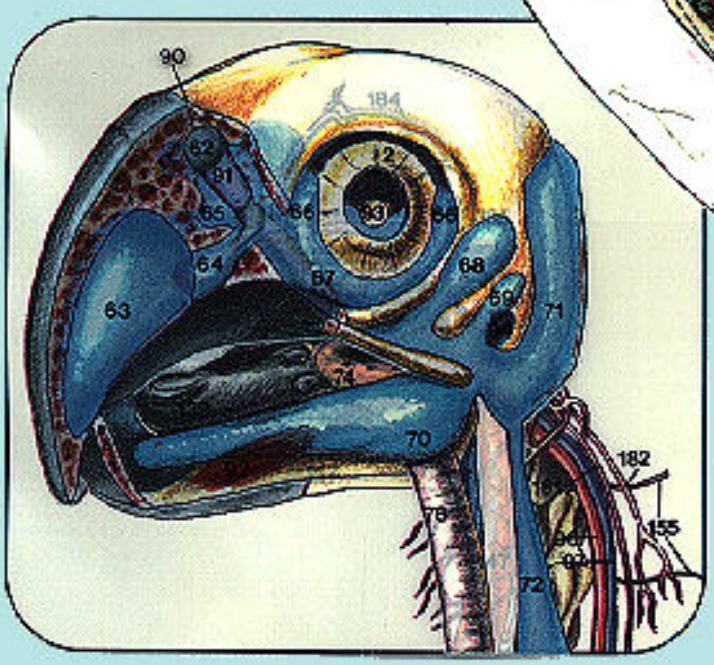
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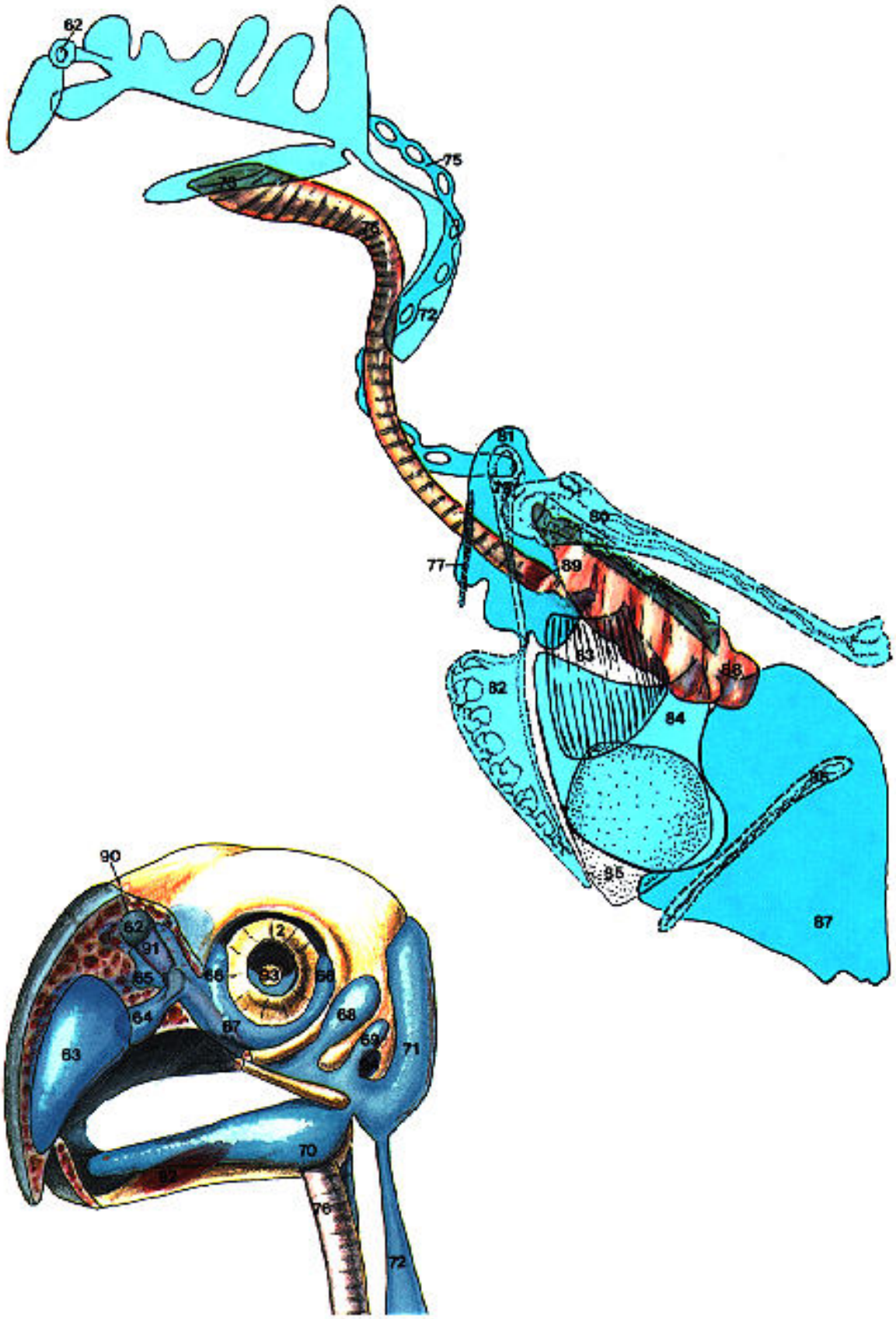
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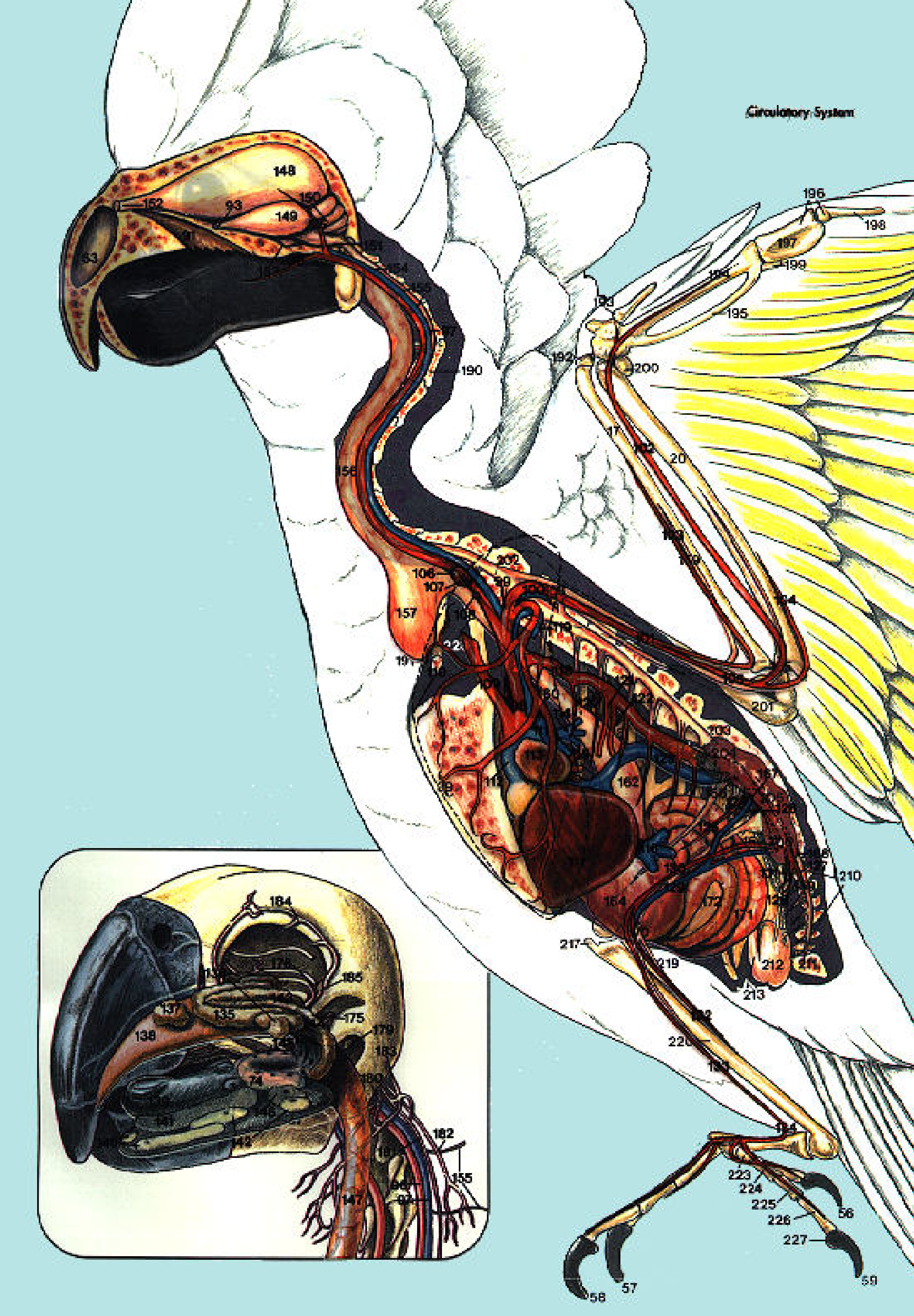
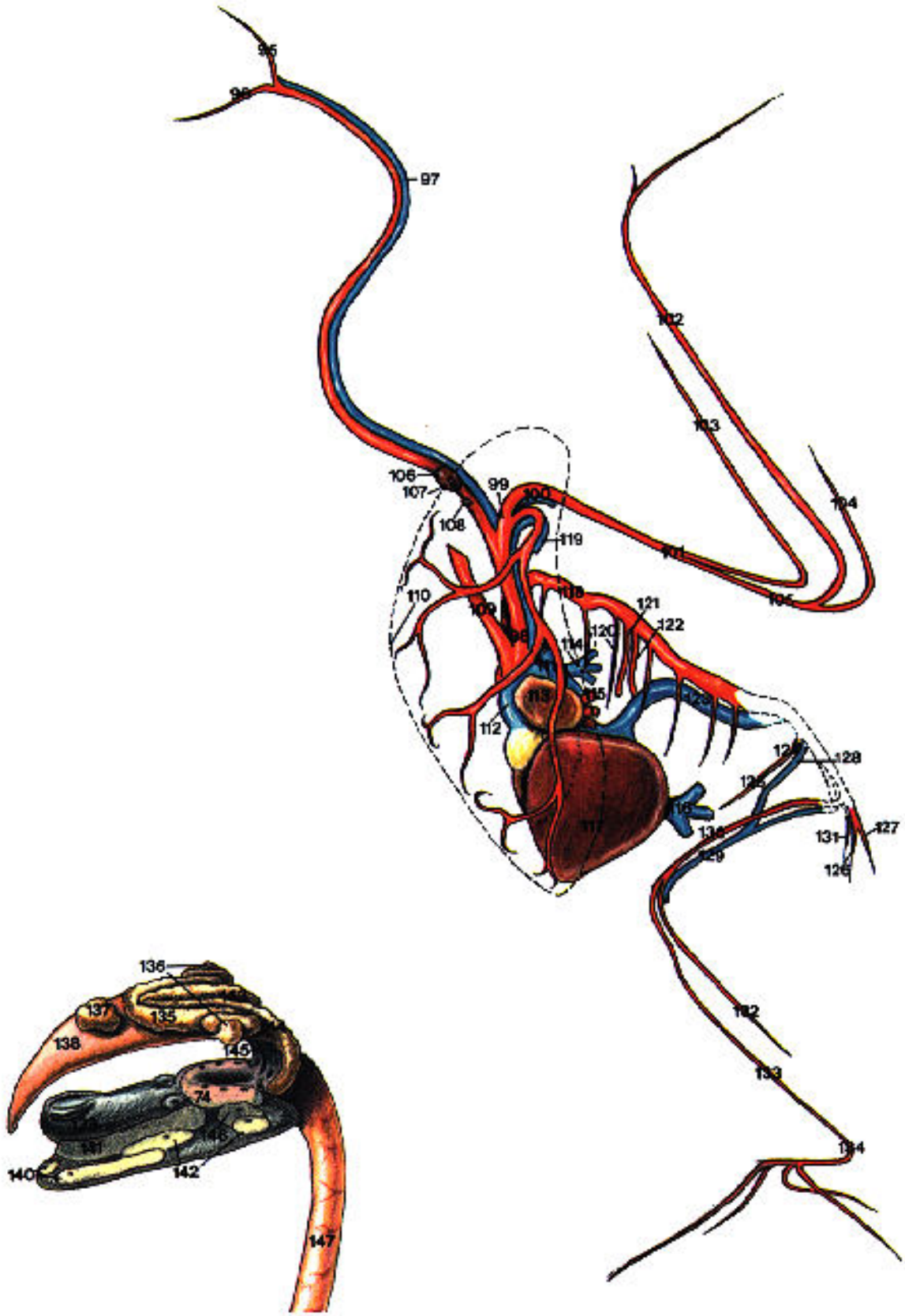
Circulatory System

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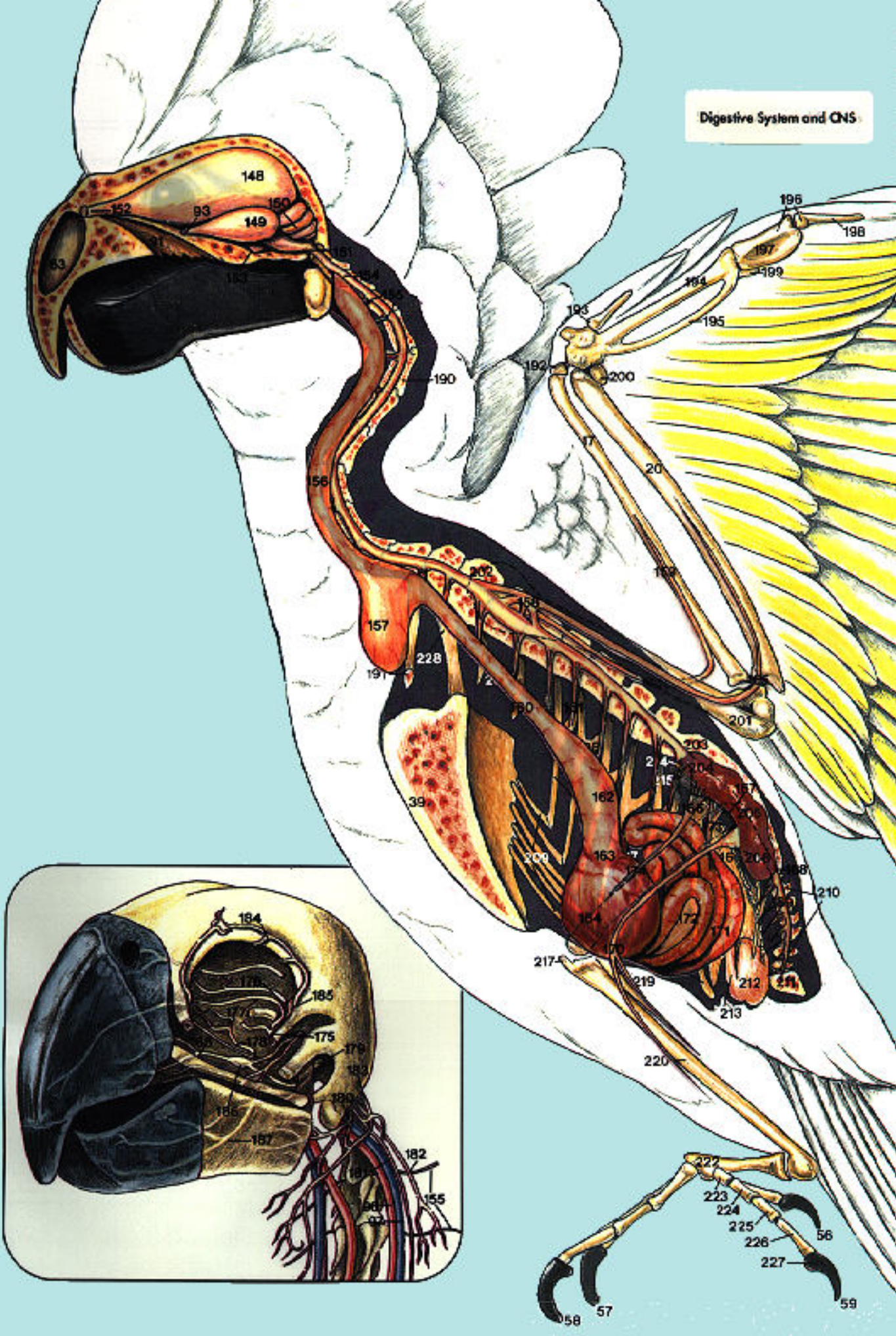
Digestive System and CNS
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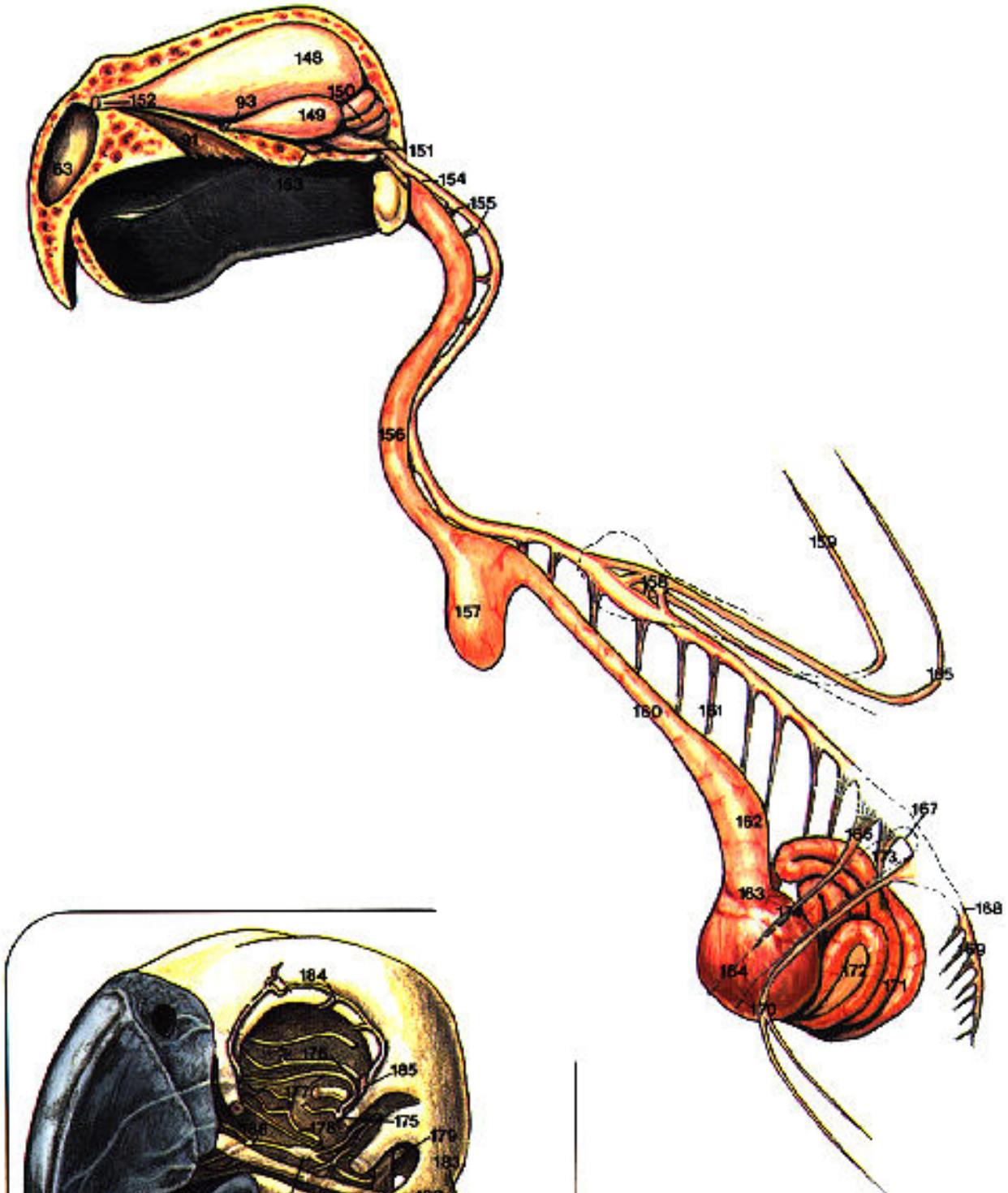
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Ventrodorsal View

Muscular System

1. M. orbicularis palpebrarum
2. Sclerotic ossicle
3. M. adductor mandibulae externus
4. M. intermandibularis (mylohyoideus)
5. Zygomatic arch
6. M. sternohyoideus
7. Coracoid
8. Clavicle (furcula)
9. M. tensor propatagialis
10. M. flexor alulae
11. M. abductor alulae
12. M. adductor alulae
13. Radius
14. M. flexor digitorum profundus
15. M. flexor digitorum superficialis
16. M. extensor longus digiti majoris
17. M. interosseus ventralis
18. M. ulnometacarpalis dorsalis
19. M. ulnometacarpalis ventralis
20. M. extensor metacarpi radialis
21. Tensor propatagialis pars brevis tendon
22. Tensor propatagialis pars longus tendon
23. M. pronator profundus
24. M. pronator superficialis
25. M. flexor carpi ulnaris
26. M. brachialis
27. A. radialis
28. A. ulnaris
29. V. basilica
30. Medianoulnar nerve
31. M. triceps brachii
32. M. biceps brachii
33. M. pectoralis superficialis
34. M. supracoracoideus
35. M. ambiens
36. M. femorotibialis internus
37. M. iliotibialis cranialis
38. Area of M. ulnometacarpus ventralis
39. M. pubo-ischio-femoralis pars medialis
40. M. tibialis cranialis
41. M. fibularis brevis
42. M. fibularis longus
43. M. flexor perforans et perforatus digiti III
44. M. extensor digitorum longus
45. Digit 1
46. Digit 2
47. Digit 3
48. Digit 4
49. A. and V. metatarsalis dorsalis
50. M. gastrocnemius (medial head)
51. Vent
52. Extensor retinaculum
53. M. rectus abdominis
54. M. obliquus abdominis externus
55. M. flexor cruris medialis
56. Sternum
57. Rib 8 (dotted area = ribs and sternum)

Inset: Gastrointestinal Tract

58. Thoracic esophagus
59. Right lobe of liver
60. Left lobe of liver
61. Proventriculus
62. Isthmus
63. Ventriculus
64. Descending duodenum
65. Ascending duodenum
66. Pancreas
67. Ascending loop of colon

Respiratory System

68. Preorbital diverticulum of infraorbital sinus (IS)
69. Infraorbital diverticulum of IS
70. Rostral diverticulum of IS
71. Nares
72. Maxillary chamber of IS
73. Larynx
74. Mandibular diverticulum of IS
75. Cervical portion of cervicocephalic air sac (light blue)
76. Trachea
77. Cervical air sac (blue)
78. Clavicular air sac (blue)
79. Pneumatic diverticulum of clavicular air sac into clavicle (dashed outline)
80. Pneumatic diverticula of clavicular air sac into the coracoid (dashed outline)
81. Right cranial thoracic air sac (striated)
82. Left cranial thoracic air sac (striated)
83. Right caudal thoracic air sac (light blue)
84. Left caudal thoracic air sac (light blue)
85. Pneumatic diverticula of clavicular air sac into the humerus (dashed outline)
86. Right ventral hepatic peritoneal cavity (stippled)
87. Left ventral hepatic peritoneal cavity (stippled)
88. Right abdominal air sac (blue)
89. Left abdominal air sac (blue)
90. Pneumatic diverticula of abdominal air sacs into the femur (dashed outline)

Inset: Male Urogenital System

91. Lung
92. Rib 7
93. Caudal vena cava
94. Aorta
95. Left testicle
96. Left adrenal gland
97. Cranial division of kidney
98. Middle division of kidney
99. Caudal division of kidney
100. Left common iliac vein
101. Left external iliac artery and vein
102. Right caudal renal vein
103. Right ureter
104. Right vas deferens
105. Left femoral artery and vein
106. Ilioishiatic foramen
107. Left ischiatic artery and vein
108. Caudal mesenteric artery and vein
109. Left internal iliac artery
110. Median caudal artery
111. Rectum
112. Cloaca

Circulatory and Central Nervous System

113. Cerebral hemisphere
114. Cranial nerve II
115. Optic chiasm
116. Pituitary gland
117. Cerebellum
118. Optic lobe
119. Spinal cord
120. Mandible
121. Hyoid bone
122. Right internal carotid artery
123. Left internal carotid artery
124. Right jugular vein
125. Left jugular vein
126. Right thyroid gland
127. Left thyroid gland
128. Right parathyroid gland
129. Left subclavian artery and vein
130. A. and V. axillaris
131. A. collateralis radialis
132. A. and V. radialis
133. A. and V. ulnaris
134. A. and V. recurrent ulnaris
135. V. collateralis ulnaris
136. A. pectoralis
137. Area of pectoral muscles (dashed outline)
138. Auricle of left atrium
139. Right lobe of liver
140. Left lobe of liver
141. Left popliteal artery and vein
142. Left cranial tibial artery and vein
143. Left caudal tibial artery and vein
144. Left dorsal metatarsal artery and vein
145. Left cranial vena cava
146. Aorta
147. Pulmonary trunk
148. Pulmonary artery and vein
149. Right cranial vena cava
150. Auricle of right atrium
151. Right ventricle
152. Left ventricle
153. Coronary arteries and veins
154. Right femoral artery and vein
155. Right external iliac artery and vein
156. Right ischiatic artery and vein
157. Right ultimobranchial gland
158. Right and left brachiocephalic trunks
159. Left fibular artery
160. Left internal iliac artery
161. Caudal mesenteric artery and vein
162. Right caudal renal vein

Inset: Mature Ovary

163. Immature follicles
164. Mature follicle
165. Post-ovulatory follicle (calix)
166. Infundibulum
167. Stigma
168. Magnum
169. Dorsal ligament of oviduct
170. Oviductal blood vessels
171. Isthmus
172. Ventral ligament of oviduct
173. Uterus
174. Vagina
175. Sphincter vaginae

Digestive System

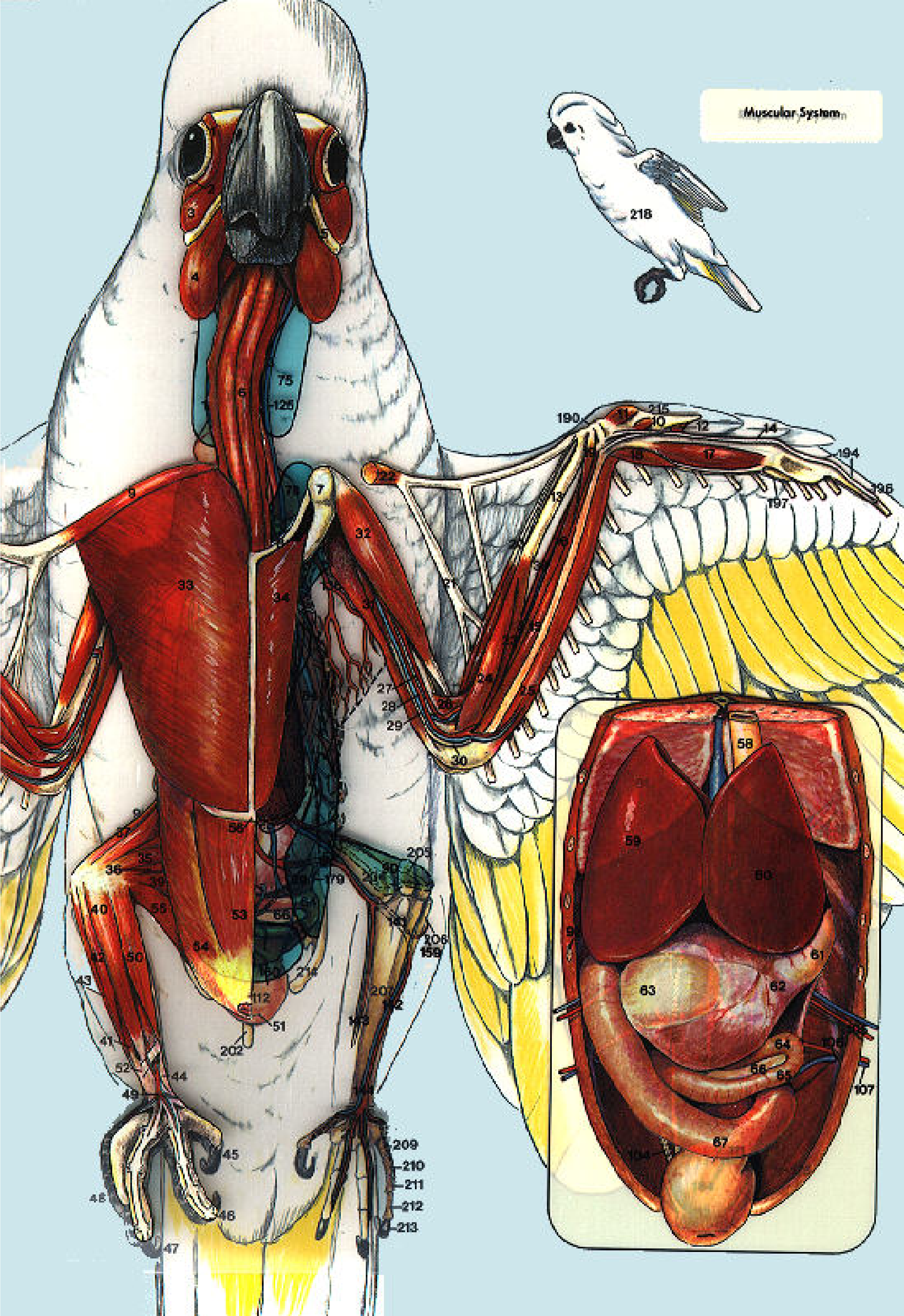
176. Tongue
177. Cervical esophagus
178. Ingluvies (crop)
179. Supraduodenal loop

Inset: Immature Ovary

180. Ovary
181. Oviduct
182. Coprodeum
183. Urodeum
184. Proctodeum

Skeletal and Urogenital Systems

185. Cervical vertebra
186. Syrinx
187. Scapula
188. Primary bronchus
189. Left humerus
190. Radial carpal bone
191. Ulna
192. Minor metacarpal bone
193. Major metacarpal bone
194. Major digit
195. P1
196. P2
197. Minor digit
198. Ulnar carpal bone
199. Ostium for caudal thoracic air sac
200. Synsacrum
201. Ischium
202. Pygostyle
203. Coccygeal vertebrae
204. Femur
205. Patella
206. Fibula
207. Tibiotarsus
208. Tarsometatarsus 2,3,4
209. P1
210. P2
211. P3
212. P4
213. P5
214. Pubic bone
215. Alular digit
216. Rostrum mandibulare (gnathotheca)
217. Rostrum maxillare (rhinotheca)
218. Miniature lateral perspective of ventrodorsal model.


Muscular System
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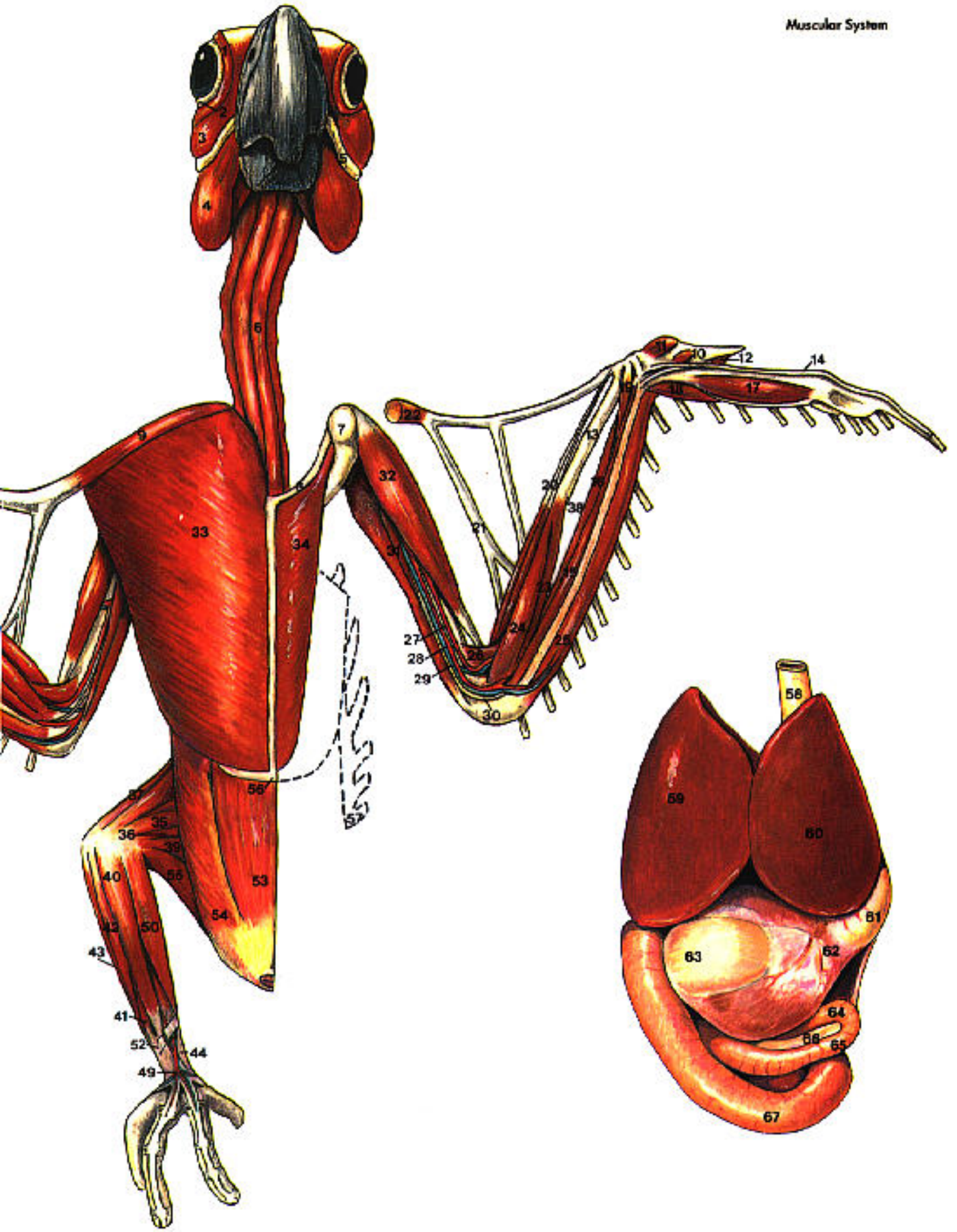
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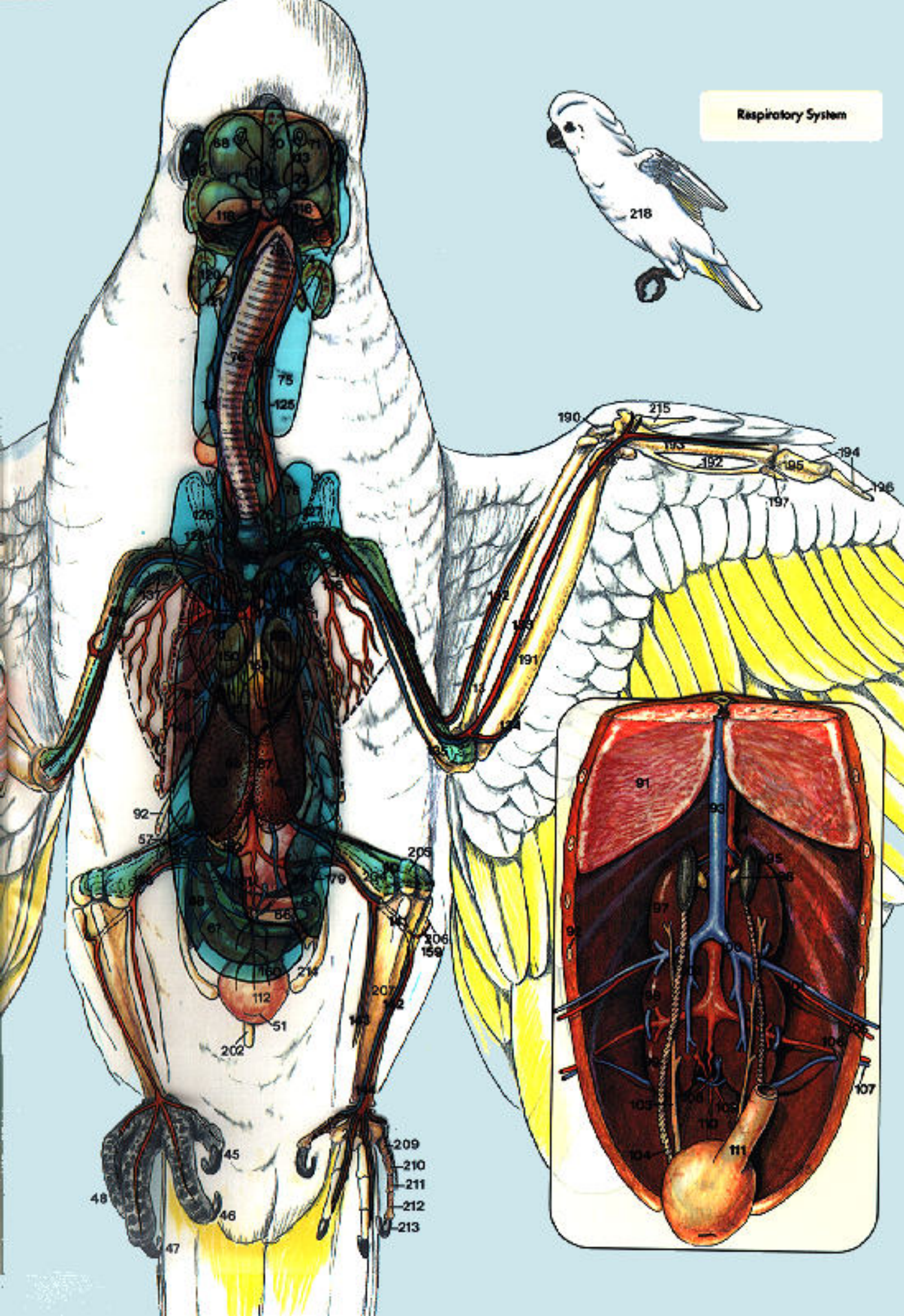
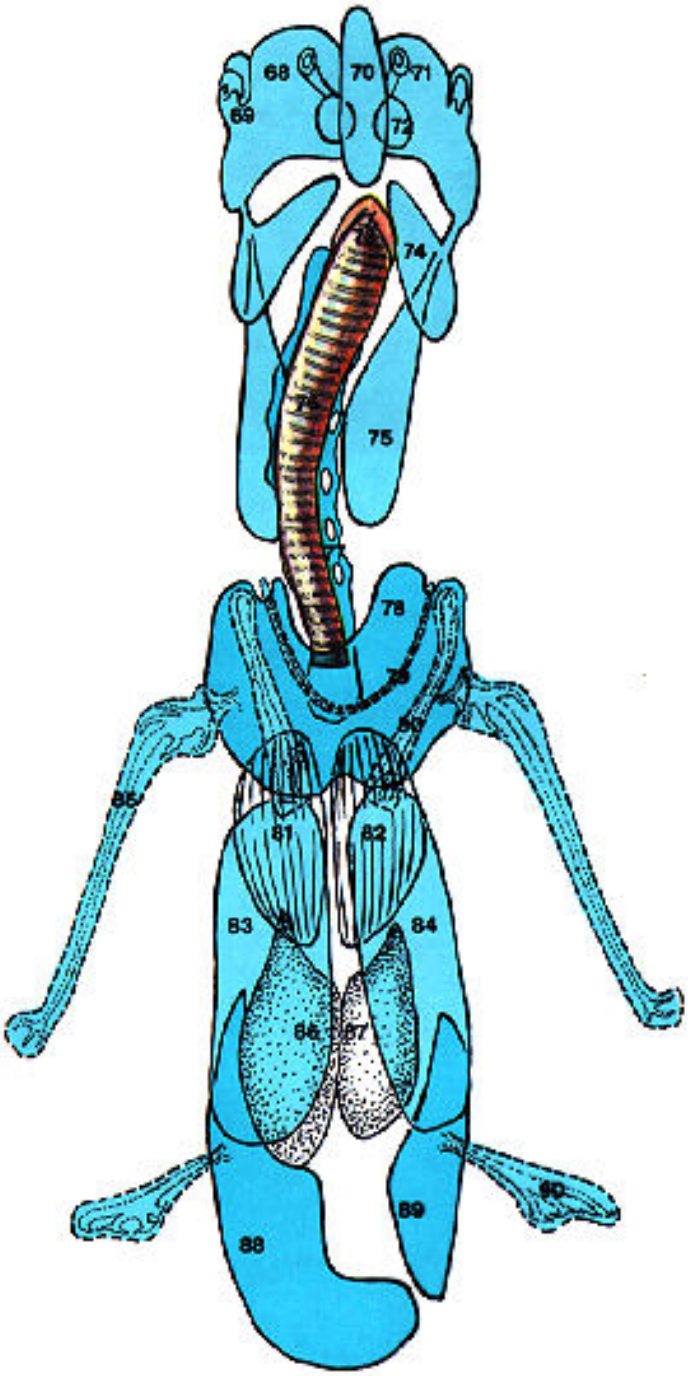
Respiratory System

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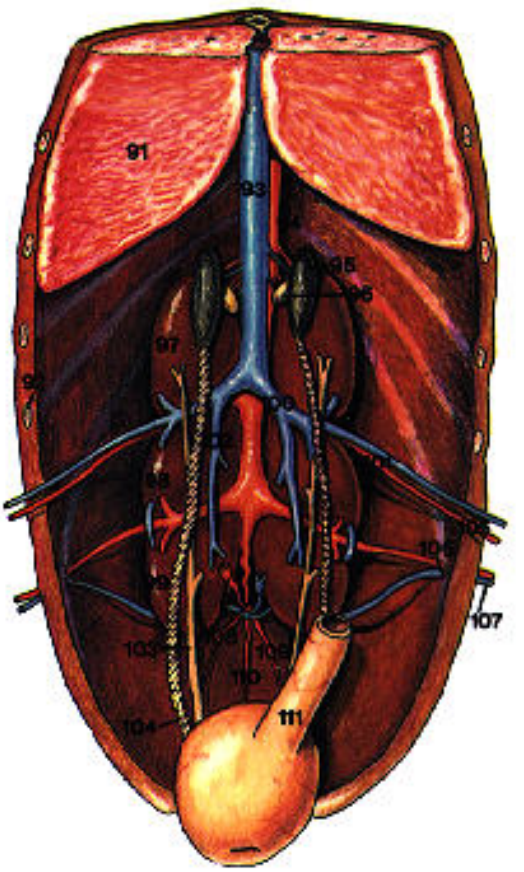
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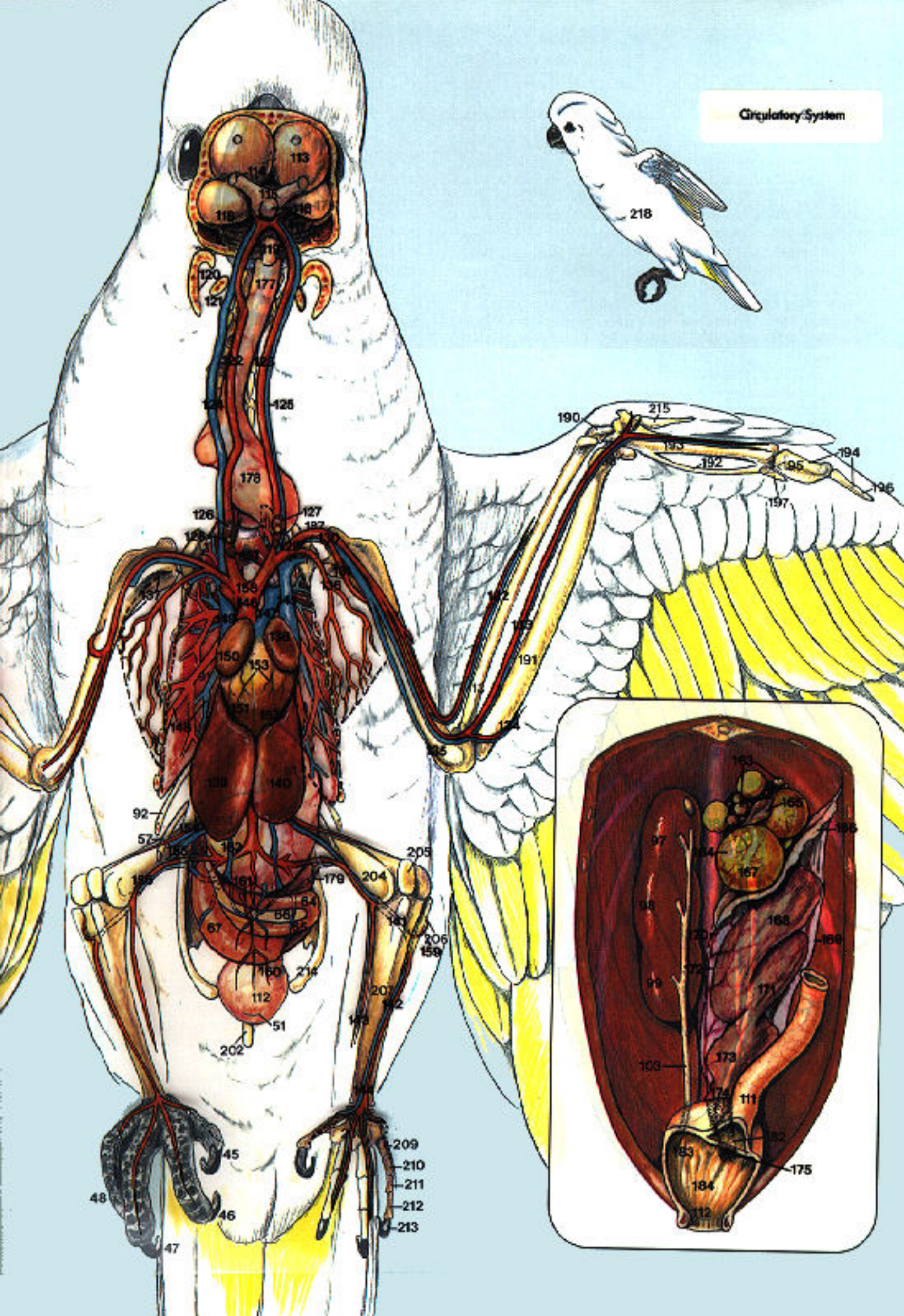
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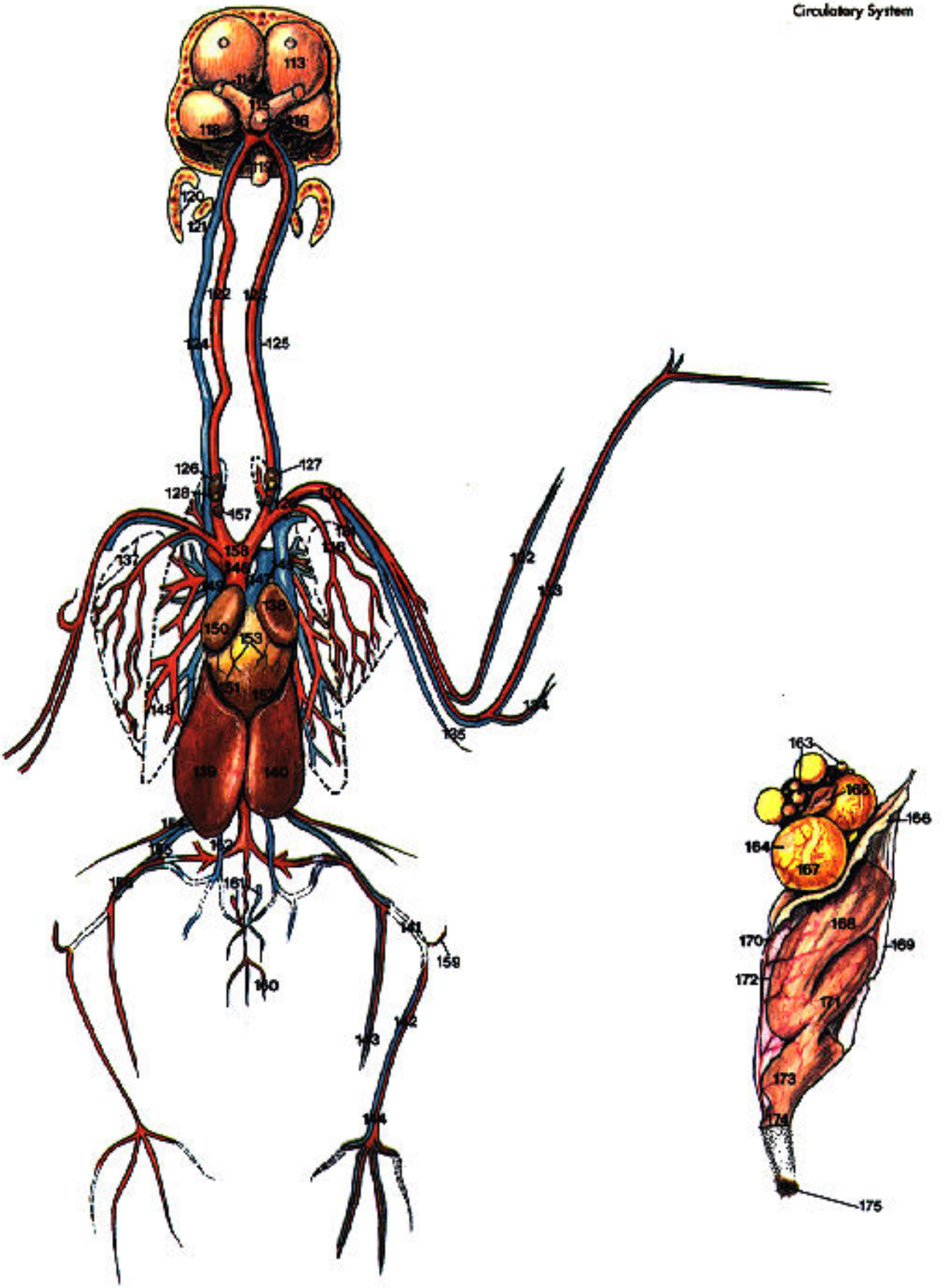
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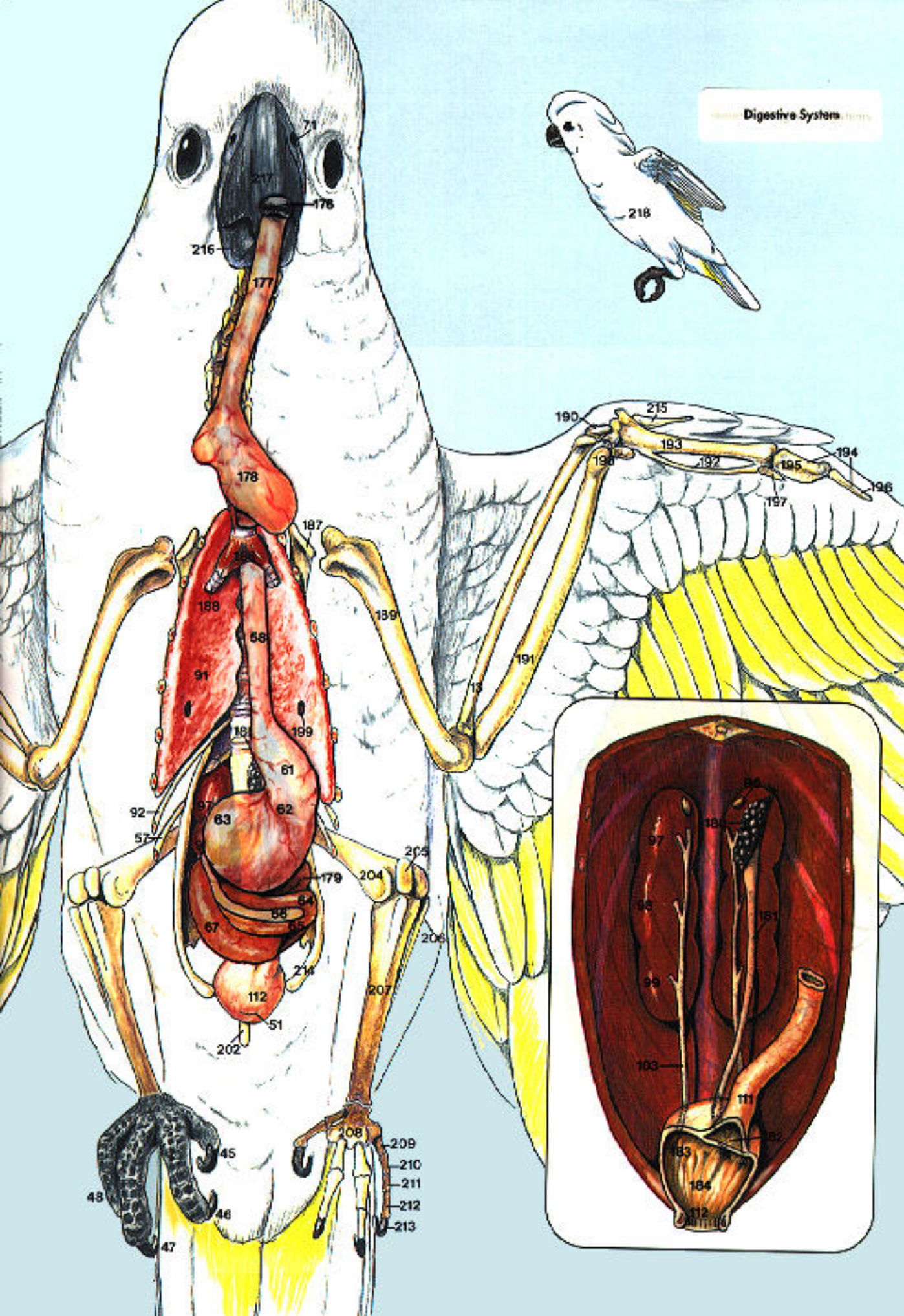
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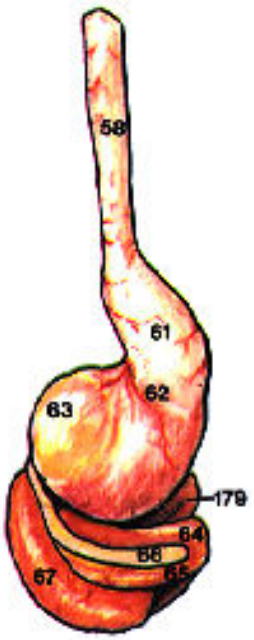
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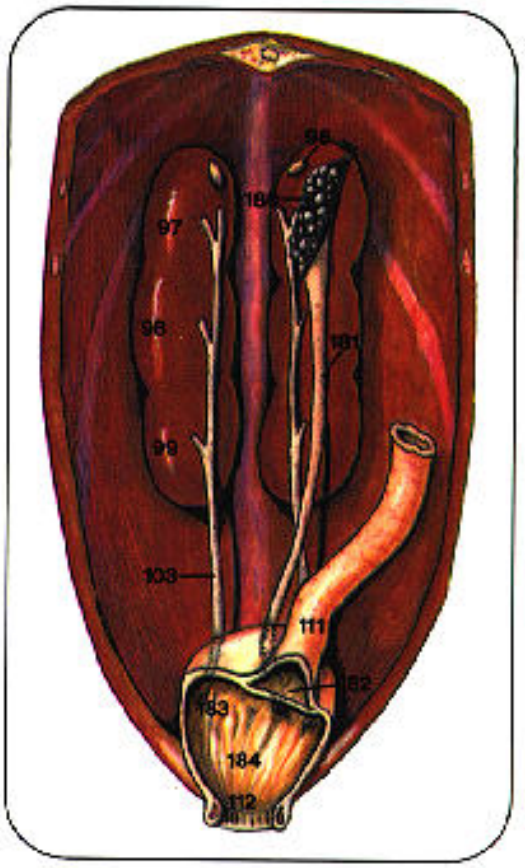
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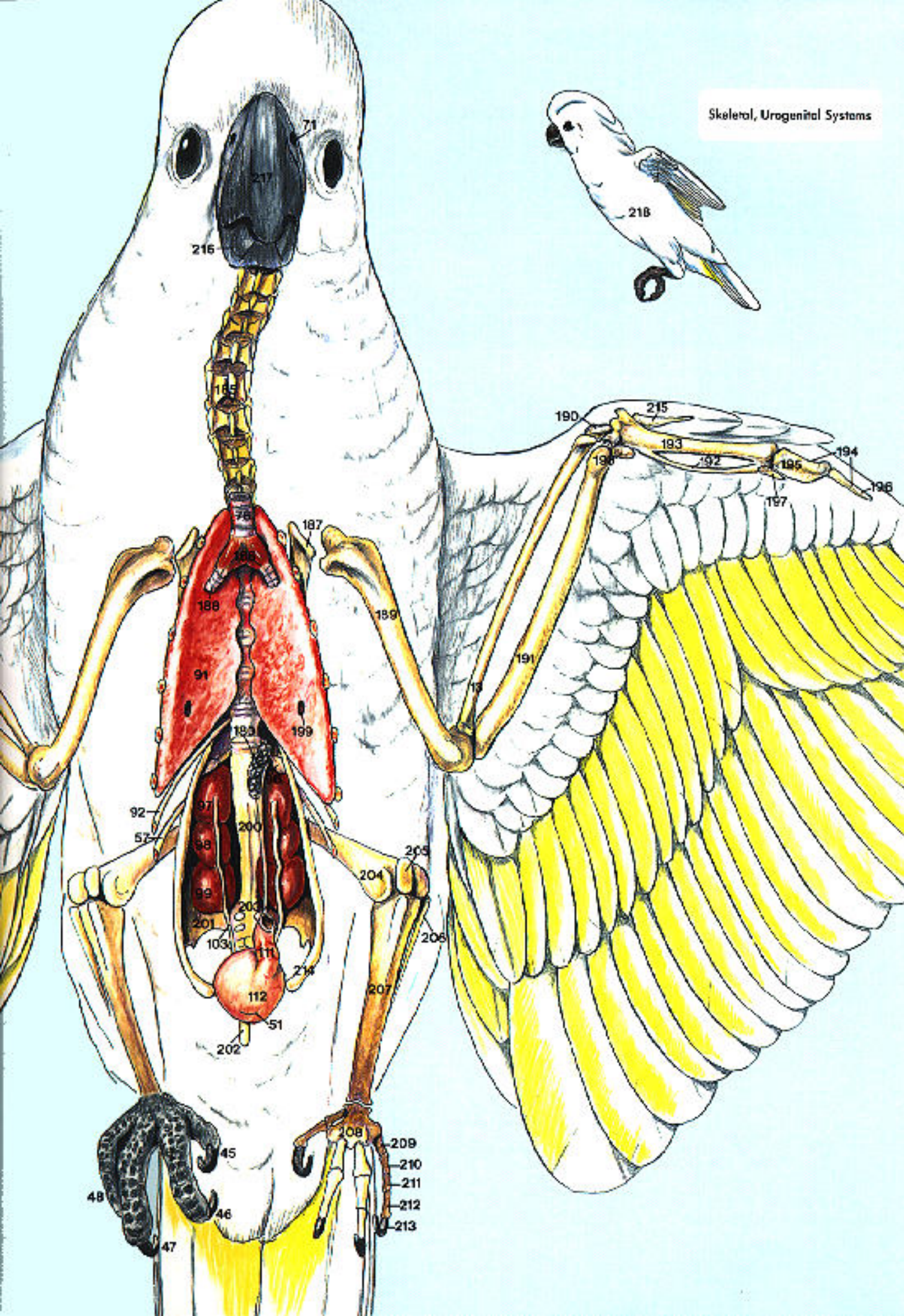
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Lateral View

Muscular System The muscles of the trunk, neck, head and appendages are displayed. The vessels of the greatest clinical importance and their relationship to the muscles and bones are also shown. Stubs of the rachis from the primary and secondary flight feathers are depicted from their origin on the dorsal surface of the wing.

The inset shows a composite drawing of information available concerning the sinuses and cervicocephalic air sac system of psittacine birds.

Respiratory System A composite drawing provides the clinician with insight into the avian respiratory system. The ventral hepatic peritoneal cavity is also represented in this view. This layer has been specially designed so that all underlying structures are clearly visible. The individual layer can be segregated for study by placing a sheet of white paper under the acetate.

The relationship of the bones of the head and sinuses in an Umbrella Cockatoo are shown in the inset.

Circulatory System This layer depicts the clinically relevant portions of the circulatory system, along with the liver, thyroid and parathyroid glands. The relative position of the pectoralis muscle is indicated with dotted lines for comparative purposes. Other dotted areas indicate that vessels are passing under or into anatomic structures.

The digestive portion of the head is depicted in the inset, including the tongue, palate, esophagus and salivary glands.

Digestive System and CNS The lateral orientation of the digestive system and portions of the central nervous system are depicted. The humerus is represented with a dotted line for orientation purposes.

The inset shows an enlargement of a representation of the orientation of the nerves with respect to the bones of the head and neck. Note the location and degree of innervation in the beak.

Skeletal, Urogenital Systems The skeletal and urogenital systems are superimposed over the exterior of the bird. The lateral body wall has been darkened to enhance the color of overlying anatomic structures. The bird has been transected sagittally to allow visualization of the spinal cord and kidneys.

Ventrodorsal View

The ventrodorsal view illustrates a live bird in normal perching position (the femur, tibiotarsus, tarsus and metatarsus have been foreshortened); therefore, the drawing does not represent radiographic positioning of the legs. The primary emphasis is on the torso.

Muscular System The superficial pectoralis muscle has been removed from the left side of the bird to expose part of the coracoid bone and the clavicle. The tendon of the supercoracoidius is barely visible. The left portion of the abdominal muscle has also been removed. It should be noted that the pectoralis muscle fills the space between the coracoids, holding the crop centrally and away from the bones. The cranial extension of this muscle is clear in photographs, but has not been accurately depicted in many previous drawings of Psittaciformes. The rachis of the transected primary and secondary feathers are depicted from their origin on the dorsal surface of the wing.

The inset is an enlargement of the abdominal cavity depicting the relationship of the liver, thoracic esophagus, proventriculus, ventriculus and intestines.

Respiratory System The lungs were not included in the ventrodorsal drawing of the respiratory system so that the relative position of the air sacs could be clearly depicted. For clarity purposes, the trachea is depicted in an unnatural position lying over the esophagus and crop. The artist's concept of a composite of information on pneumatized avian bones is also provided. The ventral hepatic peritoneal cavity and cranial thoracic air sacs have been visually enhanced with textures for improved visualization.

A transection of a male cockatoo is shown in the inset. The liver and gastrointestinal tract have been removed to reveal the organs associated with the dorsal body wall. Note the melanistic testicles, which commonly occur in cockatoos.

Circulatory System The complex system of vessels has been simplified in order to facilitate identification of those structures that are most clinically applicable for venipuncture, cannulation and surgery.

The position of the lungs and pectoral muscles are represented by dotted lines. This layer includes the liver, thyroid glands, parathyroid glands and ultimobranchial glands (for position only, as the parathyroid and ultimobranchial glands are difficult to visualize. A transected view of the brain, skull, mandible and hyoid bones are visible in this view.

The position of the mature ovary and oviduct are illustrated in the inset.

Digestive System The esophagus and crop are shown as solid structures for clarity. In reality, these organs are thin, translucent membranes. The break in the thoracic esophagus indicates the point where the organ courses dorsally to the syrinx and primary bronchi.

The inset shows a view of the urogenital system of a developing female. The cloaca is opened ventrally to reveal the positions of the rectum, ureters and oviduct.

Skeletal, Urogenital Systems Shown are the skeleton and dorsal body wall of a female cockatoo with the heart, liver and gastrointestinal tract removed. An end-on view of the ribs is provided for reference purposes. Note the melanistic ovary, which is common in cockatoos.

Nomenclature References

Baumel JJ (ed): *Nomina Anatomica Avium*. New York, Academic Press, 1979.

King AS, McLelland J: *Form and Function in Birds.* Vols 1-4. New York, Academic Press, 1979, 1981, 1985, 1989.