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THE INDIAN VETERINARY JOURNAL

(The Journal of the All-India Veterinary Association)

*A Monthly Record of
Veterinary Science*



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THE INDIAN VETERINARY JOURNAL

THE JOURNAL OF THE ALL-INDIA VETERINARY ASSOCIATION]

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★

A Monthly Record of Veterinary Science
Devoted to the cause of the
Veterinary Profession

★

EDITOR

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Editorial

A COLLEGE IS BORN

Mysore has been struggling hard to have a Veterinary College of its own for over a decade now. Many were the arguments, for and against, such a step. Heated discussions were raging over its necessity and over its place of location. Finally it was settled that it should be located in that beautiful City of Bangalore, so full of animal wealth of all descriptions—high-grade cows, bullocks and bulls, race-horses, jute-ponies, valuable dogs and cats. It is a well-known fact that Mysore plateau is a breeding tract of some of the finest breeds of fast trotting cattle and to meet the milk problem, people have been maintaining high-grade cross-bred cows and murrah buffaloes. Bangalore is full of them. Added to these, there are the Mysore Serum Institute, the Regional Research Institute of Dairy Science, the Hebbal Agricultural Farm, the Sewage farm, etc. Under such favourable auspices, we learn from the daily papers that “a new Veterinary College is to be opened in the third week of July 1958. It will provide a four-year course of study leading to the award of B.V.Sc., degree of the University of Mysore.” All honour to Mysore!

We were ourselves much exercised over this delayed initiative of the enlightened State of Mysore. With the integration of States, Mysore has become a big unit and she has to cater to the needs of varied types of land and livestock. In fact she may need more than one College. The College therefore makes its appearance not a day too soon and we only hope it will be properly planned and even more properly run. For the present, the College will be located in the Mysore Serum Institute. Let us hope it is only a measure of expediency. Much clinical wealth would be available only within the limits of this civilised City. The College, we feel could be located within the City limits or very close to it in the midst of a well laid-out Livestock farm, with a dairy unit attached and the necessary laboratory

and teaching facilities provided. The clinic should be a model one to suit this model city. Either the Tasker Veterinary Hospital could be improved or a new one built. Bangalore is a city of extensions and consequently a city of distances. There should be no 'extension', without a Veterinary Hospital of its own. We feel certain that those who are at the helm of affairs would leave no stone unturned to make this new College a model one for teaching of all aspects of Animal Husbandry Science.

The non-recurring expenditure of Rs. 27,85,000/- will be met by the Central Government - 75 per cent in the shape of grant and 25 per cent as loan. The T.C.M. of the United States of America will render substantial aid to the tune of Rs. 150,000 towards laboratory equipment and Rs. 20,000/- towards library books. So the stage is well set for a grand start. Let us hope the required personnel will be easily available to run this institution. We most heartily congratulate Dr. K. S. Shetty, the Director of Animal Husbandry Services in Mysore State for the very vigorous steps he had taken to make us all feel that it is a 'dream realised.' We wish the new college every success!

Since the above matter had gone into print, we come to understand that a new Veterinary College has also been opened at Nagpur in Bombay State. We only hope it is also on the approved University model. We are against lowering of standards, for any reason whatever.

So, it is a twin birth of Veterinary Colleges this year! Unlike family planning, this is a field where higher birth-rate could be encouraged for some more time to come! We most heartily congratulate Bombay for being so prompt to bring into existence this new College, so soon after the integration of states. That is as it should be. May the new College prosper and serve the country in the best manner possible!

Hallo!

Have you sent in your Contribution to the I.V.J. Reserve Fund?
It is to serve you better and for ever! Pay then and Prosper!

A MEDICAL STALWART PASSES AWAY

"Now his stethoscope is laid down (it should be preserved in a medical museum), the penetrative eyes which no cause of disease could escape are closed, a life that saved innumerable lives is lost. But Dr. Guruswamy Mudaliar leaves a deathless example of fellow-feeling and service". In these moving words, a leading Madras daily, *the Mail*, has bemoaned the loss of Dr. M. R. Guruswamy Mudaliar, B.A., M.B.C.M., M.D., which sad event took place on the 26th June 1958. He was 75 years old.

He was a leading medical practitioner of international repute in Madras for well over four decades now. He was the Professor of Medicine at the Madras Medical College and Physician at the General Hospital for twenty years or more. The high level of the medical profession in Madras is not a little due to the standard he has taught and maintained both as a teacher and as a practitioner. As a doyen of the profession he was much in demand as a Consultant Doctor by his fellow practitioners. His diagnostic ability was something that made everyone to stand aghast. Some even believed that he arrived at such correct diagnosis of even obscure cases, all within a few minutes, by some form of intuition. His prescriptions were so effective that the ordinary man got the impression they were infallible. Consultation at his residence for two hours daily was free to both the rich and the poor alike. Voluntary contributions could be left on a table in an adjacent room. He was even called the Gandhi of the medical profession.

His simplicity in dress and deportment, his pious nature, his habit of beginning and closing his daily rounds with a prayer, have all marked him out as out of the ordinary and endeared him to the suffering humanity. He gave liberally to educational institutions and to temples. Dr. A. Lakshmanaswamy Mudaliar, when called upon to deliver the funeral oration was visibly moved and he said "His passing away has created a void in the medical profession that can never be filled adequately. As a teacher he was unrivalled. As a fighter for just causes no one was superior to Dr. Guruswamy Mudaliar. He stood for the rights of the Indian Doctors against the powerful members of the Indian Medical Service of foreign domination. He was the first President of the All-India Association of Physicians. He was an example for all days and for all times to come."

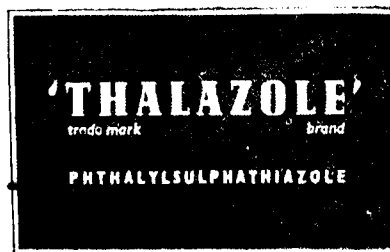
Madras mourns the loss of this stalwart of the medical profession. We tender our humble homage to his great memory and offer our heartfelt condolences to the members of the bereaved family.

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General Articles

ANATOMY OF THE FOETAL INDIAN ELEPHANT

Part VIII: The Head and Neck

(continuation)

By

D. MARIAPPA, G.M.V.C.,

Professor of Anatomy, Madras Veterinary College.

Arteries

Common carotid artery is one of the three terminal branches of the brachio-cephalic artery (vide Part VII) at the thoracic inlet. The right common carotid artery close to its origin, detaches from its ventral face, the *thymic artery*, which passes backward and supplies the thymus.

In the neck, each common carotid artery runs deeply under brachio-cephalicus and omotransversarius, with the accompanying structures bound by connective tissue—*carotid sheath* placed in front of trachea. Superficial to the carotid sheath is the *inferior cervical artery* (vide Part VII). In the sheath, below the artery is the common jugular vein and dorsolaterally, the common cord of vagosympathetic. It reaches the great cornu of hyoid, below which, it terminates by dividing into two branches—*dorsal* and *ventral*.

Its collateral branches are:

1. Muscular branches to ventral cervical muscles.
2. *Posterior thyroid artery* is small which enters the posterior pole of the lobe of thyroid.
3. *Thyro-laryngeal artery* is very large which divides into two branches—laryngeal and thyroid. The laryngeal branch supplies the muscles of pharynx, larynx, oesophagus and finally it enters by the foramen in the thyroid wing and supplies the mucous membrane of the larynx. The thyroid branch is the *anterior thyroid artery* which enters the anterior pole of the lobe of thyroid.
4. *Occipital artery* which passes deeper to the dorsal cervical muscles above the occipital bone and supplies them.
5. *Lingual artery* accompanies the lingual nerves and supplies the tongue.

6. *External maxillary artery* winds round the horizontal ramus deeper to the insertion of sterno-mandibularis, passes obliquely towards the angle of the mouth. In its course it supplies muscular branches to

facial cutaneous muscle, buccinator, *inferior labial artery* to the lower lip and continues as the *superior labial artery* into the root of the proboscis and supplies the muscles of the proboscis. It is smaller than the infraorbital artery. There is anastomosis between the branches of both the arteries.

The *dorsal branch* divides into the superficial temporal and posterior auricular arteries. The *ventral branch* divides into internal maxillary and internal carotid arteries.

The *superficial temporal artery* is deeply situated. In front of the external auditory meatus it detaches auricular branches to the auricula and its muscles and a *temporal branch* to the temporal gland, *masseteric artery* to supply the masseter on its deep face and *transverse facial artery* which runs on the upper part of the masseter supplying it.

The *posterior auricular artery* passes deeper to parotid salivary gland supplying auricular branches to auricula and its muscles and the gland and finally enters the stylomastoid foramen as the *stylomastoid artery* and supplies the tympanic membrane and the structures of the middle ear.

The *internal maxillary artery* passes through alisphenoid foramen, passes on the floor of orbit and enters the maxillary foramen, as the *superior dental artery*.

Before entering the alisphenoid foramen, it detaches :

1. *Inferior dental artery* which enters the mandibular foramen with the nerve and vein of the same name, passes through the inferior dental canal supplying branches to the lower molars and leaves the canal by the mental foramen and terminates by breaking off into a number of mental branches to supply the lower lip.
2. Muscular branches to temporalis and pterygoids.
3. *Middle meningeal artery* which enters the cranium by foramen ovale and supplies the meninges.

In the floor of the orbit it detaches :

1. Palpebral branches to both eyelids.
2. Muscular branches to muscles of the eyeball.
3. *Ophthalmic artery* to the eyeball. This detaches the ethmoidal artery which enters the cranium by the ethmoidal foramen.
4. *Palatine arteries* to supply soft and hard palate.
5. *Sphenopalatine artery* to the nasal mucous membrane.

The *superior dental artery* enters the maxillary foramen, passes in the superior dental canal with the nerve and vein of the same name,

supplies branches to the upper molars, leaves the canal by the infra-orbital foramen and continues as the *infraorbital artery* in the proboscis and supplies its muscles. It detaches a dorsal nasal branch and divides into two terminal branches which pass lateral to the nasal tube.

Internal carotid artery enters the cranium by the carotid foramen and divides into the *anterior cerebral* and *posterior communicating arteries*. The anterior cerebral arteries of both sides are connected by a transverse communicating branch to form the anterior part of *circle of willis* round the pituitary gland. The posterior communicating artery unites with the *posterior cerebral artery* on each side to complete the posterior part of the circle of willis. The *basilar artery* formed by the anastomosis of the two vertebral arteries, divides in front into *posterior cerebral arteries* and furnishes *cerebellar arteries*.

Veins

External jugular vein is formed at the base of the skull by the union of superficial temporal and internal maxillary veins. It is placed superficial and in front of the carotid sheath and receives the internal jugular vein at the level of thyroid cartilage and forms the common jugular. The tributaries received by the external jugular are, the external maxillary, lingual and pharyngeal veins. The common jugular receives the thyroid and laryngeal veins and enters the thoracic inlet.

Internal jugular vein is small, being the continuation of the transverse sinus of the duramater through the foramen lacerum.

Superficial temporal vein drains the venous blood from the temporal plexus. It receives the frontal, parietal, auricular and transverse facial veins.

External maxillary vein is formed by the union of superior and inferior labial veins.

Arterio-Venous Anastomosis

Temporal plexus lying deeper to the temporal gland is a plexus formed by the anastomosis of branches of superficial temporal artery and the superficial temporal vein.

Haemolymph Glands

A chain of eight elongated glands each measuring 1.5 cms. long and 0.5 cm wide are found along the carotid sheath and common jugular vein.

Three small glands are found along the course of the lingual vessels.

Nerves

Cranial nerves

I, II, III, IV, VI & VIII cranial nerves resembles the nerves of other animals. III, IV & VI cranial nerves enter the orbit by the sphenoidal foramen.

V. *Trigeminal nerve*

The large sensory root presents the *semilunar ganglion* which detaches the maxillary and ophthalmic nerves. The small motor root receives the communicating branch from the *semilunar ganglion* and forms the mandibular nerve.

Ophthalmic nerve enters the orbit by the sphenoidal foramen and supplies the palpebral branches, nasociliary branch joining the ciliary ganglion and the ethmoidal branch which accompanies the ethmoidal artery.

Maxillary nerve leaves the cranium by the foramen rotundum and runs in the floor of the orbit, enters the maxillary foramen and runs in the superior dental canal as the superior dental nerve and emerges out of the infraorbital foramen as infraorbital nerve and runs in the proboscis.

In the orbit, it supplies palpebral branch to lower eyelid, *posterior palatine nerve* to soft palate, *anterior palatine nerve* to hard palate, *spheno-palatine nerve* to the nasal mucous membrane.

In the superior dental canal, it supplies dental branches to upper molars and milk tusk.

The infraorbital nerve is the sensory nerve of the proboscis. It divides into three branches at the root of the proboscis. The dorsal branch supplies the lateral nasal region with the branches of the facial nerve. The middle branch unites with the facial nerve to form the *proboscideal nerve*. The ventral branch ramifies and supplies the ventro-lateral face of the proboscis.

Mandibular nerve leaves the cranium by the foramen ovale. It supplies muscular branches to pterygoids, tensor palati, temporalis, masseter and buccinator. It detaches the auriculo-temporal and lingual nerves and continues as the inferior dental nerve. The *auriculo-temporal nerve* supplies the parotid salivary gland and reaches the zygoma in front of the auricula and joins the facial nerve. The *lingual nerve* unites with the *chorda tympani nerve*, detaches a mandibular branch which ascends the facial region, passes deeper to mylohyoideus and supplies the tongue. The *inferior dental nerve* enters the mandibular foramen, supplies branches to lower molars in the inferior dental canal, leaves the canal by the mental foramen and terminates in the lower lip.

VII. *Facial nerve* is very large, emerging out of the cranium by the stylomastoid foramen, passes deeper to parotid salivary gland and then under the tendon of sternomastoideus below the zygomatico-auricularis, passes forwards below the zygomatic arch ventral to the stensons duct, runs deeper to nasolabialis and continues as the proboscideal nerve.

Its collateral branches are:

1. *Posterior auricular nerve* supplies digastricus, occipitohyoideus and posterior auricular muscles.
2. *Anterior auricular nerve* to the anterior auricular muscles.
3. Orbital branch which supplies orbicularis oculi group of muscles.
4. Muscular branches to nasolabialis, nasalis, lateralis nasi, buccinator and facial cutaneous muscle.
5. Mandibular branch (inferior buccal of ox) which supplies facial cutaneous, buccinator and terminates in the lower lip.

Proboscideal nerve is formed by the continuation of the facial and the middle branch of infraorbital which anastomose and run along the lateral face of the proboscis deeply placed in the substance of Maxillo-labialis and supplies the muscles of the proboscis.

IX. *Glossopharyngeal nerve* leaves the skull by the foramen lacerum, passes lateral to vagus and presents the *petrosal ganglion* which is fusiform, 0.5 cm long, connected to the superior cervical ganglion and vagus. It then passes down in front of internal carotid artery, descends on the wall of pharynx, detaches the pharyngeal branch to *pharyngeal plexus* and continues as the lingual nerve below the lingual artery and supplies the mucous membrane of the tongue.

X. *Vagus nerve* emerges from the foramen lacerum lateral to rectus capitis anticus minor and superior cervical ganglion. It presents the *jugular ganglion* in the foramen and the *nodose ganglion* which is fairly big above the apex of the superior cervical ganglion. The cervical sympathetic joins the vagus below the nodose ganglion to form the common cord of vagosympathetic which passes on the dorsolateral face of the common carotid artery in the neck. In front of the thoracic inlet, it leaves the company of the cervical sympathetic trunk and enters the thorax (vide Part VII).

Its collateral branches in the neck are:

1. *Auricular branch* to the pinna.

2. *Pharyngeal branch* which unites with the pharyngeal branch of glossopharyngeal and the sympathetic to form the *pharyngeal plexus* to supply the muscles of the pharynx and the cervical part of oesophagus.

3. *Anterior laryngeal nerve* supplies the cricothyroideus, mucous membrane of larynx and pharynx.

XI. *Spinal accessory nerve* leaves the cranium by the foramen lacerum and is superficial to the tendon of origin of omotransversarius. It divides into dorsal and ventral branches. The dorsal branch passes between brachiocephalicus and omotransversarius, supplying them and finally terminates by ramifying on the deep face of trapezius. The ventral branch, descends behind the auricula, along the posterior border of sternomastoideus and terminates in it.

XII. *Hypoglossal nerve* leaves the cranium by the foramen lacerum lateral to vagus and medial to the internal jugular vein. It detaches a branch to supply sternomandibularis and accompanies the lingual artery and supplies the muscles of the tongue.

Organs of the Digestive System

Mouth cavity is relatively small and narrow. The mucous membrane of the lower part of the vestibule has a long row of small round papillae (fig. 1) and the upper part at the level of the second upper molar shows a large round papilla—*papilla salivalis*, (fig. 2) in front of a depression and numerous minute papillae besides. Below the tip of the tongue is the *fraenum linguae* and on each side of the fraenum is a small pointed papilla—*papilla sublingualis*.

Lips. The upper lip has a prominent *labial cushion* on each side, behind the fossa for the tusk. The fossa is lined by smooth skin devoid of hair. The upper lip is merged with the lower face of proboscis, the junction being marked by a curved groove connecting the fossae for tusks. The lower lip is elongated with a pointed tip which is grooved above for the tip of the tongue.

Teeth will be dealt with under the skull in the next paper.

Tongue is large in the foetus, practically filling up the cavum oris proprium. It is 14 cms. long, 8 cms. wide and 5 cms. thick. The posterior part (root and body) is thick and round and the anterior part (tip) is small, the tip measuring 4 cms. in length and is blunt pointed. The dorsal face of the body is concave and the mucous membrane presents the following kinds of papillae.

1. *Circumvallate papillae* are small, three on each side, arranged as in the dog on the root of the tongue.

2. *Fungiform papillae* are more numerous than in other animals found on the dorsal face of the body and tip and very densely set along the upper margin of the side of the tongue in front of the mayer's organ.

3. *Mayer's organs* are transverse ridges arranged along the lateral margins of the root of the tongue in front of the circumvallate papillae. Each organ consists of about 16 small ridges separated by grooves. The ridges in front, pass to the sides of the body from where densely arranged fungiform papillae continue. Examined with a hand lens, large fungiform papillae are found between the ridges, indicating the gustatory nature of the organ. Microscopic sections of the organ were examined to determine the presence of taste buds in the ridges. But, the denudation of the epithelium rendered it difficult to categorically affirm the presence or absence of the taste buds. However, the presence of fungiform papillae between the ridges is sufficiently indicative of its gustatory nature and the organ corresponds to the foliate papilla of other animals.

An elongated mass of yellow fat, deeper to geniohyoid muscles, appears to correspond to the 'Lyssa' of dog.

Glands of the Mouth

1. *Buccal glands* are arranged in two rows—upper and lower, deeper to buccinator. As determined by microscopic sections, they are of the mucous type.

2. *Parotid salivary gland* is situated below the external auditory meatus and behind the vertical rams covered by the zygomatico-auricularis. It is oval, convex on its lateral face and flat medially. It measures 5 cms × 4 cms × 2.5 cms. It is related deeply to digastricus, facial nerve and the posterior auricular artery. The *stenson's duct* leaves the anterior border of the gland, passes deeper to the tendon of sternomastoideus, runs over the upper part of masseter parallel to and below the facial nerve, pierces the buccinator and opens on the summit of the *papilla salivalis*.

3. *Submaxillary salivary gland* is deeply placed in relation to the origin of styloglossus. It is elongated, brown, compact and lobulated. It is 5 cms. long, 1 cm. wide and 0.5 cm. thick. Wharton's duct opens on the summit of papilla sublingualis.

4. *Sublingual salivary gland* is absent. Situated in the fat between geniohyoideus and genioglossus muscles, is a sickle shaped red brown glandular mass, measuring 8 cms. long, 2 cms. wide in the middle and 0.5 cm. thick which has been mistaken by previous workers as the salivary gland.

This glandular mass on sectioning and examination under the microscope turned out to be adipose tissue. Such mass of brown fat tissue in rodents is called *hibernating gland*.

Hard palate is 11 cms. long and 5 cms. wide behind. It is long and narrow in front and wide behind. The oral face is concave in its anterior half and immediately behind, it is convex except the posterior fourth which is again concave. The mucous membrane shows a median raphe and 12 ridges—*transverse palatine ridges* on either side. The ridges are parallel and concave, concavity facing backwards. The posterior fourth of the palate is devoid of ridges and is demarcated behind by a curved ridge from the soft palate. Behind this ridge there are about 30 large round papillae and the mucous membrane is pale. The mucous membrane of the palate between the anterior series of palatine ridges is papillated. In front the palate is demarcated by the groove connecting the fossae of the tusks. The mucous membrane at its anterior border shows two curved ridges on either side which are inflected to meet the median raphe. At the junction of these is a round papilla—*papilla incisiva* on each side. In front of each papilla is the minute oral opening of the organ of Jacobson.

Soft palate (Fig. 5) is 6 cms. long and 5 cms. wide in front. The oral part is thick and the pharyngeal part is thin, measuring 1.5 cms. in length, with its free concave border overlapping the epiglottis. The free concave border is 2 cms. long and is continued on either side on the lateral wall of pharynx by a prominent mucous fold—*palato-pharyngeal fold* (posterior pillar) which meets its fellow over the auditus oesophagi. From the oral face of the pharyngeal part, another faint mucous fold—*palatoglossal fold* (anterior pillar) descends on either side to the root of tongue. Behind the origin of the anterior pillar and at the junction of oral and pharyngeal parts of the palate is a large oval opening—*tonsilar sinus*, which is 0.5 cm. long and 0.5 cm. deep, being oblique in direction—upward and backward as in the ox. Tonsils are absent.

Pharynx (Fig. 5) is 8 cms. long and 6 cms. wide. The soft palate divides the cavity into a dorsal, large nasopharynx and a small ventral oropharynx.

The *nasopharynx* is divided into two parts—anterior 2/3 being the nasal part and posterior 1/3 being the pharyngeal diverticulum by a mucous fold arising from the nasal face of the soft palate and passing upward and backward into the middle of the lateral wall. In the nasal part, 1 cm. in front of the fold and 2 cms. behind the posterior nares, situated in the lateral wall is an oblique slit—Eustachian orifice, about 0.8 cm. long facing downward and forward. Its medial margin is formed by a mucous fold and the orifice is ventral to the body of postsphenoid

and above the hamular process of pterygoid. The nasal part communicates in front with the nasal cavities by the posterior nares.

The *oropharynx* communicates in front with the oral cavity by the oropharyngeal isthmus. It forms a deep diverticulum or receptacle (glossoepiglottic space) behind the root of the tongue. The receptacle is large and crescentic, leading behind into the lateral food channels which open into the oesophagus. In the receptacle are found 4 or 5 round masses of mucous glands. A transverse crescentic fold of mucous membrane—*lateral pharyngo-epiglottic fold* connects the lateral face of epiglottis to the (posterior pillar) palatopharyngeal fold behind the tonsilar sinus limiting the receptacle from the lateral food channel which is bounded by the posterior pillar laterally and the arytnoepiglottic fold medially. It is a narrow canal, slit like in section. Five small haemolymph glands are found on the lateral wall of pharynx.

Oesophagus was described under Part VI.

Organs of the Respiratory System

Nasal cavity is pyramidal, with its apex towards the nasal aperture. It consists of an olfactory part occupied by the ethmoturbinate and the respiratory part occupied by the nasoturbinate. The ethmoturbinate consists of ten ethmoidal cells, the anterior one being the largest. In front of this is the large nasoturbinate which is rhomboid. In the recess between these two turbinates, are the minute openings of frontal and ethmoidal sinuses. The roof of the respiratory part has a large opening leading into the sinuses of the nasal and premaxillary bones. The lower part of the lateral wall has an opening leading to the sinuses of the maxillary and premaxillary bones. Maxilloturbinate is not apparent. The anterior end of the nasoturbinate is continued outside the nasal aperture by a cartilagenous prolongation in the form of an 'S' shaped ridge in the medial wall of the nasal tube for a distance of about 7 cms. (Fig. 3).

Septum nasi is very long consisting of two parts—nasal and proboscideal.

The *nasal part* is osseocartilagenous et membranous formed by the vomer, mesethmoid, orbitosphenoid, septal cartilage and the nasal mucous membrane filling up the space between the vomer and floor of the nasal cavity and forming a free concave border between the posterior nares. The septal cartilage covers the anterior ethmoidal cell and nasoturbinate and the rest of the ethmoturbinate is covered by the osseous part. The nasal septum is shortened, in relation to the compression of the cranium. The anterior end of the septal cartilage extends between the furrow of pars dentalis of the premaxillae, a little in front

of the internasal suture as a curved hook like process connected to the alae nasi.

The *proboscideal* part of the nasal septum is made up of connective tissue and transverse muscle fibres of rectus nasi and extends to the tip of proboscis separating the two nasal tubes.

Nasal cartilages (alae nasi). They are two. Each is large, oval, convex above in both directions and elongated. The posterior part extends into the nasal cavity, medial to nasal bone and lateral to the nasoturbinate. The anterior part covers the bony nasal aperture and is attached to the thick septum nasi. Each is united to the other on the median line. There is a large *alinasal pouch* between the ala nasi and the anterior end of nasoturbinate.

Proboscis is a highly mobile, tactile and prehensile organ. The root or attached part is over the premaxillae and anterior to it is the free mobile part. It is made up of two nasal tubes separated by the septum nasi, muscles, blood vessels and nerves.

The nasal tubes are made up of connective tissue. They form a bend at the bony nasal aperture. Behind the bend, the tube extends into the bony nasal cavity. Over the bony nasal aperture, it is related above to the ala nasi and the cartilagenous prolongation of the nasoturbinate. In the root of the proboscis (transection) the tube shows a wide base in front and rounded posteriorly with the lateral angle pointed and is supported laterally by the fibromuscular labial cushion (Fig. 6). The nasal tubes extend to the tip of the proboscis and open at the anterior nares. The anterior margin (dorsal) of the tip of the proboscis has the 'prehensile finger' which is highly tactile.

The nasal tube about 3 cms. from the nasal aperture shows in its medial wall a large oval opening (fig. 3) behind the cartilagenous prolongation of the nasoturbinate and at the same level another small opening in front of the turbinate (fig. 4). The openings lead into small shallow mucous pouches.

Larynx

Thyroid cartilage consists of two rhomboidal wings that unite midventrally to form the body, with the large thyroideal notch behind filled up by the cricothyroid membrane. Dorsally the wings are separated by the position of arytenoids in front and the cricoid behind. Dorsal border of the wing has a convex facet in front for the thyroid cornu of hyoid and another convex facet behind for the cricoid. In its upper part the wing has two foramina—small one in front for the artery and the large one behind for the nerve.

Cricoid is a complete ring with the lamina above and the arch below. Dorsolaterally it has two facets—anterior convex facet for arytenoid and posterior concave facet for thyroid. The arch is narrow. In front it is connected ventrally to the thyroid by cricothyroid membrane and behind to the first and second rings of trachea as the first ring is obliquely cut off dorsally.

Epiglottis is connected by its base to the body of thyroid. Its free border is rounded and covered by mucous membrane which extends far beyond the cartilage.

Arytenoids are placed in front of cricoid lamina and above the wings of thyroid and meet dorsally. Each is large and pyramidal. Medial face below has a vocal process for the vocal ligament. The lateral face has a large muscular process. Medial faces of their dorsal parts have oval concave facets enclosing a joint cavity. The anterior part is thin, curved and expanded and everted forming the posterior boundary of auditus laryngis. The posterior part of its medial face has a concave facet for cricoid.

Cartilages of Santorini.—Each is a small oval nodule articulating above the dorsal face of the apex of arytenoid.

Cuneiform cartilages are absent.

Joints formed by the facets of all the cartilages are synovial joints.

Ventricular and vocal ligaments resemble those of the horse.

The larynx is 7 cms. long, 2.5 cms. wide and 4 cms. high. (dorso-ventral).

Cavity of the larynx.—Auditus laryngis is large formed by the anterior border of epiglottis in front, large arytenoepiglottic folds laterally and free borders of arytenoids behind. Glossoepiglottic fold is small.

The cavity is divided into three parts—anterior (vestibule), middle (glottis) and posterior. The vestibule is between the auditus and the false vocal cords, glottis between the true vocal cords and the posterior part between the true vocal cords and the first ring of trachea.

The false vocal cord is a prominent rounded fold of mucous membrane extending upward and backward in the lateral wall from the root of epiglottis to the arytenoid close to the vocal process. The true vocal cord extends from the thyroid cartilage at the root of epiglottis and runs parallel to and behind the false vocal cord to the vocal process of arytenoid and meets the former. At its origin, it is narrow,

but widens dorsally. It is 0.25 cm. wide below and 0.5 cm. wide above (Fig. 5) The mucous membrane covering the vocal cord shows two sharp borders (vibratile)-anterior and posterior which are raised from the lateral wall to a height of 0.25 cm. which increases dorsally. Between these two margins, the medial face of the cord is concave, so that the glottis is a vertical slit wider above and narrow below. A median recess at the root of epiglottis is the *middle ventricle* and extending from it laterally on each side between the false and true vocal cords are the *lateral ventricles* leading dorsally into mucous pouches-laryngeal *sacculae* under the arytenoids for a depth of 0.5 cm.

The Eye

Orbit will be described in the next paper on axial skeleton.

Periorbita is thick and external to it are found two small pieces of hyaline cartilage. The *musculus glandulae temporalis* connecting the temporal gland to the bits of cartilage is absent.

Eyelids do not contain the meibomian glands.

Third eyelid has an extensive *nictitating membrane*, a thin triangular piece of hyaline cartilage and a large brown lobulated *harderian gland* on the lateral face of the cartilage, its duct opening on the external surface of the membrane by an orifice covered by a small papilla.

Lacrymal gland is absent.

Muscles of the eyeball and eyelids are similar to those of other animals in attachments. The four *recti* are wide thick bands.

The *posterior rectus* (retractor) is ill-developed consisting of thin layer of muscle fibres enveloping the optic nerve. *Superior oblique* is reflected over a cartilagenous pulley as in other animals. *Inferior oblique* arises from behind incisura lacrymalis. There is *levator palpebrae superioris* as in other animals and besides a *depressor palpebrae inferioris* is present. *Protractor* of nictitating membrane consists of two small slips derived from orbicularis oculi and attached to the deep narrow part of the cartilage.

Blood supply :—Ophthalmic artery.

Nerve supply :—IV cranial nerve supplies superior oblique

VI cranial nerve supplies lateral rectus.

III cranial nerve supplies all other muscles.

Tunics of the eyeball.—The *tapetum lucidum* of the chorioid extends from about 3 mm. below fovea optica dorsally. Unlike in other

animals showing an optic papilla, the piercing of the tunics by the optic nerve is marked by a small circular *fovea optica*.

Refractive media.

The *optic lens* is small, 0.5 cm. thick and has a diameter of 1 cm. The posterior face is strongly convex and the anterior face is nearly flat except at the periphery where it is convex.

The visual fields of the eyeball.—The elephant, with a short compressed neck that does not permit lateral flexion, possessing eyeball that is disproportionately small to its size (of the body) and a vestigial retractor oculi muscle, consequently has a very narrow restricted field of vision. This fact is supported by victims that had the experience of being charged by a wild elephant. The only way to escape from him is to side step by a distance of 5 to 6 feet, when the elephant loses sight of the victim and moves on. This personal experience by a professional colleague (intimately known to the author) working for several years with the elephants was narrated to the author.

The Ear

The external ear consists of the acoustic meatus and the pinna, scutiform and annular cartilages of other animals being absent. The pinna is a thin quadrilateral plate of elastic cartilage that does not extend to the periphery, but stops about 4 cms. away from it, so that the periphery has only a double fold of skin. Towards the external auditory meatus, the cartilage forms below—a funnel shaped acoustic meatus and above a thick prominent tragus. The acoustic meatus is a U shaped tube, the bend of U facing forwards, the limbs being lateral and medial, the latter passing into the external auditory process to be attached to the inner opening of the process. The acoustic meatus has a caliber of 8 mm.

Study of the middle ear and internal ear involves sectioning of the petrous temporal bone which will be done after the study of the axial skeleton and a full account will be given in the next paper.

Discussion

1. Digastricus in other animals consists of a fibrous intermediate tendon connecting the muscular belly of origin and belly of insertion. In the elephant the digastric structure of the muscle is absent. Besides, occipitohyoideus and stylohyoideus are blended with it at its origin, all the three muscles forming a single mass and rendering it difficult to effect clean separation. This is in agreement with the observation of Rajagopal (1956).

2. Multifidus cervicis of other animals is also present in the elephant and no mention of it is made by previous workers.

3. Brachiocephalic artery terminates at the thoracic inlet in a trifurcation, giving off two common carotid arteries and right axillary artery, resembling the condition often seen in the buffalo.

4. Unlike in other animals (ox) where the internal jugular vein, runs down the jugular furrow and anastomoses with the external jugular vein at the thoracic inlet, in the elephant, it is small and unites with the external jugular at the level of the thyroid cartilage of larynx.

5. The facial nerve in the elephant is very large consequent on the prolongation of the upper lip and nasal region as the proboscis. The proboscideal nerve corresponds to the superior buccal and the mandibular branch corresponds to the inferior buccal nerves of other animals.

6. Papillary condition of the mucous membrane of the cheek in this study agrees with the observation of Eales (1926) though Rajagopal (1956) has stated that it is smooth in the four foetuses that he examined. *Papilla salivalis* noted in this specimen has not been observed by any of the previous workers.

7. All previous workers have noted the mayer's organs of the tongue without remarking on its significance or its function. It is definite that they are gustatory organs, as they contain large fungiform papillae between the ridges and are comparable to foliate papillae of other animals in function though not in structure.

8. The existence of sublingual salivary gland has been noted by Mayer and Forbes (cited by Eales 1926). Miall and Greenwood (1878) are doubtful of its presence and Rajagopal (1956) is definite of its absence in his four specimens and so also Eales (1926) in the african species. In this specimen, it is absent, but a sickle shaped red brown glandular mass situated on the median line, in the mass of yellow fat between geniohyoideus and genioglossus muscles was found which has been mistaken by Mayer and Forbes as the salivary gland. This glandular mass in microscopic sections turned out to be adipose tissue. Such mass of brown fat tissue in rodents is called *hibernating gland*.

9. The papillary condition of the mucous membrane of the hard palate agrees with the observation of Eales (1926) though Rajagopal (1956) disagrees.

10. Anterior pillars of the soft palate—palatoglossal folds and tonsillar sinus are similar to those of ox, though all the previous workers have not made any observation on these. Tonsils are absent.

11. Pharyngeal receptacle and pharyngeal pouches of this specimen agree with the description given by Miall and Greenwood (1878).

12. Cartilagenous prolongation of the nasoturbinate in the medial wall of the nasal tube as seen in the present study and the two openings of short blind mucous pouches by its side are not observed by any of the previous workers. These mucous pouches are vestigeal structures and what they represent or correspond to, will remain a conjecture till we know of similar structures, whether functional or not in the proboscidean ancestors.

13. Each vocal cord has two sharp vibratile borders. The ventricles and laryngeal saccules resemble those of the horse to some extent. Miall and Greenwood (1878) have referred to a small laryngeal pouch in the specimen of the adult, but Rajagopal (1956) while confirming the presence of small pouch in his specimens has equated that with the lateral ventricle of the larynx in the horse.

14. None of the previous workers have remarked on the presence of *tapetum lucidum* and the *fovea optica* as observed in the present study.

15. Lacrymal gland is absent which is compensated by the large harderian gland. Rajagopal (1956) and others reporting its presence have not verified it by microscopic sections.

Summary

1. Digastricus, occipitohyoideus and stylohyoideus are blended to form a muscular mass. Levator palati, palatoglossus and kerato-hyoideus of other animals are absent. *Multifidus cervicis* is present. Muscles of hyoid, tongue, soft palate, pharynx, larynx and the eyeball resemble those of other animals except the posterior rectus which is vestigeal.

2. Trifurcation of the brachiocephalic artery is similar to the condition seen in the buffalo. The internal carotid and vertebral arteries form the circle of willis as in the horse. Internal jugular vein is very small and there is *temporal arterio-venous anastomosis*.

3. Proboscideal and mandibular branches of the facial nerve correspond to the superior and inferior buccal nerves of other animals. Other cranial nerves resemble those of ox and horse.

4. Mucous membrane of the cheek is papillated and *papilla salivalis* is present. *Mayer's organs* are gustatory and comparable to foliate papillae of other animals. Sublingual salivary gland is absent. Transverse palatine ridges of the hard palate resemble those of the horse and the mucous membrane between them is papillated. Anterior pillar of the soft palate and the tonsillar sinus resemble those of the ox and tonsils are absent. Eustachian orifices of pharynx are large oblique slits; the posterior pillar of the soft palate is large like that of the horse.

5. Nasoturbinate is prolonged in the form of an 'S' shaped ridge in the medial wall of the nasal tube. The two openings, one on each side of the ridge lead into small mucous pouches which are vestigial structures and what they represent in the evolution of the proboscidea from its original ancestors is not known. The laryngeal ventricles and sacculi resemble those of the horse to some extent.

6. *Tapetum lucidum* of the chorioid is extensive as in all other nocturnal animals. There is *fovea optica* at the entrance of the optic nerve. The visual fields are narrow and very much restricted. Harderian gland is large to compensate for the absence of the lacrymal gland.

7. Scutiform and annular cartilages of other animals are absent. Pinna does not extend to the periphery but stops about 4 cms. away from it. The inner limb of the acoustic meatus is osseocartilagenous.

EXPLANATION TO FIGURES

- Fig. 1. Mucous membrane of the lower part of cheek showing linear series of papillae.
 Fig. 2. Mucous membrane of the upper part of cheek showing papilla salivalis.
 Fig. 3. Medial wall of nasal tube showing: t, 'S' shaped prolongation of nasoturbinate and the arrow points the large opening of the mucous pouch behind it.
 Fig. 4. Highly magnified view of fig. 3, arrow showing the small opening of the mucous pouch in front of the turbinate.
 Fig. 5. Saggital section of skull showing the interior of pharynx: O, oropharyngeal isthmus; N, nasopharynx; S, soft palate; a, anterior pillar of soft palate; p, posterior pillar of soft palate; ts, tonsillar sinus; E, epiglottis; C, food channels; AS, auditus oesophagi; U, eustachian orifice; n, posterior naris; R, pharyngeal receptacle; P, pharyngeal pouch; V, vocal cord.
 Fig. 6. Transection of proboscis showing the two nasal tubes with blood vessels and nerves by their side.

REFERENCES

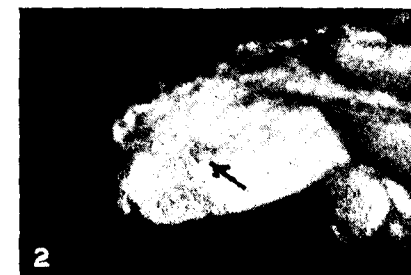
- Same as for Part VI which appeared in No. 5, Vol. 35 of I.V.J. (1958); and
 1. Eales, N. B. (1926) ... "The Anatomy of the Head of a Foetal African Elephant, *Elephas africanus* (*Loxodonta africana*)",
Trans. Roy. Soc. Edn., LIV, Part III, No. II, 491-551.

Anatomy of the Foetal Indian Elephant

Part VIII: The Head and Neck

By

D. MARIAPPA, G.M.V.C.



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Fig. 1.

Enlarged liver covered with patches or strands of fibrous tissue (Perihepatitis).



Fig. 2. An early lesion with necrosed tissue in the centre and with concentric layers of fibrous tissue.



Fig. 3. A well developed lesion showing commencement of calcification and presence of empty spaces resembling the ova of schistosomes. Note the pointed and tapering ends.

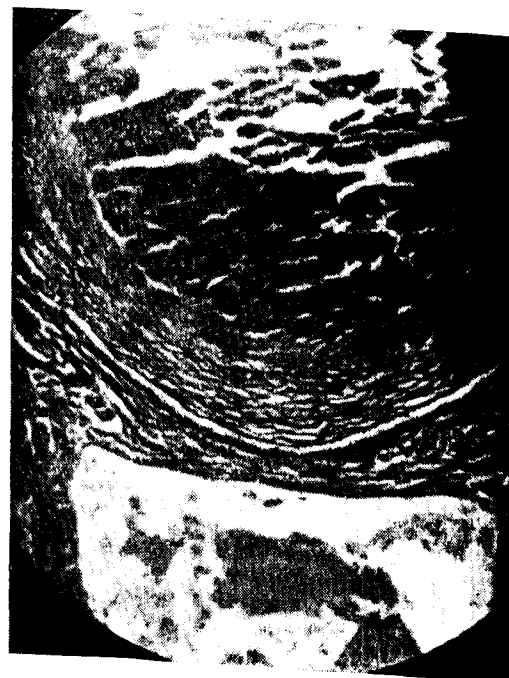


Fig. 4. An advanced lesion showing concentric calcification and well developed fibrous capsule.

NODULAR CIRROHOSIS OF LIVER IN EQUINES

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Introduction

Cirrhosis of the liver is not uncommon in horses and the causes are varied. But those caused by schistosomes are frequently encountered. The lesions of schistosomiasis in liver of horses have been extensively studied by several foreign authors. Among Indians, Dutta (1933) has dealt with this subject from a study of several cases in India, amongst which one was from Hyderabad region.

During routine postmortems conducted on ponies received after Surgery classes it was seen that many of them showed calcified nodules in the liver. The presence of identical nodules in a number of ponies indicated a common etiological factor. It was surmised that they may be due to schistosomes, as the other two causes, viz. tuberculosis and Strongylus infection were eliminated.

Out of 15 Postmortems conducted it was seen that 8 of them showed characteristic lesions and 4 of them less conspicuous lesions. The clinical picture observed in the animals was as follows :—

The ponies were in an extremely debilitated condition. Their ages ranged from 5 to 12 years. The visible mucous membranes were pale indicating anaemia; the blood smears of the ponies showed marked anaemia and lymphocytosis. Some of the animals exhibited skin diseases as mange and bone disorders as spavin, ring bone etc.

Post Mortem Examination

The P. M. examination of the animals revealed the following marked lesions.

Liver.—Most of the animals showed enlargement of liver with cirrhosis. The surface of the liver was studded with pale whitish patches or small strands of fibrous tissue at many places indicating chronic perihepatitis. (Fig. No. 1). In one of the livers, it was seen that the left lobe was more enlarged than the other regions. Numerous greyish or chalky white nodules were seen immediately under the capsule. The nodules were distributed all over the surface of the liver. Their number varied in different animals. Out of 15 animals, 5 showed a large number of nodules, 3 a lesser number and the remaining showed 1-4 nodules only,

scattered here and there on the liver. The size of the nodules varied. The smallest was of the size of a pin head and the largest that of a pea.

The other internal organs and the alimentary canal did not reveal any marked abnormality.

Sections of the liver showed three types of lesions, depending upon the age.

(1) *Recent type*.—Small nodules communicated with the portal tracts. The nodules were made up of concentric layers of fibrous tissue. (Fig. No. 2).

(2) *Intermediate type*.—The nodules presented an area of necrosis in the centre and surrounded by a large number of leucocytes. The adjoining liver tissue was separated by a well formed fibrous tissue capsule. The fibrous tissue was arranged in the form of concentric rings. All the nodules communicated with the blood vessels or the adjoining sinusoids. The centre of the nodule in some cases presented an empty space suggesting the presence of an ovum. The space resembled the out-line of a schistosome egg. (Fig. No. 3).

(3) *Advanced type*.—The advanced type of nodules revealed the presence of calcified zone in the centre. The calcified matter was arranged in a concentric manner. It was also covered externally by a thick wall of greatly hyalinised fibrous tissue. (Fig. No. 4). The adjoining liver cells showed degenerative changes and atrophy.

The nodules in their early stages of development consist essentially of cells surrounded by a few strands of connective tissue. As the condition progresses necrosis sets in the centre and fibrous tissue surrounds the necrosed area in the concentric rings. Leucocytes infiltrate the nodule in large numbers. This is followed by calcification. The calcium salts are deposited in the form of concentric rings. Externally it is surrounded by fibrous tissue capsule.

The ovum is represented in the form of an empty space having tapering points. There may be more than one such space in a single nodule, representing more than one ovum.

These appearances are in conformity with the description provided by Dutta (1933) and the conclusion is inevitably reached that it is a Schistosome infection that is responsible for this extreme debility in ponies, notwithstanding the fact that the egg of schistosome could be recovered from one nodule only.

Summary

Routine postmortem examination on ponies showed the presence of Nodular Cirrhosis of liver. Numerous chalky white nodules of

various sizes were seen on the surface of the liver. The size of the nodules ranged from that of a pinhead to that of a pea. Microscopical examination of liver sections showed three types of lesions depending upon their age as recent, intermediate and advanced. Some of the nodules contained one or two spaces resembling a schistosome egg. The liver cells exhibited degenerative changes and atrophy. The conclusion of schistosome infection was reached as the lesions were in conformity with the description provided by Dutta (1933) and on the recovery of schistosome egg from the lesion.

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REFERENCE

Dutta, S. C. A. (1933)

... *Ind. Jour. Vet. Sci. and Ani. Husband.* 3, 1.

CONTROL OF HAEMORRHAGIC SEPTICAEMIA WITH SPECIAL REFERENCE TO THE NEW ADJUVANT VACCINE

By

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Pasteurellosis is to-day one of the most serious diseases of livestock, especially in countries in the East. It has been estimated, that in India alone, losses due to haemorrhagic septicaemia in cattle and buffaloes run annually into several lakhs of rupees and at an average more than 33,000 deaths occur each year.

In endemic areas, haemorrhagic septicaemia has a seasonal incidence and generally a large number of outbreaks appear with the onset of monsoons and winter rains. The onset of the disease is usually very sudden and the course extremely short and rapid. As such, treatment with the well-known sulpha preparations can hardly be taken up in time. Besides, the cases of the disease may be so widely scattered that it may be difficult to pay individual attention. The only practical approach in the control of haemorrhagic septicaemia, therefore, seems

to be to carry out timely prophylactic vaccination in endemic areas and to treat sporadic cases with sulpha preparations.

For the past two or three decades, vaccinations have generally been carried out with cultures of *Pasteurella septica* grown for 24 to 48 hours in nutrient broth or agar and killed by heat or chemicals like formalin, phenol, lysol, etc. These vaccines, no doubt, afford some degree of protection, but the immunity has been found to be short and of a low order. In many endemic areas, heavy mortality continued to occur in spite of two inoculations carried out at short intervals and instances of breakdown in immunity soon after vaccination were not uncommon. In such cases, plurality of strains within the species of *Past. septica* was considered to be the probable cause. Investigations were, therefore, taken up at the Indian Veterinary Research Institute with a view to study the serological and immunological difference in *Past. septica* isolated from cases of the disease in different outbreaks and different parts of the country so as to select suitable strains for the preparation of haemorrhagic septicaemia vaccine.

Serological studies

Cornelius (1929) classified 17 of 26 strains of *Pasteurella* of diverse origin into 4 groups by agglutination and agglutinin absorption tests, and the remaining 9 strains defied classification. According to him, no relationship between the serological group and the animal of origin of the strains was evident. Later, Yusef (1935) subjected 21 strains of *Pasteurella* to precipitin-absorption tests and found that 14 of these belonged to 3 different serological groups. Rosenbuch and Merchant (1939) divided *Past. septica* into two main types and Little and Lyon (1943) into three main types. Battelli (1944) also reported on the antigenic heterogeneity of *Pasteurella* strains. Recently, Rao (1953) working at the Indian Veterinary Research Institute typed serologically by agglutination and agglutinin-absorption tests, seventy-three authentic strains of *P. septica* of diverse origin and his findings confirmed the earlier observations of several workers such as Jones (1921-22), Roderick (1922), Fitch and Nelsen (1923), Lal (1927), Cornelius (1929), Yusef (1935), Khalifa (1935) etc., that, on serological grounds, the strains of *Past. septica* cannot be classified according to the species of animals from which they were isolated and also that there were several serological groups within the species of *P. septica*. In this study, Rao found that 6 strains belonged to Group I, 4 to Group II and 12 to Group IV of Cornelius. It was interesting to observe that 30 strains belonged to one group, serologically indistinguishable from the I.V.R.I. stock strain of P. 52. However, the possibility of these strains belonging to Group III of Cornelius could not be completely ruled out as Group III strain available with Rao (1953) might not have been fully antigenic for

absorption tests on account of its possible change to 'R' type. The remaining strains did not fall into any of the groups tested. It appears that the major antigen involved in all these studies has been the heat-stable somatic antigen.

Observations of Priestley (1936) suggested that *P. septica* resembled *P. pestis* in forming a heat-labile envelope antigen and a heat-stable somatic antigen. It differed, however, from the plague bacillus in that the envelope antigen appeared to be present only in virulent strains freshly isolated from the animal tissue. These findings have now been confirmed by the recent work of Carter (1950, 51, 52, 53), Bain (1954), Dhanda (1954) etc. The significance of the envelope antigen was also realised by Rajagopalan (1945) who pointed out that it was highly important to ensure that the structure of the essential parts of the organisms particularly of their surface layers, did not suffer by the treatment adopted to kill them. Carter (1952) extracted a type-specific substance from *P. septica* by heating cultures in normal saline at 56°C for an hour and, on the basis of precipitation of this substance and capsule swelling tests, established three serological types designated A, B and C. Carter and Annau (1953) isolated polysaccharides possessing different physical, chemical and biological properties from the capsular substance of the 'fluorescent', 'Intermediate' and 'Mucoid' variants of *P. septica*.

All these studies have raised an important issue as to whether it is necessary to prepare a polyvalent vaccine incorporating strains representing each of the different serological groups for use as a prophylactic against pasteurellosis in animals or a monovalent vaccine prepared from a strain belonging to some particular serological group could serve the purpose.

The work carried out in this connection by Roberts (1947), Dhanda (1954), Hudson (1954) and others is important as it opens another field for investigation which might lead to a better understanding of this problem. According to the work of Roberts (1947) who studied the antigenic behaviour of 37 strains of *P. septica* by cross-protection tests in white swiss mice, using twenty-one strain-specific rabbit and horse anti-sera, there were several immunological types within the species of *Past. septica* and there was little relationship between the immunological group and the animal or country of origin. Incidentally, Roberts' collection included three bovine strains which belonged to his immunological type I and the avian strain was the only representative of its type. Dhanda (1954) subjected 24 Indian strains of *Past. septica* isolated from cases of haemorrhagic septicaemia in bovines and three strains from cases of fowl cholera to immunological studies on the lines of

Roberts (1947) and their work also showed that 24 bovine strains belonged to one immunological group, corresponding to type I of Roberts, while the three fowl strains belonged to a different immunological group (s). Similarly, Hudson (1954) subjected 15 strains of *P. septica* isolated from cases of haemorrhagic septicaemia in bovines in Pakistan, India, Thailand and Kenya, to immunological studies by mice protection tests on the lines of Roberts (1947) and found all of them to belong to one type corresponding to Roberts' group I. He suggested that a monovalent vaccine would suffice for the protection of cattle and buffaloes against true haemorrhagic septicaemia. Since in the work of Roberts (1947), Dhanda *et al* (1954) and Hudson (1954) reviewed earlier, the significance of heat-labile capsular antigen was not properly understood, heat was employed to kill cultures of *Past. septica*. This might have resulted in the production of anti-bodies only against somatic antigen. Further work is now being carried on entirely different lines.

It has already been stated that the only practical approach in the control of haemorrhagic septicaemia appears to be to carry out timely prophylactic vaccinations of all the cattle and buffaloes in endemic areas and to treat the sporadic cases with the well-known sulpha preparations. During the past 2 or 3 decades, haemorrhagic septicaemia bacterins prepared by growing highly antigenic strains of *P. septica* in nutrient broth or on nutrient agar for a period of 24 to 48 hours and later inactivating those by the addition of chemicals have been used but the results have not been encouraging. This may either be due to the poor grade of immunity produced by such bacterins or there may be different immunological groups within the species, of *P. septica*. The limited observations made at the Indian Veterinary Research Institute and elsewhere have shown that the strains responsible for the classical type of haemorrhagic septicaemia in cattle and buffaloes probably belong to a single immunological type corresponding to type I of Roberts and, until the contrary is proved, it may not be wrong to assume that a monovalent vaccine prepared from a highly antigenic strain belonging to type I of Roberts would confer adequate protection against the disease provided the strain could be maintained in its fully antigenic form during the process of manufacture of the vaccine.

Dhanda *et al* (1956) carried out an extensive study of this problem and as a result the following procedure was evolved for the manufacture of a new vaccine. This vaccine has been found to be far superior in its immunising properties to the commercial broth vaccine that has been in common use in our country till recently.

Procedure of the manufacture of the new vaccine

Indian Veterinary Research Institute stock strain 'P 52' was selected as a seed strain, as the serological studies carried out by Rao (1953) had shown that this strain represented the largest serological group and the immunological studies carried out by Dhanda (1954) had shown that all the strains isolated from cases of haemorrhagic septicaemia in bovines belonged to one group (Roberts type I) immunologically indistinguishable from stock strain 'P 52.' The seed strain was passaged through a susceptible bovine so as to ensure the presence of capsular substance. The culture while in 'phase I' was inoculated into Roux flasks containing the yeast extract medium with the following formula :

Lab. Lamco.	...	0.3 gm.
Peptone Difco.	...	0.3 „
Yeast Extract.	...	1.5 „
Creatinine.	...	0.3 „
Sodium chloride.	...	1.5 „
Distilled water	...	300 ml.
Agar	...	9 gm.

Autoclave at 15 lb., for 30 minutes. Final pH 7.2.

After incubation for 24 hours at 37°C, the growth in the Roux flasks was washed with 0.5 per cent formal-saline and the washings were diluted with the same fluid to an opacity of 6-7 of Brown's scale and the product was left overnight at room temperature which did not exceed 25°C. Adjuvants were added in the following proportion on the lines of Bain :—

Bacterial suspension.	...	15 parts.
Liquid paraffin.	...	10 parts.
Anhydrous lanolin.	...	1 part.

The mixture was placed in a waring blender which was run for about 5 to 10 minutes when a homogenous suspension was obtained.

Adjuvant vaccines somewhat on similar lines were prepared by Bain (1954), Iyer *et al* (1955) and Krishna Murthy (1957), and all the workers got better results with the adjuvant vaccine prepared from formalin-killed *pasteurella bovisseptica* organisms in phase I, than with the commercial broth vaccines. We have studied under carefully controlled laboratory conditions, the immunizing properties of the new adjuvant vaccine developed at the Indian Veterinary Research Institute in comparison with those of the commercial broth vaccine issued from this Institute. The results are tabulated below, which clearly prove the superiority of the former over the latter.

TABLE I

Showing the comparative immunogenic value of the adjuvant vaccine with the commercial broth vaccine.

No. of animals	Details of inoculation	Interval between vaccination and challenge	Challenge dose	Result	Percentage of survival	Result of bacteriological examination in animals dying after challenge
10	3 ml. intra-muscularly adjuvant vaccine.	2 months	50 million mouse M.I.D.	10/10	100.0	
10	5 ml. subcutaneously commercial broth vaccine.	2 months	do.	0/10	0	+++++
3	Unvaccinated.		do.	0/3	0	+++

Note :—Numerators denote survivals; Denominators denote total number inoculated.
 + = Positive for *P. septica* on bacteriological examination.
 A 24 hour old broth culture of *P. septica* was used for challenge purpose. Of this 1 ml. was determined to contain 1,000 million mouse M.I.D.

There are, however, some differences in the method of production by the various workers, and it appears difficult to critically assess the superiority of the one over the other. However, without going into the finer details, it may be stated that for obtaining growth of culture for vaccine production, we prefer the use of agar medium which gives an excellent growth. Under ordinary laboratory conditions the growth in broth rarely exceeds the density of Brown's tube No. 2 after 24 hours' incubation and, as such the density required in the bacterial suspension to keep the dose at a reasonable level cannot be attained without concentration by centrifugation, which appears to us quite a laborious process. However, by aerating broth cultures, it is possible to obtain profuse growth matching Brown's tube No. 7 but the apparatus required for large-scale aeration is very expensive and may not be within the reach of small Production Units.

Our present knowledge of the antigenic structure of *P. septica* is far from complete and so very little is known regarding the immunizing properties of the various fractions of the capsular substance and of the somatic antigen. However, a preliminary comparison of the yield of crude isoelectric fraction and the polysaccharides on agar medium and the broth medium made by Bain (1955) showed that the yield of both fractions was higher when *P. septica* was grown on agar medium than in broth medium under identical conditions, the difference being quite

marked in the case of polysaccharide, although very slight for protein-complex. The results are tabulated below :—

Source	Iso-electric fraction	Polysaccharides
Agar-grown Phase I (Fluorescent phase)	56 mgm. per gramme of freeze-dried extracted <i>P. septica</i> type I	81 mgm. per gramme of freeze-dried extracted <i>P. septica</i> type I
Broth-grown phase I (Fluorescent phase)	53 mgm. per gramme of freeze-dried extracted <i>P. septica</i> type I.	25 mgm. per gramme of freeze-dried extracted <i>P. septica</i> type I

Safety and potency of the new adjuvant vaccine

Thirty-one brews totalling about 2,50,000 ml. have been manufactured so far according to the procedure outlined above and the vaccine has been used on as many as 60,000 heads of cattle and buffaloes including young stock under laboratory, farm as well as field conditions. In general, no untoward reaction following vaccination was observed in any animal excepting one buffalo which started sweating profusely soon after inoculation. This may be due to the animal being allergic to foreign proteins.

Body temperature of 1300 animals out of those vaccinated in different places was recorded for a period of two days before and seven days following vaccination. In general, the animals were reported to have maintained a normal temperature excepting on one farm with a strength of 769 animals where the vaccinated animals were reported to have recorded a rise of a degree or two in their body temperature for 3 to 4 days. The average milk yield at four big dairy farms for a week before and a week following vaccination was compared and it was observed that there was statistically no significant difference. Slight swellings at the site of inoculation were seen in about 5 per cent of the cases but these generally disappeared in about four or five days excepting in one solitary case where a field worker reported that in the 929 animals inoculated by him slight swellings in about 5 per cent of the cases had persisted for more than two months. However, no report of abscess formation or sloughing of the skin over the site of inoculation was received from any quarter.

Observations on the value of the adjuvant vaccine

(a) Under laboratory conditions.

The immunising properties of twenty-six brews of the vaccine prepared in the manner indicated earlier were tested on 138 hill-bulls,

There was a survival of 126 out of 138 (91.3%) when the vaccinated animals were challenged with as severe a dose as 50 million mouse M.I.D. to 1000 million mouse M.I.D. while all but one of the 51 healthy un-vaccinated animals, used to serve as controls during these potency tests, died of typical pasteurellosis within 40 hours. The only one control hill-bull, which resisted the massive challenge to which the animals were exposed, appeared to be naturally immune as it did not show any reaction whatsoever. The results of the potency tests are presented in table II.

Brew No. 11-56 was also tested on 18 buffalo-bulls which showed a 100 per cent survival as against both the un-vaccinated buffalo-bulls, kept to serve as controls, dying of typical pasteurellosis. The results of the test are presented in table III.

TABLE III
Showing the results of potency tests in buffalo-bulls

Brew No.	No. of animals	Details of vaccination	Interval between vaccination and challenge	Challenge dose	No. of animals survived	Percentage survival	Result of bacteriological examination on animals dying after challenge	Remarks
11	2	3 ml. intra-muscularly	85 days	5 ml. of an 18 hour old broth culture of virulent <i>P. septica</i>	2	100.0		
	5	"	67 days	Do.	5	100.0		
	4	"	30 days	Do.	4	100.0		
	7	"	19 days	Do.	6*	100.0		
	18				17			One animal died of causes other than pasteurellosis
Unvaccinated healthy buffalo-bulls								
	2				0	0	++	

Note :—1. ++ Positive for *P. septica* on bacteriological examination.

2. — — Negative for *P. septica* on bacteriological examination.

3. An 18 hour old broth culture of virulent *P. septica* was used for challenge purposes. Of this 1 ml. was estimated to contain 10,000 million mouse M.I.D.

4. Adult buffalo-bulls were used throughout the above study.

5. All the 18 vaccinated buffalo-bulls were challenged simultaneously.

(b) *On organised dairy farms.*

This vaccine is being used for the last three years in succession on three Military Dairy Farms and at the Aarey Milk Colony, Bombay. It is highly satisfactory to report that during the period of observation only one buffalo-heifer, which was about 7 months old at the time of vaccination, died of pasteurellosis at these farms, whereas there were indications of several deaths due to haemorrhagic septicaemia in the villages around the farms. These farms prior to vaccination with the adjuvant vaccine used to have high mortality due to haemorrhagic septicaemia in spite of two or three inoculations being carried out each year with the commercial broth vaccine.

(c) *Under field conditions.*

Field trials under village conditions were carried out in the States of Jammu and Kashmir, and the Punjab. In the State of Jammu, a total of 1,892 animals (cattle, buffaloes and young stock) in six villages of tehsil Ranbirsinghpura were vaccinated with the adjuvant vaccine and another group of 1,245 animals with the commercial broth vaccine. During an observation period of eight months, no deaths due to pasteurellosis were reported from either group.

In the Punjab, as many as 7,306 animals in 32 villages of the districts of Ludhiana, Jullundur, Hoshiarpur and Amritsar were vaccinated with the new adjuvant vaccine.

The observations made over a period of five months, during which most outbreaks of haemorrhagic septicaemia usually occur in the areas, showed that whereas several un-vaccinated animals and those vaccinated with the Hissar broth vaccine died of the disease there was only one death amongst animals that had been vaccinated with the adjuvant vaccine.

Duration of immunity

Several immunity tests have been carried out under laboratory conditions on animals vaccinated with the new adjuvant vaccine and the immunity has been found to be solid for a period of 12 months, the maximum period for which the tests have been carried out so far. The vaccinated animals have been able to withstand challenge with as severe a dose of virulent culture as 1,000 million mouse M.I.D., whereas, all the un-vaccinated animals used to serve as controls have succumbed to infection within 40 hours.

Keeping quality of the adjuvant vaccine

Experiments carried out at the Indian Veterinary Research Institute have shown that the new adjuvant vaccine maintains its protective properties for at least one year when stored at low room temperatures,

The vaccine had remained at temperatures varying from a minimum of -2.2°C to a maximum of 20.0°C for a period of 3 months and at a temperature varying from a minimum of 2.9°C to a maximum of 29.5°C for a period of nine months. This is considered very satisfactory as it is not likely that the vaccine will have to be stored for longer than a year.

In an investigation undertaken by the authors storage of the vaccine at temperatures of 37°C and 40°C for a period of 10 days in an electrically heated incubator did not result in a deterioration in its immunogenic properties.

An additional proof of the ability of the vaccine to withstand high temperatures during summer months without losing its potency was obtained when about 34,000 doses of the vaccine were despatched during the hot months of May, June and July from Mukteswar to far off places such as Bombay, Poona, Secunderabad, and places in the Punjab and Jammu and Kashmir in connection with field trials of the vaccine in these areas. The vaccine was filled in amber-coloured bottles and was packed in ordinary wooden boxes, which were transported from Mukteswar to the rail-head, Kathgodam, by bus and further by passenger train. It took about 5-10 days for the vaccine to reach its destination. As many as 30,215 animals were vaccinated during 1955 and 1956 with the adjuvant vaccine transported by bus and rail during the summer months of May, June and July, but only two animals died of pasteurellosis over an observation period of 5-7 months, the rest of the animals remained quite well throughout the monsoon season while several deaths occurred amongst the un-vaccinated animals as well as in the animals protected with the commercial broth vaccine.

From the above studies, carried out under laboratory as well as field conditions, it would be safe to conclude that the adjuvant vaccine can be safely transported over long distances during the summer months without any appreciable deterioration of its potency.

Summary

1. The problem of haemorrhagic septicaemia in cattle and buffaloes in our country with particular reference to its control under Indian conditions is discussed.

2. Serological and immunological studies carried out on different strains of *P. septica* and the evolution of an adjuvant vaccine against haemorrhagic septicaemia in cattle and buffaloes are reported.

3. Large scale field and laboratory tests have shown that the adjuvant vaccine is absolutely safe for cattle and buffaloes of all ages and that in its immunizing properties it is far superior to the commercial broth vaccine.

4. The immunity following vaccination with the new adjuvant vaccine has been found to be solid for a period of 10 months, the maximum period for which the tests have been carried out so far.

5. The vaccine does not deteriorate in its protective properties for at least one year when stored at low room temperatures. The vaccine has also been found to withstand fairly high temperatures and can be safely transported under ordinary conditions of rail and bus journey, to far off places covering a journey period of about 10 days during the hot summer months.

Recommendations

1. More investigations should be carried out to study serological and immunological groups within the species of *P. septica* with a view to decide whether a monovalent or a polyvalent vaccine is required for the control of haemorrhagic septicaemia in animals in our country and whether a more highly antigenic or super-strain other than the Indian Veterinary Research Institute stock strain P 52 should be employed for the manufacture of the adjuvant vaccine.

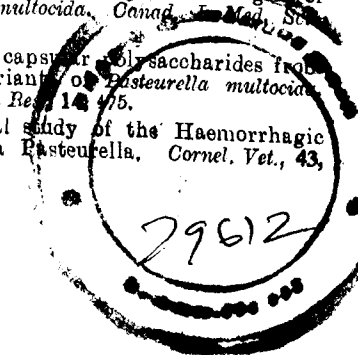
2. Since it has been proved beyond doubt that the new adjuvant vaccine is far superior in its immunizing properties to the commercial broth vaccine, work should be taken up at different production centres to study the most economic method for its large scale manufacture so that the new vaccine may become available for carrying out mass-vaccination campaigns in areas where the disease is highly endemic.

REFERENCES

1. Bain, R. V. S. (1954) ... Immunisation Centre les Pasteurelloses des bovins. *Bull. Off. Int. Epiz.*, **42**, 256.
2. Bain, R. V. S. and Jones, R. F. (1955) ... Studies on Haemorrhagic Septicaemia. III. Production of adjuvant vaccine. *Brit. Vet. J.*, **111**, 90.
3. Batelli, C. (1944) ... Pasteurellosis in Eritrea. *Boll. Soc. Ital. Med. Ij. Trp.*, **3**, 1. (Abst. in *Vet. Bull.*, 1946, **16**, 1705).
4. Carter, G. R. (1950) ... Studies on a *Pasteurella multocida* chicken embryo vaccine. *Amer. J. Vet. Res.*, **11**, 252.
5. Carter, G. R. (1951) ... Studies on a *Pasteurella multocida* chicken embryo vaccine. II. Type specific nature immunity elicited by a monovalent *P. multocida* vaccine. *Amer. J. Vet. Res.*, **12**, 326.
6. Carter, G. R. (1952) ... Some comments on Pasteurellosis. *Canad. J. Comp. Med.*, **16**, 105.
7. Carter, G. R. (1952) ... The type specific capsular antigen of *Pasteurella multocida*. *Canad. J. Med. Sci.*, **30**, 36.
8. Carter, G. R. and Annau, E. (1953) ... Isolation of capsular polysaccharides from colonial variant of *Pasteurella multocida*. *Amer. J. Vet. Res.*, **14**, 475.
9. Carter, G. R. and Bryne, J. L. (1953) ... A serological study of the Haemorrhagic Septicaemia Pasteurella. *Cornel. Vet.*, **43**, 221.

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10. Corneline, J. T. (1929) ... An investigation of the serological relationships of twenty-six strains of *Pasteurella*. *J. Path. and Bact.*, **32**, 855.
11. Dhanda, M. R. (1954) ... Unpublished records of the I. V. R. I., Mukteswar.
12. Dhanda, M. R. *et al* (1956) ... Immunological Studies on *Pasteurella Septica*. Part I—Trials on adjuvant vaccine. *Ind. J. Vet. Sci. and Anim. Husband.*, **26**, 273.
13. Dhanda, M. R. *et al* (1958) ... Immunological Studies on *Pasteurella Septica*. II—Further trials on adjuvant vaccine. *Ind. J. Vet. Sci. and Anim. Husband.*, In Press.
14. Fitch, C. P. and Nelson, E. N. (1923) ... Preliminary report on the differentiation of various organisms belonging to the haemorrhagic septicaemia group. *J. Amer. Vet. Med. Ass.*, **63**, 147.
15. Hudson, J. R. (1954) ... Prophylaxie de la Pasteurellose bovine. Note preliminaire sur la classification des souches de *Pasteurella septica* et sur un vaccine vivant atténue. *Bull. off. Int. Epiz.*, **42**, 267.
16. Iyer, S. V. *et al* (1955) ... Studies on Haemorrhagic Septicaemia vaccines. The effect of adjuvants upon the immunising value of formalin-killed *Pasteurella bovisseptica* organisms. *Ind. Vet. J.*, **31**, 379.
17. Jones, F. S. (1921-22) ... The types of *Pasteurella bubaliseptica* in a dairy herd. *J. Amer. Med. Ass.*, **63**, 271.
18. Khalifa, A. B. (1936) ... *Pasteurella* in animals and their inter-classification. Ministry of Agriculture, Egypt. Technical and Scientific Services, Veterinary Section, Bulletin No. 147, (Quoted by Rao, U. R. K., 1953).
19. Krishnamuthy, D. (1957) ... Studies on some aspects of prophylactic vaccination for Haemorrhagic Septicaemia. Proc. 47th Session of Ind. Sci. Congr., Part III, 367.
20. Lal, R. B. (1927) ... A study of certain organisms of the *Pasteurella* group with respect to specific complement fixation by the ice box method. *Amer. J. Hyg.*, **7**, 561.
21. Little, P. A. and Lyon, B. M. (1943) ... Demonstration of serological types within the non-haemolytic *Pasteurella*. *Amer. J. Vet. Res.*, **4**, 110.
22. Priestley, F. W. (1936) ... Some properties of the capsule of *Pasteurella septica*. *Brit. J. Exp. Path.*, **17**, 374.
23. *Idem* (1936) ... A note on the association of the virulence of *Pasteurella septica* with capsulation. *J. Comp. Path.*, **49**, 348.
24. Rajagopalan, V. R. (1914) ... Haemorrhagic septicaemia in buffaloes and cattle. *Indian Eng.*, **5**, 176.
25. Rao, U. R. K. (1953) ... Studies on *Pasteurella septica*. Thesis: University of Madras.
26. Roberts, R. S. (1947) ... An immunological study of *Pasteurella septica*. *J. Comp. Path.*, **57**, 261.
27. Roderick, L. M. (1922) ... Some antigenic relationships of *Bipolaris septicus* group of bacteria. *J. Inf. Dis.*, **31**, 318.
28. Rosenbusch, C. T. and Merchant, I. A. (1939) ... A study of the Haemorrhagic Septicaemia *Pasteurellae*. *J. Bact.*, **37**, 69.
29. Yusef, H. S. (1935) ... A contribution to the serological classification of *Pasteurella* strains. *J. Path. and Bact.*, **41**, 208.

A NEW PARASITIC MITE *INDOCHIRUS UTKALENSIS* (LISTROPHORIDAE : ACARINA) FROM GUINEA-PIGS

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While on a search for parasitic mites in Orissa the present authors came across a type of mite infesting the hairs of guinea-pigs housed in the Biology Laboratory of the Orissa College of Veterinary Science and Animal Husbandry, Cuttack. A perusal of literature on the taxonomy of the hairmites of guinea-pigs led the authors to two controversial generic terms which have been synonymised with each other by different acarologists at different times. Thus Hirst describing the mite *Chirodiscoides caviae* from guinea-pigs has only figured (in 1922) the ventral surface of the male, and unfortunately has not described the dorsal surface. Subsequently Ewing (1929) synonymised Hirst's *Chirodiscoides*, 1917 with *Campylochirus* Trouessart, 1893. Later Womersley (1943) again synonymised *Chirodiscoides* Hirst, 1917 with *Campylochirus* Trouessart, 1893. The present authors with a view to make a critical analysis of this controversy have first made a study on the taxonomy of this mite, which is described herein. The morphological characters of the mite herein described present certain differences from those of *Campylochirus caviae* which, to the minds of the writers, need an erection of a separate genus (as evident from the accompanying key at Table I) for the type under study and hence has been named *Indochirus utkalensis* n.sp.

Materials and Methods

Twenty four guinea-pigs (12 males and 12 females) of good condition were purchased from a small laboratory animal dealer in Calcutta for the Biology Department of the Orissa College of Veterinary Science and Animal Husbandry in the month of February, 1957, with history of no known previous parasitic infestations either internal or external or any other infections whatsoever. To be doubly sure these fresh arrivals at the Biology Department were carefully examined and were found to be free from either parasitic (internal or external) or other infections. They were kept in wooden cages and were given soaked Bengal gram, greens and water *ad lib* every day. The cages were cleaned once in a day. Every now and then their faecal specimens were examined and were treated against coccidial infection, from which these little animals were suffering from time to time. Under these management practices they were keeping good health and their

population increased very appreciably and by September 1957 the Biology Department of Orissa College of Veterinary Science and Animal Husbandry could have a small lovable guinea-pig colony.

Towards the later part of September 1957 falling of hairs in many of these animals accompanied by constant pruritis characterised by frequent rubbing of the body against the sides of the cages and scratching of the body parts with their hind legs drew the attention of the authors.

On close examination, erection of the body hairs was observed in all most all the guinea-pigs, either male or female, young or adult. At or near the roots of the erected hairs numerous minute brown spots were observed. These were the mite colonies proliferating in the body hairs responsible for the constant pruritis and unthriftiness in these animals.

Mites in their various stages of development were collected, preserved and mounted for morphological study. Till the study was under way the animals were not treated with any of the insecticides, in order to get a constant supply of these mites.

Mountants used are :—

- (1) Poly-Vinyl Alcohol as given by Baker and Wharton (1952).
- (2) Gum-Chloral of Womersley (1943) as described by Gray (1954)

Poly-Vinyl Alcohol did not prove satisfactory as it turned brown with time thus hampering the clear definition of the object mounted with it. Gum-Chloral was alright in this respect but heavy crystallisation occurred within a week of mounting.

As such the above Gum-Chloral mountant of Womersley was modified by adding some glycerin to it (Kanungo and Biswal, 1957) which proved satisfactory. In this medium crystallisation was less and that too it appeared after a long period of time, of course, in this case the coverslips were ringed.

Taxonomic descriptions of *Indochirus Utkalensis* :—

Male—(Fig. A—Dorsal view; Fig. B—Ventral view)
Length—347.7 μ .

Smaller than the female. Body is dorso-ventrally flattened, brown and opaque, is clearly divided into gnathosoma, propodosoma and hysterosoma. Gnathosoma is separated from the idiosoma by two distinct notches on either side. One dorsal scutum covers the base of the gnathosoma anteriorly and extends behind the second pair of legs posteriorly; another dorsal shield partly covered by the scutum extends

A New Parasitic Mite *Indochirus utkalensis* (Listrophoridae : Acarina) from Guinea-pigs.

BY K. KANUNGO and G. BISWAL.

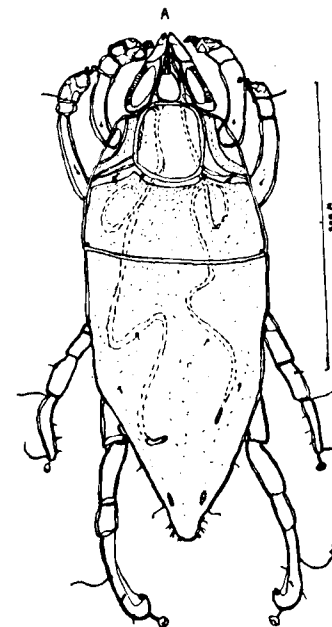


Fig. A. *Indochirus utkalensis*.
Male, Dorsal View.

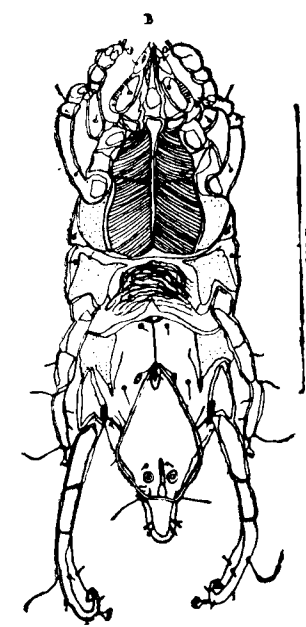


Fig. B. *Indochirus utkalensis*.
Male, Ventral View.

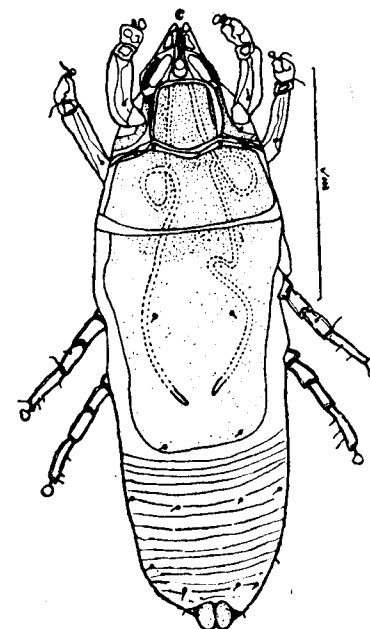


Fig. C. *Indochirus utkalensis*.
Female, Dorsal View.

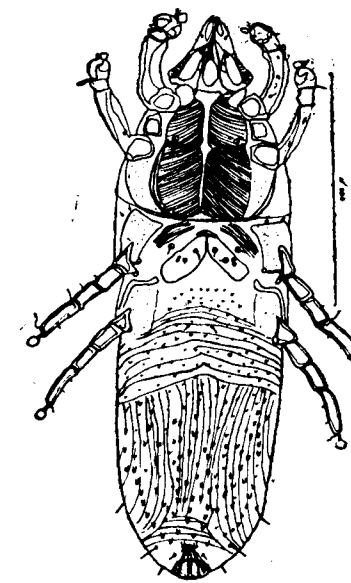


Fig. D. *Indochirus utkalensis*.
Female, Ventral View.

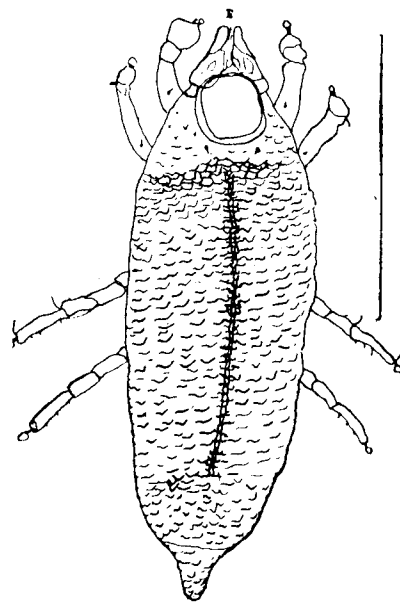


Fig. E. *Indochirus utkalensis*.
Protonymph, Dorsal View.

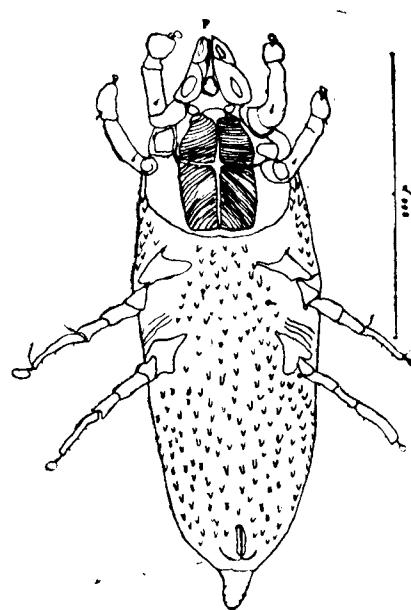


Fig. F. *Indochirus utkalensis*.
Protonymph, Ventral View.

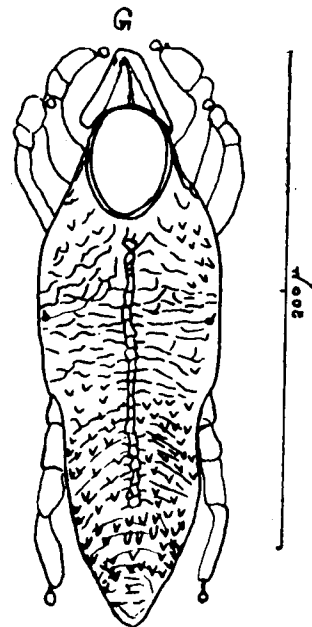


Fig. G. *Indochirus utkalensis*.
Larva, Dorsal View.

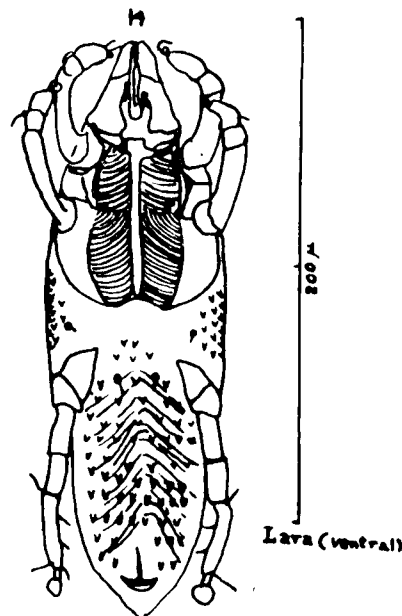


Fig. H. *Indochirus utkalensis*.
Larva, Ventral View.

up to the line separating the propodosoma and hysterosoma. Hysterosoma is more or less truncated behind the legs IV and ends in a more or less conical projection. Two pairs of vertical setae are present besides four other pairs on the dorsal side.

On the ventral surface a pair of anal spines are present anterior to adanal suckers. Bordering the posterior lobe there are a pair of large setae and two to four pairs of small ones. There are a pair of genital setae lateral to the genitalia, another pair just below the transverse chitinous bar formed by joining of apodemes IV and another pair above it. Besides there are two more pairs bordering the anterior boundary of Coxae III. A pair of sternal setae are also present on the sternal area just above the apodemes I.

A saddle-shaped sternum is present on the ventral side of the propodosoma to which join Coxae I and II forming sternal plates. Inner area of the sternum is obliquely striated. Coxae III and IV are fully pitted while Coxae I and II are partly pitted.

Genitalia are situated in between the Coxae IV. The Genital pore is U-shaped and is bounded by a thin chitinous plate anteriorly and by a thick U-shaped chitinous plate posteriorly. There are a pair of spurs (Genital Spurs ?) like whiskers. Probably this pair of spurs protruding outward somehow help in the act of copulation. A pair of accessory genital suckers are also placed laterally to the genital pore.

Posterior to the genitalia is the anal area. Anal opening is longitudinal and extends partly to the posterior lobe. A pair of conspicuous adanal suckers and a pair of anal spines anterior to the suckers are present. The genital pore and the anus including adanal suckers and anal spines are placed in a rhomboidal depression. At the anterior end of that depression are situated the genitalia whereas at the posterior end is the anal area.

The gnathosoma is triangular in outline having notches on either side of its base. Palpi are 2-segmented with basal outer border serrated and heavily chitinsed and each segment bearing one seta. The tips of the palpi also have small spines. Chelicerae are scissor-like and have teeth on both the blades. In between the two chelicerae is the lingua.

The legs are 5-jointed. Coxae are fused with the body. Legs I and II are strongly flattened and modified as claspers to grasp a single hair of the host. Femurs I and II are the longest segments; they bear one spine each. Their borders are thickly chitinsed. Tibiae I and II bear one seta each. Tarsus I is incurved and ends in a caruncle and is palm-like flattened. Two spurs arise from the base of the caruncle. The palm-like flattened inside has one heavily chitinous pad and one

adhesive sucker. The pad bears a spine. The whole palm is transversely cirrosc by a groove. Tarsus II is similar to tarsus I except that it bears one additional spur at its outer base.

Legs III and IV are not flattened but leg IV is the longest of all and extends far backward to the posterior end of the body and is incurved hook-like on its apical segment. Coxae III and IV are pitted; III are widely separated whereas IV pointedly elongate below the level of the trochanter. Trochanters III and IV have small thick chitinous knob-like pads at their inner corners. The tarsal joint is very much constricted and curved. Tarsus III ends in one caruncle and bears a long seta proximally and another at the base of the caruncle and a few others in between. Tarsus IV bears two caruncles, one at the curved tip and the other on the outer border of the curvature. The latter is larger than the former. Tarsus IV is also equipped with one long seta and four to five spines.

Female :—(Fig. C—Dorsal view; Fig. D—Ventral view)

Length :—516.06 μ .

Larger than male, colour is similar to male but the posterior part behind the legs IV is transparent and transversely striated dorsally. The ventral surface has papillae-like outgrowths starting just below the genitalia upto the posterior end of the body. The posterior end is round with two ridge-like projections in the mid-line. Lateral margins of the body behind the legs IV are serrated.

Chaetotaxy is like that of male except four pairs of setae. There are on the dorsal side a few more setae and 3—4 pairs on the ventral side in addition to that as found in male. Genital area is in between the Coxae III. Posterior end of the Coxae IV is not elongated. Epimera of Coxae IV are thickly chitinated but do not join in the mid-line. Genital opening is longitudinal, anteriorly bounded by a thick transverse genital sclerite; genital folds are membranous and wavy posteriorly. Three pairs of genital setae and two pairs of genital suckers are present. Longitudinal anal opening is at the posterior end of the body. There are two chitinated anal plates on the sides of the anal openings. Legs are same as in male except that the legs IV are normal, not longer and incurved hook-like as in male.

Deutonymph :—*(Fig. J)

Length :—395.28 μ .

It is almost like the adult female except that it has no genitalia. One scutum is present on the dorsal side. Posterior to the scutum the

*The description of the deutonymph was made from the one which was in copula with the adult male.

Indochirus utkalensis in Guinea-pigs.

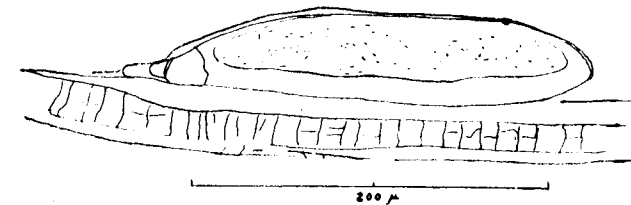


Fig. 1. *Indochirus utkalensis*.
Egg with hair.

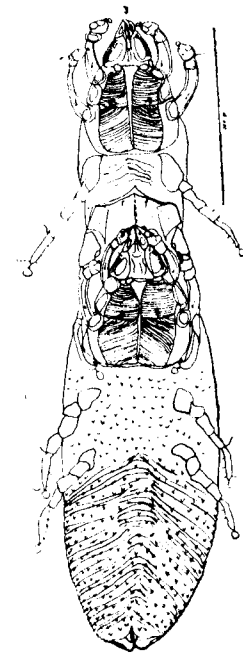


Fig. J.
Indochirus utkalensis.
'Copula', Ventral View.

Ovario-Hysterectomy in an Afghan Hound

By
S. D. SHARMA



Transfusion being administered to the patient.

[To face page 420]

IN MEMORIUM



Dr. L. M. WINTERS

who died on 16th March '58 at Baghdad.

dorsal surface is obliquely striated and scaly. A mid-rib, like a vertebral column, extends from a little behind the scutum almost up to the posterior end. Oblique striated lines starting from the so-called mid-rib extend posteriorly and marginally. As in the adult female the ventral surface is covered by papillaceous outgrowths right from the posterior end of the sternum.

Protonymph :—(Fig. E—Dorsal view; Fig. F—Ventral view).

Length :—420·90 μ .

Almost like the deutonymph except in size. Dorsal surface is covered by polygonal scales on either side of the mid-rib. A post-anal tail-stump is present which is also scaly like the rest of the body. Posterior end is more or less conical.

Larva :—(Fig. G—Dorsal view; Fig. H—Ventral view)

Length :—256·20 μ .

It is almost like the protonymph except that it has three pairs of legs and the posterior end is conical. Anus is terminal.

Egg :—(Fig. I).

Length :—267·18 μ .

It is transparent pear-shaped, pointed at one end; it remains attached to the hair of the host, rounded end always faces the root of the hair.

Copula :—(Fig. J.—Ventral view).

This is a peculiar phenomenon hitherto not described in any of the genera of listrophoridae. This is of frequent occurrence in the present type.

In this case always one immature, probably a deutonymph, pairs with an adult male. The male clasps his partner with its 4th pair of legs in such a way that the tips of these legs fit to the transverse sternal bar of the immature marginally. The suckers of these legs also help in clasping the partner rigidly. In so doing the male covers the anterior half of its partner while the tip of the gnathosoma of the immature fits into the genital opening of the male. Probably the gnathosoma and a part of the propodosoma of the immature lie in the genito-anal depression and fit to it like a ball-and-socket. Besides the adanal copulative suckers probably help in adhering the partner. Thus a rigid and intimate attachment between the two is obtained.

In this phenomenal characteristic posture they have been found clinging to the hairs of the host. The copula are so intimate and rigid that they do not separate out even when the partners are disturbed repeatedly by mechanical needle prickings.

TABLE I

GUNTHER (1942)	WOMERSLEY (1943)	KANUNGO AND BISWAL (1958)
1. Legs I and II modified as claspers ...	1. Legs I and II modified as claspers ...	1. Same as in Womersley (1943)
2. Legs I and II provided with Caruncles; not very highly modified. Sometimes with accessory claspers ... Atopomelinae	2. Legs I and II with Caruncles; not highly modified. Sometimes with accessory claspers Atopomelinae, Gunther 1942	2. Same as in Womersley (1943)
3. n. sub-fam. (Type genus Atopomelinae)	3. Body depressed. Sternal region without claspers ...	3. Same as in Womersley (1943)
4. Body much broader than high. Type species from Africa <i>Listrophoroides</i> Hirst	4. Coxae I and II touching medially, large, inner areas striated, III and IV widely separated ...	4. Same as in Womersley (1943)
5. Body slightly broader than high. Type species from Tasmania <i>Campylochirus</i> Trouessart (= <i>Chirodiscoides</i> Hirst)	5. Legs I and II strongly flattened and incurved hook-like or apical segments; Tarsus IV also incurved and hook-like Dorsal scuta? Gen. <i>Campylochirus</i> Trt. 1893 = <i>Chirodiscoides</i> Hirst, 1917	5. Legs I and II strongly flattened and incurved on apical segments. Tarsus IV in male incurved and hook-like
		6. Coxae IV in male pointed and elongated posteriorly; Legs IV longer in male than in female. Palpi 2 segmented with basal outer border serrated. Two dorsal scuta. Two pairs of small dorsal propodo-anal setae. Sexes strongly dimorphic ... Gen. <i>Indochirus</i> Nov.
		Coxae IV in male not pointedly elongated posteriorly. Basal outer border of palpi not serrated. Dorsal scuta? Dorsal propodosomal setae? Gen. + <i>Campylochirus</i> Trt.
		+ The characters given here for this genus have been taken from the diagram given by Lapage (1956) and key of Womersley (1943)

Type Material:—Holotype male and allotype female from dorsum of guinea-pig (*cavia porcellus*) housed in the Biology Laboratory of the Orissa College of Veterinary Science and Animal Husbandry, Cuttack, Orissa, India collected September, 25, 1957. Holotype and allotype mounted on one slide and paratype (one adult male and one deutonymph in copula) mounted on another slide have been deposited in the Zoological Survey of India, Indian Museum, Calcutta-13, India.

Holotype and allotype slide No. 2341/18.

Paratype slide ,, No. 2342/18.

Acknowledgement

The authors wish to express their grateful appreciation to Dr. N.D. Levine, Professor of Parasitology, College of Veterinary Medicine, University of Illinois, Urbana, U.S.A. and Dr. Lewis J. Stannard, Associate Taxonomist, Section of Faunistic Surveys and Insect Identification, State Natural History Survey Division, Illinois, Urbana, U.S.A., for their kind co-operation extended and keen interest shown in the study of this mite; to the Director, Zoological Survey of India, Calcutta and Dr. B.K. Behura, Head of the Department of Zoology, Ravenshaw College, Cuttack, for furnishing a few valuable literature on the subject and to Sri B.N. Sahoo, Instructor, Orissa College of Veterinary Science and Animal Husbandry for his assistance in drawing a few of the figures presented herein.

REFERENCES

- Baker, E. W. and G. W. Wharton ... An Introduction to Acarology. The Macmillan Co., New York. (1952)
- Behura, B. K. (1958) ... Personal communication.
- Ewing, H. E. (1929) ... A manual of external parasites, I-225 + XIV, Baltimore (Original not seen).
- Gray, P. (1954) ... The Microtomist's Formulary and Guide, Constable and Co., Ltd. London.
- Gunther, C. E. M. (1942) ... Notes on Listrophoridae (Acarina: Sarcoptoidea), *Proc. Linn. Soc. N. S. Wales* 67: 109-110.
- Hirst, S. (1922) ... Mites injurious to domestic animals; *Brit. Mus. (Nat. Hist.) Econ. Ser.* No. 13 (Original not seen).
- Kanungo, K. and G. Biswal (1957) ... Unpublished data.
- Lapage, G. (1956) ... Veterinary Parasitology, Oliver and Boyd, Edinburgh.
- Radford, C. D. (1950) ... Systematic check list of mite genera and type species. *Union Internat des Sci. Biol. Ser. C. (Sec. Ent.)* 1: 1-232.
- Stannard, L. J. (1958 a) ... Personal communication.
- (1958 b) ... Personal communication.
- Womersley, H. (1943) ... Australian species of Listrophoridae Canest. (Acarina) with notes on the new genera, *Trans. Roy. Soc. South Australia*, 67: 10-19.

EXPERIMENTAL TRANSMISSION OF *TRYPANOSOMA EVANSI* IN POULTRY

By

V. S. ALWAR, G.M.V.C., B.V.Sc., M.Sc.,
Madras Veterinary College.

While *Trypanosoma evansi* was successfully cultivated in chick embryos by Longley *et al* (1939), Van Den Berghe (1941, 1943), Naik (1950) and Alwar and Ramanujachari (1952, 1953) and was also transmitted to fowls with the infected mammalian blood by Alwar and Ramanujachari (1955), records about successful trials in the embryos of other varieties of poultry with the same protozoa are not available. Encouraged by the success obtained in infecting chicks in their embryonic stage as well as after they hatch out, the transmission experiments were extended to pigeons, ducks and turkeys.

Experimental details

Blood of guinea-pigs or white rats or white mice heavily parasitised with the bovine strain of *T. evansi* maintained in the laboratory formed the inoculum for the trials. A drop of blood was instilled on the chorio-allantoic membrane for infecting the embryos and 0.25 c.c. of blood was injected subcutaneously for infecting the young ones. The presence of the trypanosomes in the experimental subjects was detected either on wet film examinations or by biological tests.

Eighteen eggs of pigeons were inoculated on the 10th day of their incubation. Thereafter eggs were opened on each day and the embryos examined for the flagellates. Trypanosomes were detected in them after 72 hours by microscopical examination. One of the three squabs hatched out revealed the parasites in its blood. No further observations could be made on these birds as they could not be maintained alive by hand feeding. Trypanosomes appeared in the blood of a white rat utilised for finding out the virulence of the strain from an infected embryo after 23 days and the rat died after another 15 days.

A batch of 25 duck's eggs was inoculated on the 16th day of incubation. The picking up of the infection by the embryos in 72 hours could be detected by biological test only. But from 96 hours onwards the flagellates could be noticed in the embryos on wet film examination. Sixteen embryos died within 10 days after inoculation. One of the 3 ducklings hatched out was found infected, but all the three died after a week and no progression of infection was observed in the infected one while it was alive. A second batch of 4 eggs was inoculated on the 13th day of incubation. Trypanosomes appeared in the embryos in 48 hours. No change in virulence was noticed when the blood from the infected embryos was tested on white rats.

Of the 7 pigeon squabs (either just then hatched out or a day-old ones) inoculated, one did not pick up the infection; the presence of trypanosomes in 4 was detected by biological test only and the other 2 revealed the parasites on microscopical examination. The infection was uniformly very light and no increase in the number of parasites was noticed. The earliest time the trypanosomes appeared was on the 8th day and they persisted in the blood for a period of 7 to 17 days. All these birds survived. During the biological and virulence tests conducted with the infected blood, white rats revealed the flagellates 3 to 8 weeks after inoculation and died 4 to 10 weeks later. Three 5-9 day-old squabs failed to take up the infection even with a heavy inoculum. Successful transmission was also effected in a day-old squab with the blood from an infected pigeon. The infection was detectable by biological test only.

Six of the twelve ducklings inoculated as soon as they hatched, picked up the infection and in all except one, trypanosomes were seen on wet film examination. The infection which was invariably light was noticeable after 5-15 days and persisted till 7-24 days. In 2 there was a slight progression of infection and these as well as 3 more infected ones died leaving only one to survive. No change in the virulence of the strain from these ducks was noticed.

Two turkey chicks inoculated soon after hatching, revealed the parasites on the 8th and 10th day respectively. While the one which was very weak died on the next day after the appearance of the flagellates, the other one persistently revealed stray trypanosomes for 12 days. This bird after throwing off the infection thereafter lived for over 1½ years. There was no change in the virulence of the strain.

Discussion

The appearance of *Trypanosoma evansi* in the embryos of ducks and pigeons in 48-72 hours after the egg inoculation was similar to the observations made by Alwar (1953) in chick embryos with the same parasite. But all others who successfully cultivated the pathogenic mammalian trypanosomes in chick embryos noticed the parasites only on or after the 4th day of inoculation.

While a large number of workers invariably observed death of all the infected embryos, a few were successful in getting infected chicks hatched out. Of them, Mitchell *et al* (1939) experimented with *T. equiperdum*, Acanfora (1939) and Hallauer and Kuhn (1940) with *T. brucei* and Hood (1949) with *T. brucei*, *T. equiperdum* and *T. hippicum*, while Van Den Berghe (1943) and Alwar and Ramanujachari (1952, 1953) utilised *T. evansi*. The present investigation indicates the possibility of pigeon squabs and ducklings also hatching as infected ones from the inoculated

eggs; however no prolonged observations could be made as all of them died soon after hatching.

Literature on the successful transmission of *T. evansi* direct from the mammalian host to the various species of poultry other than fowls is not available. But infection had been established with *T. brucei* in geese (Shilling, 1904; Mesnil and Martin, 1906; cited by Laveran and Mesnil, 1907) and pigeons (Solazzo, 1929), with *T. rhodesiense* in guinea-fowls and ducks (Corson, 1931, 1932) and with *T. equiperdum* in ducks (Seager, 1944). In the present experiments it was found possible to infect pigeons, ducks and turkeys with *T. evansi*. The infection from a pigeon was also transmitted to another. The other records of similar transmission in chicks were by Biocca (1938) and Alwar and Ramanujachari (1953) with *T. brucei* and *T. evansi* respectively. Observations on the infected birds were more or less similar to those made by Alwar and Ramanujachari (1953, 1955) in the infected fowls.

Summary

Trypanosoma evansi was successfully cultivated in the embryos of pigeons and ducks. The infection in the embryos was noticed in 48-72 hours. One-third of the birds hatched from the inoculated eggs harboured the parasites.

Successful transmission of *T. evansi* with the parasitised blood from the mammalian host was effected in freshly hatched or day-old pigeon squabs, ducklings and turkey chicks. The flagellates were found in the blood after a minimum period of 5 days and persisted for a maximum of 24 days. The infection from the pigeon was also transmitted to another squab.

The virulence of the organism was found unaltered during the passage in ducks and turkeys. But white rats on inoculation with the strain from pigeons revealed the trypanosomes in the blood after 3 to 8 weeks only and died 2 to 10 weeks later, evidently manifesting attenuation of the virulence.

Acknowledgement

The author thanks Sri Bertie A. D'Souza, Principal, Madras Veterinary College, for his keen interest and encouragement in the above work.

REFERENCES

- Acanfora (1939) ... *Arch. Ital. Sci. Med., Colone. Parasit.*, (Abst.) *Trop. Dis. Bull.*, **37**, 409.
 Alwar, V. S. (1953) ... Thesis, Madras University.
 Alwar, V. S. and Ramanujachari, G. (1952) *Ind. Vet. J.*, **29**, 113.
 Idem (1953) ... *Ibid.*, **29**, 383.
 Idem (1955) ... *Curr. Sci.*, **24**, 87.

- Biocca, E. (1938) ... *Ann. Igien.*, **48**, 532. (Abst.) *Vet. Bull.*, **11**, 359.
 Corson, J. F. (1931) ... *Jl. Trop. Med. and Hyg.*, **34**, 109, 133.
 Idem (1932) ... *Ibid.* **35**, 123.
 Hallauer, C. and Kuhn, C. (1940) ... *Z. Hyg. Infekkr.*, **122**, 406. (Abst.) *Vet. Bull.*, **11**, 677.
 Hood, M. N. (1949) ... *Amer. Jl., Trop. Med.*, **29**, 379.
 Laveran, A. and Mesnil, F. (1907) ... *Trypanosomes and Trypanosomiasis*. Bailliere, Tindall and Cox, London.
 Longley, B. J., Clausen, N. M. and Tatum, A. L. (1939) ... *Proc. Soc. Exp. Biol. and Med.*, **41**, 365.
 Mitchell, C. A., Walker, R. V. L., Heath, L. N. and McKereher, D. G. (1939) ... *Canad. Jl. Comp. Med.*, **3**, 223.
 Naik, R. N. (1950) ... *Ind. Vet. J.*, **27**, 138.
 Seager, L. D. (1944) ... *Science*, **100**, 428.
 Solazzo, G. (1929) ... *Z. Immunitätsforsch.*, **60**, 239.
 Van Den Berghe, L. (1941) ... *Acta. Biol. Belg.*, **1**, 146. (Abst.) *Vet. Bull.*, **18**, 197.
 Idem (1943) ... *Ann. Soc. Belge de Med. Trop. Bruxelles*, **23**, 113. (Abst.) *Trop. Dis. Bull.*, **42**, 871.

EFFECTS OF CLIMATE ON REPRODUCTION

By

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Climatic components have considerable effects on reproductive efficiency of animals. Under natural conditions it is difficult to determine the individual effects of various components. Temperature is associated with sunlight, both varying simultaneously and in the same direction and it is common knowledge that light often regulates reproductive activity. Rowan (1925) showed that in birds the annual rhythm of gonadal development is due to seasonal changes in light. Bissonnette in 1941 induced sexual activity in goats during the anoestrus by changing the hours of light. That the duration of breeding season in the sheep is associated with length of day light has been inferred by a number of workers (Marshall, 1937; Kelley and Shaw, 1943; Hammond, Jr., 1944 and others), Yeates (1947, 1949) finally demonstrating this point experimentally.

Since temperature is perhaps the most important climatic factor in livestock production and certainly the easiest to control in experiments, considerable work has been done on its effects on reproductive efficiency. Anderson (1945) reviewed extensive literature showing the deleterious effect of heat on male animals. The most detailed work of this type has been on function of scrotum. Moore (1932) showed that

the natural occurrence of cryptorchidism, the experimental replacement of the testes in the abdominal cavity, and the artificial induction of increased testis temperature, produce rapid impairment of the germinal epithelium. Phillips and McKenzie (1934) have experimentally demonstrated that high summer temperatures materially lowered the *vitality* of spermatozoa in the ram and, if continued for periods of several weeks, caused degeneration of reproductive tissue, resulting in sterility. Other experiments of this type have confirmed the deleterious effects of heat on rams (McKenzie and Berliner, 1937; Gunn, Sanders and Granger, 1942; and others). Low environmental temperature during the summer months apparently improves fertility in rams (Dutt, 1953; Dutt and Simpson, 1954; Dutt and Bush, 1955).

The fact that increased testicular temperatures influence spermatogenesis in the bull has been demonstrated by Lagerlof (1934) and Phillip and Andrews (1936). Casady, Myers and Legates (1953) employing a controlled environmental chamber, concluded that "under chamber conditions spermatogenesis in the young dairy bull may be impaired when the animal is continuously exposed to temperatures exceeding 85°F for periods exceeding 5 weeks."

Dawson (1938) found that average fertility of aged sires at stations located in the southern portions of U.S.A. was 36% as compared with 49% for sires at northern and western locations. He suggested that these differences in fertility may be due to differences in both temperature and length of day light. Bonsma, Scholtz and Badenhorst (1940) attributed the sterility in Africa of a large percentage of bulls of exotic (imported) breeds in the hot months to high atmospheric temperature; and Bonsma (1949) has reported that at Mara Agricultural Research Station, South Africa, Africander bulls gave an average serviceable life of 8 years and 10 months while the bulls of exotic beef breeds could be used for an average period of only 3 years and 3 months.

Erb, Andrews and Hilton (1942) found definite seasonal trends in the quality of semen of bulls. Seath and Staples (1941) working with dairy cattle at a lower latitude in Louisiana, U.S.A., found that more services were required per conception during summer months than at any other season. It is apparent that the seasonal temperature and number of services required per conception are correlated, at least where the temperature is very high (Hilder, Fohrman and Graves, 1944; Morgan and Davis, 1938; Trimberger and Davis, 1945; Anderson, 1945; and others). As reviewed by Erb and Waldo (1952) the available evidence still suggests that, in areas where high environmental temperatures are common during a portion of the year, breeding efficiency in dairy cattle does decline during the summer. Mercier and Salisbury (1947) reported that fertility in bulls seemed to vary directly with the

length of day-light, the hours of sunshine and the outside temperature, and as a result of partial correlations determined, the length of day-light was more closely associated with level of reproduction than temperature.

Our knowledge about the effects of heat on reproduction in the female is limited. Adverse effects of hot climate on the conception rate of European types of cows is shown by the observations of Villegas (1939) with Holstein cows kept in an air conditioned barn at 70°F. He reports that 58% of the cows in the air conditioned barn conceived within five months, while only 25% of those in an ordinary barn did so. Bonsma (1949) has reported that the calves born after a summer gestation are small in the case of unadapted breeds of cattle. He found that calves of cows of the unadapted British breeds born in May-June were 20% lighter than calves of the same animals born in December-January, and that the differences in weaning weight was 27%. The percentage of Africander cows bred when 10-16 years old was 21.5% *versus* 6.4% for Shorthorn X Africander and 1.2% for Hereford X Africander. Hammond (1949) mentions that there is a decline in fertility, survival rate, growth rate and milk production, which is cumulative from generation to generation in animals unsuited to hot climates. Bonsma, Marle and Hofmeyr (1953) demonstrated that not only the average calving percentage in the unadapted breeds of cattle is low but that their calf mortality is also very high.

Steinach and Kammerer (1920) have reported that high temperature reduces the fertility of female rats and the size of their litters, so that, at 20°C the litter size was ten, and at 30°C it was eight. Sundstroem (1922) did not observe any reduction in litter size of mice kept for four generations in a hot room with an average dry-bulb temperature of 31.8°C and wet-bulb 27.9°C, and he concluded that when the fertility of the parent generation is of medium dimensions, a species may be capable of preserving this fertility uninfluenced by a hot environment. Sundstroem (1927) found that seven month old male rats in the hot room at the age of 15 months could not impregnate the oestrous females from outside, after repeated successful matings. With females it was found that the vagina opened as a rule in the hot room animals at an earlier age than in the controls. However, when successfully mated with normal fertile males, normal pregnancy and birth of living young took place only in two instances while in the remaining cases the foetuses had died or undergone resorption. Remarkable experiments have been carried out by Ogle (1934) who studied the effect of artificially created hot and cold environments on the sexual functions of white mice. He observed that the exposure of the white mice to hot room temperatures of 88-92°F with nearly 75% humidity, resulted in low

percentage of fertile matings, smaller litter size and low viability of off-springs. Likewise, when exposed to changeable environments of hot and cold rooms, the white mice exhibited poor adaptability, and suffered a severe loss of sexual functions. However, they resumed normal sexual activity when relieved of the climatic stress, showing that the loss of functions is not permanent.

There is considerable evidence that foetal losses in the form of resorption or atrophy or abortion occur in females of all species (Hammond, 1921; Tanabe and Casida, 1949; Burns, Warnick, Koger and Pearson, 1954; Kidder, Blake, Ulberg and Casida, 1952; Heitman, Hughes and Kelly, 1951; Glasgow, Mayer and Dickerson, 1951; Dutt, 1951; Dutt and Simpson, 1954). Attempts to correlate the embryonic death rate with low fertility of the bull have failed (Kidder, Blake, Ulberg and Casida, 1952). Abortions in Brucellosis free cows and sows have been reported with high atmospheric temperature. Ragsdale, Brody, Thompson and Worstall (1948) reported that two brucellosis-free dairy cows aborted 4½ and 6 months fetuses respectively, 2 days following 27 hours' exposure to 100°F. Heitman, Hughes and Kelly (1951) who studied the effect of heat on pregnant sows, reported that one sow out of 13 aborted on the 103rd day of gestation. However, Heitman *et al* do not consider the high air temperature to be the cause of abortion in the pregnant sow, but it seems reasonable to believe that the abortion may be related to high air temperature since as the authors mention, the aborted sow was Brucellosis-free and had produced one normal litter before the exposure to high temperature and two normal litters subsequently.

Studies of Yeates (1953) showed an adverse effect of heat on pregnancy in the sheep. In his experiments using Romney Marsh sheep, only one out of six ewes exposed to high air temperature (105° F dry bulb and 87° F wet bulb) daily, throughout pregnancy, lambed. In a further experiment to confirm this, he exposed two groups of six sheep each, during the last two thirds and last third of pregnancy respectively to a high temperature of 107° F dry bulb and 92° F wet bulb. He observed that one ewe from the last-third-pregnancy group and 3 ewes from the last-two-thirds-pregnancy group failed to lamb. For both years the yield of lambs per ewe was 9 lb. 5 oz. for controls, and 7 lb. 13 oz., 4 lb. 1 oz. and 1 lb. 2 oz. per ewe for those ewes exposed to heat during the last third, last two thirds and throughout the whole of pregnancy respectively. Although this effect of high temperature on gestation was so pronounced, oestrous behaviour was found to be unaffected.

Thus it is apparent that pregnancy may be disturbed by high air temperature in some species at least.

REFERENCES

- Anderson, J. (1945) ... Imperial Bureau of Animal Breeding and Genetics, Technical Communication.
- Bissonnette, T. H. (1941) ... *Physiol. Zool.*, **14** : 379.
- Bonsma, J. C., Scholtz, G. D. J. & Badenhorst, F. G. J. (1940) ... *Emg. S. Africa*, **15** : 7.
- Bonsma, J. C. (1949) ... *J. Agric. Sci.* **39** : 204.
- Bonsma, J. C., Marle Van, J. & Hofmeyr, J. H. (1953) ... *Empr. J. Agric.* **21** : 154.
- Burns, W. C., Warnick, A. C., Koger, M. and Pearson, A. M. (1954) ... *J. Anim. Sci.* **13** : 1016.
- Casady, R. B., Myers, R. M. & Legates, J. E. (1953) ... *J. Dairy Sci.* **36** : 14.
- Dawson, J. R. (1938) ... *J. Dairy Sci.* **21** : 725.
- Dutt, R. C. (1951) ... *J. Anim. Sci.* **10** : 1075.
- Dutt, R. C. (1953) ... *J. Anim. Sci.* **12** : 945.
- Dutt, R. C. & Simpson, E. C. (1954) ... *J. Anim. Sci.* **13** : 1019.
- Dutt, R. C. & Bush, L. F. (1955) ... *J. Anim. Sci.* **14** : 885.
- Erb, R. E., Andrews, F. N. & Hilton, J. H. (1942) ... *J. Dairy. Sci.* **25** : 815.
- Erb, R. E. & Waldo, D. R. (1952) ... *J. Dairy. Sci.* **35** : 245.
- Glasgow, Betty Ruth, Mayer, W.T. & Dickerson, G. E. (1951) ... *J. Anim. Sci.* **10** : 1076.
- Gunn, R. M. C., Sanders, R. N. & Granger, W. (1942) ... *Coun. Sci. Industrial. Res., Aust. Bull. No. 148.*
- Hammond, J. (1921) ... *J. Agric. Sci.* **11** : 337.
- Hammond, J. (1949) ... *Proc. U. N. Sci. Conf. Conserv. Utiliz. Resources.* **6** : 414.
- Hammond, J. Jr. (1944) ... *J. Agric. Sci.* **34** : 97.
- Heitman, H. Jr., Hughes, E. H. & Kelly, C. F. (1951) ... *J. Anim. Sci.* **10** : 907.
- Hilder, R. A., Fohrman, M. H. & Graves, R. R. (1944) ... *J. Dairy Sci.* **27** : 981.
- Kelley, R. B. & Shaw, H. E. B. (1943) ... *Counc. Sci. Industrial. Res. Aust. Bull. No. 166.*
- Kidder, H. E., Black, W. C., Ulberg, L. C. & Casida, L. E. (1952) ... *J. Anim. Sci.* **11** : 796.
- Lagerlof, N. (1934) ... *Acta. path. microbial. scand. Suppl.* **19**, (quoted by Anderson, 1945).
- Marshall, F. H. A. (1937) ... *Proc. Roy. Soc. (London)*, **122** : 143.
- Mercier, E. & Salisbury, G. W. (1947) ... *J. Dairy. Sci.* **30** : 747.
- McKenzie, F. F. & Berliner, V. (1937) ... *Mo. Agric. Exp. Sta. Res. Bull. No. 265.*
- Moore, C. R. (1932) ... "Sex and Internal Secretion". Ed. by: Edgar Allen, Williams & Wilkins Co., Baltimore.
- Morgan, R. F. & Davis, H. P. (1938) ... *Nebraska Agric. Exp. Sta. Res. Bull. No. 104.*
- Ogle, C. (1934) ... *Amer. J. Physiol.* **107** : 628.
- Phillips, R. W. & McKenzie, F. F. (1934) ... *Mo. Agric. Exp. Sta. Res. Bull. No. 217.*
- Ragsdale, A. C., Brody, S., Thompson, H. J. & Worstall, D. M. (1948) ... *Mo. Agric. Exp. Sta. Res. Bull. No. 425.*
- Rowan, W. (1925) ... *Nature*, **155** : 494.
- Seath, D. M. & Staples, C. H. (1941) ... *J. Dairy Sci.* **24** : 510.
- Steinach, E. & Kammerer, P. (1920) ... *Arch. Entw. Mech. Org.*, **46** : 391.
- Sundstroem, E. S. (1922) ... *Amer. J. Physiol.* **60** : 397.

- Sundstrom, E. S. (1927) ... *Physiol. Rev.*, **7** : 320.
 Tanabe, T. Y. & Casida, L. E. (1949) ... *J. Dairy Sci.* **32** : 237.
 Trimberger, G. W. & Davis, H. P. (1945) ... *J. Dairy Sci.* **28** : 659.
 Villegas, V. (1939) ... *Philipp. Agric.* **27** : 693.
 Yeates, N. T. M. (1947) ... *Nature*, **160** : 429.
 Yeates, N. T. M. (1949) ... *J. Agric. Sci.* **39** : 1.
 Yeates, N. T. M. (1953) ... *J. Agric. Sci.* **43** : 199.

Clinical Article

OVARIO-HYSTERECTOMY IN AN AFGHAN HOUND

By

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Veterinary Surgeon, New Delhi.

The subject was an Afghan Hound named "Shahi" (Royal). She was a present from the Royal Afghan family to the Ambassador of India in Kabul, Wing Commander Roopehand. She was with Sardar Surjit Singh Majithia ever since 1953 and appeared to be a little in difficulty to understand Hindi, as she was used to Urdu in her home tract.

When she was on 'heat' in October 1957, she could not be mated for want of a suitable mate of the same breed. Strict security measures proved of no value, as she broke loose one day and 63 days later gave birth to a litter of three non-descript pups. The trouble started when she could not deliver any more pup in spite of mild pains for over 24 hours.

Examination revealed that she had yet a job to perform. Pituitary Extract 1 c.c. (Posterior lobe) was given intramuscularly and repeated an hour later. No progress was noticed. Forceps delivery was attempted. The pup was dead, swollen and putrified. The head and part of the neck came off, leaving the rest inside the uterus. All attempts proving futile, a caesarian operation appeared to be the only hope, if the valuable mother was to be saved.

She was running 106° F. Anti-Gas-Gangrene Serum 2 c.c. and 1500 units of Anti-Tetanus Serum was injected intramuscularly. Three-hourly intramuscular injections of Hydro Streptomycine $\frac{1}{2}$ gm. with Pencillin G. Sodium 2,00000 units were given. The temperature came down to 103° F. by the evening. The co-operation of Dr. Belani, Anaesthetist and Dr. Katariya, Surgeon, was sought to do the operation jointly.

The site of operation just behind the navis was disinfected with 2% Mercurochrome Solution, after clean shaving. Rigid aseptic

precautions were taken in all details. The dead pup was lying high up close to the left horn of the uterus. The offensive putrid odour was quite suggestive of the gangrenous condition of the uterus. Due to perforation of the uterus at a certain spot, it was found that the infective discharge had gone into the abdominal cavity also. Nearly a pint of such fluid was soaked out. There were already signs of peritonitis. Even the left horn of the uterus was showing evidence of gangrene. The situation was alarming and the chances of recovery appeared to be beyond all hope. But yet, not losing heart, ovario-hysterectomy was decided upon and carried out. The abdominal cavity was sprayed with Pencillin G. Solution and the chromic catgut No. 1 closed the peritoneal layer and the aponeurotic muscular structure. Skin sutures were of silk thread.

Rubber corrugated drainage tube 4" long was left in position with the help of sutures. Immediately after the operation the transfusion of Glucose 5% solution (Crooks) by means of a drip was started through the saphenous vein. This was followed up with Plasmosan, Glucose Saline and Glucose 25%. The first transfusion was mixed with one ampoule of *Nor Adrenaline* and the rest with Soluthiazole. The rate of flow was 30 to 35 drops per minute. Each bottle on an average lasted for six hours except the Glucose 25% solution of 100 c.c. which lasted for an hour and a half.

Hydrostreptomycin $\frac{1}{2}$ Gm. with Pencillin G. Sodium 100000 units was injected intramuscularly every three hours without a break. The above treatment was continued from 10 p.m., on 30—12—57 to 4 p.m. on 5—1—58. On the night of the operation and till mid-day next, the patient was moaning, groaning and yelling from time to time. $\frac{1}{4}$ grain of Morphine Hydrochloride was given at 1 a.m. and two attendants were always on duty by turns and the author himself had to be very vigilant during the first 48 hours, practically remaining near the patient. Coramine was given whenever there was indication for it. The temperature range was from 102° F to 103° F throughout the period and it touched normal on the afternoon of 8th January 1958. Bowels were regulated with Glycerine enema and when the injections and transfusion were discontinued the patient was put on Synermycine 250 mg. capsule every six hours for four days. With the usual care on feeding, the patient made an un-eventful recovery.

The case is recorded only to show what is possible in Veterinary Surgery also, with the modern lines of treatment and all possible care. The natural powers of resistance in our patients are a great asset in our favour. I only hope this humblerecord will induce a wave of confidence in our colleagues and make them dare and do.

I wish to acknowledge my thanks to Dr. R. N. Katarita and Dr. Belani for their masterly help and to Sardar M. S. Mali, Director of Veterinary Services, Punjab, and Dr. A. N. Chadha, Assistant Director, Animal Husbandry, Delhi, for their continued interest and encouragement.

Abstracts

A study of relationship between skin thickness and fibre thickness and medullation in the fleece of Bikaner Sheep.—BY S. SRINIVASA RAO, Gurbax Singh Mahal and Sudershan Kumar, Government Livestock Farm, Hissar—Report of a Research Work done at the Govt. Livestock Farm, Hissar.

A study to determine the relationship between skin thickness and fibre thickness and percentage of medullation, in the fleece of Bikaneri sheep, was made on a group of 119 yearling ewes maintained at the Govt. Livestock Farm, Hissar.

The mid back region was found suitable for making the study. The measurements of the skin were made with the help of a pair of callipers while fibre thickness measurements and percentage of medullated fibres were made with the help of a projector.

A highly significant negative correlations $r = -0.83$ was found between skin thickness and fibre thickness but the relationship between skin thickness and percentage of medullated fibres was almost negligible $r = -0.14$. There was a significant positive correlation between fibre thickness and percentage of medullated fibres $r = 0.21$.

The regression coefficient indicated that the mean skin thickness decreased by 0.04 mm. per micron increase in the fibre thickness and increased by 0.01 mm. with unit percent increase in medullation.

On the basis of linear relationship obtained between skin thickness on one hand and fibre thickness and medullation percentage on the other, it was possible to explain that 25 per cent variation in skin thickness was due to these two attributes.

GURBAX SINGH MAHAL

The Production of Bovine Haemorrhagic Septicaemia Vaccine by continuous culture.—BY M. STERNE and I. HUTCHISON. *B.V.J.* Vol. 114, No. 5, Ps. 176-179.

The authors describe for the routine production of H. S. Vaccine, a continuous culture technique in which by maintaining satisfactory

aeration and a steady H-ion concentration they were able to get dense harvest of the culture (*Pasteurella multocida*, Roberts, Type 1), which was 20 times more than the one usually obtained in an unaerated liquid medium. By this an effective immunising dose (2 mg. of killed antigenically satisfactory culture) could be included in 1 c.c. and approximately 1000 doses could be obtained from a litre of culture. Dissociation was negligible.

The authors were able to produce 30,000 doses per day. Their seed culture had a mouse virulence of 5 to 10 x 10⁶ MLU/ml. Medium used is also described.

M.S.J.

The action of Bioestrogen on wound Healing.—BY I. N. LIKAR *et al.* *B.V.J.* Vol. 114, No. 4, ps. 152-160.

The effects of "Bioestrogen" (Extracts of oestrogenic hormones from stallions' urine) upon tissue repair, particularly epithelialisation and granulation, were studied. The results of treatment of a great number of wounds, mostly long standing and which have failed to heal by first intention, were highly encouraging. Adequate control of granulation and growth of epithelium could be achieved by the application of thin layers of ointment. Where there was a tendency to excess granulation thick application at the edges and thin layers in the centre checked the excess efficiently.

The effect of "Bioestrogen" on surgical wounds in ten rabbits was studied. It was applied as a 25% ointment in a lanolin base after dissolving in cod-liver oil or linseed oil. The results were compared with those of an antiseptic powder and ointment. "Bioestrogen" was found to heal the wounds more rapidly and efficiently and notably without suppuration.

"Bioestrogen" appears to produce remote effects also. It possesses greater biological activity than pure crystalline oestrogenic compound probably due to some other factors combined with the steroids.

M. S. J.

Penicillin Blood Levels in the Horse with Fortified Benzathine.—BY P. B. English. *Australian Veterinary Journal*, Vol. 34, No. 3, ps. 82-88.

Serum levels of Benzathine Penicillin (a repository penicillin salt) combined with Procaine and Potassium Penicillin were studied after injecting into horses.

Penicillin assay was made against a standard strain of *Sarcina lutea*.

The mean value at one hour varied between 0.6 and 3.35 $\mu\text{g/ml}$ and at 120 hours it varied between 0.27 and 0.04 $\mu\text{g/ml}$.

There was no significant difference in the serum levels attained in their persistence between doses of 25,000 and 50,000 Units/Kg. Similar were the results when the fixed dose was given in one or four times.

Variation in the weight of the horse did not affect the response when the standard dose (11,300,000 units) was given. The author feels the response may vary if the dose fell below a certain critical level lying between 15,000 and 25,000 Units/Kg.).

There was a marked variation in response both between different individuals and in the same individual at subsequent treatments.

In their experiments only one horse showed an acute reaction resembling anaphylaxis.

To obtain persistence of blood levels for several days, depository Penicillin such as Benzathine, Benzathamine or Procaine Penicillin plus aluminium monostearate may be used. To produce initial high blood level Benzathine Penicillin may be combined with Crystalline and Procaine Penicillin.

Fortified Benzathine will prove therapeutically useful in respiratory tract infections, in infections of urogenital canal and in cases where time, distance and cost are overriding factors. Prophylactically it will be found useful in surgical and traumatic wounds.

M. S. J.

News and Views

Dairies for Temples:—"Instructions have been issued by the Commissioner of the Hindu Religious Endowments Board to big temples in the Madras State to consider the feasibility of maintaining small dairies.

The suggestion appears to have been made by the Commissioner with a view to enabling the temples not only to engage themselves in *Gosamrakshana* but also to provide pure and good milk for the purpose of *Abishekam*. The Commissioner has also asked the temples to collect the *Abishekam* milk on hygienic lines and distribute the same to the children of the place.

In pursuance of the above proposal, it is gathered that four temples in the Tanjore district have actually taken steps to start dairies. The temple authorities have also contacted the Animal Husbandry

Department for assistance from the Government for the selection of the best breed of cows."

This is a step which we have ourselves advocated long ago during war-time. Even Residential Colleges should have their own dairy units.

The Hindu, July 6th, 1958.

* * *

Grazing Lands for Cattle. Sri Sankaracharya's Appeal:—"It was an irony that in the land where the cow was worshipped, cows were found in an emaciated condition. In lands where cow-slaughter was not regarded as a sin, the cattle yielded more milk per head and were better looked after. In India the peasant was perpetually indebted and his cattle were mere skin and bones. In the past this neglect was trotted out as an excuse for not bringing in legislation to prevent cow slaughter. The Government as well as the public owed a duty in attending to the cattle wealth of the country. In ancient days every village had a common pasture. These pasture lands had got assigned to private individuals. The Government should take steps to acquire these pasture lands for the benefit of cattle. They should also include the maintenance of common Village tanks and tank bunds for cattle under their minor irrigation works. So far as the public was concerned, each house should keep a vessel or a bucket for collecting the water after the rice was washed, and kanji as well as kitchen garbage, like discarded portion of vegetables, skins of fruits, leaves, etc. Arrangements should be made to feed cows with this collection. If every house-holder took care of one cow in this manner, the cattle wealth of the country would improve in no time." How simple and practical it sounds, against all our mighty national plans!

The Hindu, July 8th, 1958.

* * *

A Jap Doctor's Feat:—Dr. Kamata of Keio University Hospital has carried out a successful transplantation on a 54-year-old man who had suffered from nearsight since childhood through a scarred right eye. The cornea taken from a chicken's eye is immersed in the patient's blood plasma and kept in a refrigerator for two days with the addition of penicillin. A part of the patient's cornea is then replaced with the chicken's cornea. A month after the operation, the patient regained 0.02 vision, whereas before the operation it was 0.04.

Although it is twenty months since the operation, there is no deterioration in the patient's eye-sight. This is the second successful operation of the kind in Japan, the first having been on a 14-year-old girl who was cured of a rare cornea trouble.

The Hindu, July 8th, 1958.

* * *

Dr. Carlos Gonzalez.—Fish Marketing Expert, deputed by the FAO, will advise the Madras Government on the best manner in which fish could be marketed. The output of fish in Madras State, both inland and marine, for the year 1957-58 is stated to be of the order of one lakh tons.

Dr. Gonzalez proposes to stay for three months in this State. He is expected to meet the Minister for fisheries and officers of the department for discussions and to visit important landing and consuming centres.

The Hindu, July 8th 1958.

Block Development Corner

[Articles under this section, should be more in the nature of simple 'talks' to rural folks and village level workers, on Animal Husbandry matters, and not loaded with scientific terms and theories.]

GRASS FARMING WITH SEWAGE WATER IN MADRAS—PART II

BY

C. RAJASEKHARA MUDALIAR, M.A.,
Professor of Botany, Agricultural College, Coimbatore (Retired),
and
formerly Superintendent, Sewage Farm, Madras City.

The Editor of the *Indian Veterinary Journal* had asked me to furnish certain particulars with regard to my article on the above subject which had appeared in May 1958 issue of that Journal. I could not do so immediately as I was away from headquarters and I now gladly incorporate all the information asked for in this article.

1. **Name of the grass:**—The "Water grass" is the same as "Para grass" and its botanical name is *Brachiaria mutica*. (Synonym—*Panicum barbinode*). Sometimes it is erroneously called as Buffalo grass. The Buffalo grass is *Buchloe dactyloides* and is suited for drought conditions only.

2. **Nutritive value:**—Water grass contains 2.7% crude protein while Guinea grass contains only 1.62% crude protein.

3. **Duration of the crop:**—Water grass is perennial like Guinea grass. Replacing may not be necessary for a number of years; surplus tillers have to be removed once in six weeks.

4. **Palatability:**—Cattle relish the grass very well though slow to take to it at the beginning and it is even stated that cattle

accustomed to this grass do not relish the other grasses so much. Calves are not affected adversely by this grass.

5. **Yield:**—The yield is about 25,000 pounds per acre per cutting or about 1,50,000 pounds in a year in 6 or 7 cuttings.

6. **Initial cost of planting:**—It works out to Rs. 100 per acre.

7. **Sale value:**—It is at present sold to the public at Rs. 9.00 per 1000 pounds at farm site. The quantity sold per day is about 6000 pounds though they could even now supply 10,000 pounds per day.

8. **Relative proportion of land to population:**—About 150 acres per 1000 population can be brought under sewage farming.

Sewage farming should come into existence wherever possible in our land. All Panchayat Boards where drainage facilities exist may think of producing fodder and thus contributing towards livestock improvement of our land.

Association News

The All-India Veterinary Association

THE RESERVE FUND

An event of great importance to the Veterinary profession in India, took place in August 1924. It was the birth of the *Indian Veterinary Journal*. Circumstances were positively hostile and yet the profession took that bold step and the lion-heartedness of the early pioneers cannot be too highly praised. Ever since then, the *I.V.J.* has toiled hard under very adverse circumstances. The *I.V.J.* lives to-day so that the profession could prosper and science advance.

And now the hat is sent round so as to place this journalistic venture on a sounder and firmer basis. The *I.V.J.* is a priceless possession of our profession. It has placed the Indian Veterinary Surgeon on the map of the scientific world. Just pause and ponder over, how much we owe to this Journal both individually and collectively. Is it too much then to expect the profession to respond to the appeal issued for a Reserve Fund? We hope not.

Some enquiries have come to us asking us to indicate the extent of help expected. We do not want to put the members of the profession

to any undue financial strain in these hard days. At the sametime, a certain amount of sacrifice is needed to make this fund a great success, so as to make it worthy of our profession. So we feel that the following scale of contribution will be quite reasonable. It could even be paid in two or three instalments.

Class I Officers	...	Rs. 100/- and above.
Class II Officers	...	Rs. 50/- and above.
All others	...	Rs. 25/- and above.

It is our ambition that no Veterinary Surgeon in this land should remain without contributing to this fund. Brick by brick, this great edifice of our's should begin to rise higher and higher. On the success or otherwise of this venture, the solidarity of our profession depends. "Pay and Prosper" is the slogan we pass on to the members of our profession.

Jai Hind !

T. VINAYAKA MUDALIAR,
Editor,
The Indian Veterinary Journal,
and
General Secretary, A.I.V.A.

THE I. V. J. RESERVE FUND

LIST OF CONTRIBUTORS

	Amount so far acknowledged	Rs. nP.
Bank commission from Dr. S. B. V. Rao, I.V.R.I.	...	1,280.50
Dr. P. A. Simon, Canada	...	0.50
Dr. K. Parameswaran Nair, Trivandrum, 1st instalment	...	119.80
Dr. A. Benjamin Chelliah, Malaya	...	10.00
	...	100.00
Total	...	1,510.80

Cheques, money orders and all correspondence should be addressed to the Editor, *The Indian Veterinary Journal*, Madras-17.

Memoir

Dr. LAURENCE M. WINTERS

(Contributed)

Dr. Laurence M. Winters, Ex-Professor of Animal Husbandry, University of Minnesota, U.S.A., who was one of the world's leading authorities on Animal Breeding has passed away at Baghdad (Iraq) on 16th March 1958, due to heart failure. After retirement Dr. Winters accepted a two-year assignment with the International Co-operation Administration in Iraq from July 1956 and was working with one of his former students Dr. Khalid Ali, on all aspects of livestock production with cattle, sheep and goats.

Dr. Winters was most widely known for developing three new breeds of hogs—the Minnesota No. one, two, and three, all of which are now used nationally. He was also instrumental in developing two new sheep breeds—Minnesota No. 100 and 102 and miniature pigs. The miniature pigs are being used in livestock research and medical studies.

A native of the Lake City Minneapolis, Dr. Winters received his B.S., and Ph.D., degrees from the University of Minnesota and his M.S. from Iowa State College. He served as Professor of Animal Husbandry at the University of Saskatchewan from 1920 to 1928 and then joined the University of Minnesota. It was due to his efforts in a large measure, that the University of Minnesota had developed one of the largest research stations devoted to the study of Applied Genetics in U.S.A. His work covered experimentation in cross-breeding, in-breeding, artificial insemination and development of new breeds.

The book on Animal Breeding written by him which has successfully gone through 5 editions is a highly valuable reference book. Dr. Winter's contributions in his chosen field of work stand out as monuments to his many qualities. His sad demise marks the passing away of a great man.

To make the grief more poignant the following further details have been received. Dr. and Mrs. Winters were to have left the next morning on a month's tour of India. Mrs. Winters planned to settle down at Denver after her husband's death until her son Peter graduated from Air Force Academy. But on April 8th, Mrs. Winters also passed away suddenly—barely 23 days after her noble husband's death. May their souls rest in peace !

M. P. SINGH,
Ex-student of Dr. Winters at Minnesota.
At present—District Animal Husbandry Officer,
Dhanbad, Bihar State.

Announcement

Post-Graduate Training at the Madras Veterinary College
M.V.Sc., DEGREE COURSE

The Post-Graduate Degree of M.V.Sc. will be instituted in the following subjects: Group 1: (a) Animal Nutrition; (b) Animal Genetics; and (c) Dairy Science; Group 2: (a) Pathology; (b) Bacteriology; (c) Parasitology; Group 3: (a) Physiology; (b) Pharmacology; (c) Therapeutics; Group 4: (a) Anatomy; (b) Surgery; (c) Gynaecology; and Group 5: (a) Medicine; (b) Hygiene; (c) Meat Inspection.

Groups 3 and 5 will be introduced during 1958-59 and 18 students will be admitted, nine for each group. The remaining three groups will be started next year. After all the five groups are started, there will be a total of 45 students for each course of the M.V.Sc. Degree. Fifty per cent of the seats will be reserved for candidates of other States and the balance will be for students of this State. It has been decided to start the course, from September 1, 1958.

The Hindu, dated July 21, 1958.

Review

Tuberculosis in animals and man.—A study in comparative Pathology.

By John Francis D.Sc., M.R.C.V.S., Professor of Veterinary Preventive Medicine and Dean, Faculty of Veterinary Science, University of Queensland—Brisbane, Australia. 5 gns. net. Cassell and Company Ltd., London, 1958. pp. 357.

At a time when determined efforts are being made in various countries to control tuberculosis in man and animals the publication of this book is indeed welcome. The author who has published a book on 'Bovine Tuberculosis' in 1947 is a well-known authority on the subject.

The book is divided into three sections—the first on 'bovine tuberculosis' the second on 'tuberculosis in animals other than bovines' and the third on 'a comparison of the pathology and epidemiology of tuberculosis in animals and man'. In an appendix, the contents of the Report of the British Royal Commission on Tuberculosis (1904-1911) is given, in order to facilitate reference on these which "still represent the best source of information on many aspects of tuberculosis".

As stated by the author, the section on bovine tuberculosis is based on his earlier work on the subject, but the matter has been brought up-to-date and much additional information on the nature of the disease in man due to the bovine type of infection has been furnished. In the chapter on incidence it is interesting to note that the author has quoted references (Soparkar, 1925, Carmichael 1941) to show that Zebu cattle are more resistant to tuberculosis than the European breeds. However, the work done in India by the T. B. and Jhone's Disease Scheme of the I.C.A.R. has shown that the incidence in different

parts of the country varied greatly and that where dairy cattle were kept in conditions similar to those in European countries, the incidence was almost equally high. Possibly the method of husbandry followed in this country might be an important factor in reducing incidence in our Cattle.

The relationship between human and bovine tuberculosis has been fully discussed by the author and he has brought statistical and epidemiological evidence to show that infected milk increased resistance to pulmonary tuberculosis in the general population. It was shown that a remarkable inverse relationship existed between the incidence of bovine tuberculosis and death rate from human tuberculosis. However, it was rightly emphasised that indiscriminate drinking of infected milk was not a desirable method of increasing resistance to tuberculosis and that the method of choice was one of vaccination by B. C. G.

In the 2nd part of the book the author deals very exhaustively with the various aspects of tuberculosis in animals other than bovines—monkeys, guinea-pigs, rabbits, pigs, horses, asses and mules, dogs, cats, minks and silver foxes, ferrets, hamsters, mice, rats, wild animals, fowls, turkeys, ducks, geese, swans, peacocks, chick-embryo and cold-blooded animals.

In the third and final section of the book the author has attempted to present "a closed comparison between the pathology and epidemiology of tuberculosis in man and animals than has previously been done and to introduce some unifying concepts". It was found when different species of animals (including man) are grouped according to the nature of reaction provoked by the bacilli, there was close correlation between the characteristic 'tubercle' formation and the degree of allergic response.

Thus in man, monkey, cattle etc. where typical tubercles are formed, a high degree of allergy is produced, whereas animals like dogs, rats, mice etc. which show no characteristic tubercle formation, the allergy response is poor. Again it was found that there is an inverse relationship between the number of bacilli present in the lesion and the allergy developed and that the extent of caseation depends on the balance between these two factors". These and certain other concepts developed by the author help in understanding the nature of tuberculous process in man and animals.

The number of references given is very exhaustive and this adds to the value of the book for research workers and specialists on the subject.

The book contains a large number of well reproduced illustrations on art paper. The publishers have done their part of work exceedingly well and deserve praise.

K. P. C. NAIR.

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