As an extension of our histochemical studies of the skin (1, 2, 3) this report deals with an investigation of the distribution and activity of monoamine oxidase in various parts of the skin in adult as well as embryo rats.

The distribution of monoamine oxidase has been investigated histochemically in the skin of the adult rat by Hellman (4) and in adult human skin by Shelley et al. (5) as well as by Yasuda and Montagna (6). A biochemical assay of this enzyme was carried out by Thompson and Tickner (7) in blood vessels of various sizes, including the rat's aorta; but these authors did not study the skin. The distribution and activity of monoamine oxidase during the embryonic development of the skin has not been investigated so far.

**MATERIALS AND METHODS**

**Animal Materials.** 12 rat embryos (3 each on the 12th, 14th, 18th and 19th days of gestation), 5 new-born rats, 3 ten-day-old rats, and 10 adult rats each weighing approximately 100 g. were used. All rats were of the Wistar strain. New-born and older rats were killed by a blow on the neck without anesthesia, following which skin was removed from various parts of the body and the hair shaven off. In embryos, skin was taken from the back while they were still alive. Frozen sections were cut approximately 20 μ in thickness and were incubated immediately in substrate media, in control media and also in formol-calcium solution for silver impregnation.

**Histochemical Demonstration of Monoamine Oxidase (MAO).** The method described by Glenner et al. (9, 10) was used. Tryptamine hydrochloride was used as substrate, and nitro-blue-tetrazolium chloride (nitro-BT) was used as electron acceptor.

**Controls.** For control substrate-free media were used. In addition, incubation media were used containing either potassium cyanide as inhibitor of MAO (10^-3 M in final concentration), or iodoacetic acid as an inhibitor of sulfhydryl groups (0.01 M, 0.05 M or 0.1 M in final concentration).

**Other Stains.** In some instances, Coenzyme Q₂ (6 mg per 100 ml) or phenazine methosulfate (3 mg per 100 ml) (11) was added to the substrate media. Bielschowsky's silver impregnation method, as modified by Suzuki (12), was used for the demonstration of nerve fibers.

**RESULTS**

**Ten-Day-Old and Adult Rats**

**Epidermis.** The staining intensity of the epidermis was greater in the upper portion of the squamous layer and in the granular layer than in the lower portion of the squamous layer and in the basal layer. However, some of the reaction in the upper squamous layer and most of the reaction in the granular layer resulted from a non-enzymatic reduction of nitro-BT by sulfhydryl groups inasmuch as some positive reaction was observed in these areas even when sections were incubated in a substrate-free medium; and, furthermore, partial inhibition of the reaction occurred when the sections were incubated in substrate media to which iodoacetate in a final concentration higher than 0.01 M had been added (13). This allows the conclusion that the reaction in part resulted from a non-enzymatic reduction of tetrazolium salt by sulfhydryl groups. The stratum corneum did not stain. In the cells of the lower epidermis fine formazan granules, representing a true enzymatic reaction, were located in the cytoplasm.

**Hair Follicles.** The inner and outer root sheaths were reactive throughout the entire length of the follicle. The hair bulbs, especially their innermost layer of cells bordering on the hair papilla, were always intensely reactive in contrast to the weakly positive reaction of the hair papilla. The keratogenous zone of the hairs reacted intensely; but this reaction was non-enzymatic, resulting from the presence of protein-bound sulfhydryl groups (13, 14, 15) since an equally intense reaction was observed in sections incubated in...
substrate-free media and, furthermore, the reaction could be inhibited by the addition of iodoacetate to substrate media. In resting follicles a moderate enzyme reaction was observed in the epithelial sac of the club hair and also in the “hair germ” connecting the base of the club hair with the resting hair papilla (Fig. 1). The resting hair papillae stained weakly. The reaction in the “capsule” which is situated between the epithelial sac and the club hair was caused by the presence of sulfhydryl groups.

**Sebaceous Glands.** The acini of sebaceous glands stained intensely with fine granules. In addition, large coarse granules were located in the sebaceous ducts (Fig. 1). Since substrate-free media did not stain the sebaceous glands and sebaceous ducts the reaction can be regarded as a true enzymatic reaction. The staining of the sebaceous glands and sebaceous ducts was not affected by the cyclic changes in the hairs.

**Dermal Vessels.** The large vessels in the lower dermis and the perifollicular capillary networks reacted quite strong; but the subepidermal capillary networks stained only weakly. The nerve plexuses surrounding the large vessels were well stained.

**Dermal Nerve Fibers.** The large nerve bundles in the lower dermis composed of myelinated fibers as well as the non-myelinated thin nerve fibers in perifollicular and subepidermal location stained moderately (Fig. 2). A differentiation between neural and vascular elements usually was possible because of the characteristic beaded appearance of the reactive axons in the nerves. In addition, myelinated nerve fibers differed from blood vessels by showing a weakly reactive myelin sheath surrounding the strongly reactive axoplasm; whereas the walls of vessels stained diffusely (Fig. 2). An exact localization of the
enzyme activity in the nerve fibers was not possible; but sections embedded in glycerine jelly showed deposits of reactive formazan granules arranged like chains of beads in the axoplasm as well as in the periaxonal region (Fig. 3). A greater concentration of nerve fibers was found in the dermis of the sole than in the dermis of the back. Nerve fibers were seen particularly in association with sweat glands and tactile corpuscles. Fine nerve fibers in the upper dermis were seen leading to tactile corpuscles in the dermal papillae (Fig. 4). The intensity of reaction in these fibers decreased rapidly as they approached the tactile corpuscles which themselves stained weakly, so that it was difficult to recognize the termination of these fibers.

**Dermal Muscles.** At least two types of muscle fibers could be differentiated, namely small dark-staining and large light-staining fibers. The reactive granules were located in the sarcoplasm in a linear arrangement.

**Arrector Pili Muscles.** The arrector pili muscles showed a moderate reaction. As in the other dermal muscles, the reactive granules were located in the sarcoplasm in a linear arrangement (Fig. 1).

**Motor End-Plates.** The demonstration of motor end-plates in the dermal muscles, namely in the muscles of the upper lip and of the sole, was not as satisfactory with the stain for monoamine oxidase as with the stain for cholinesterase (3). Nevertheless, at the end of some motor nerves, strongly reactive horseshoe-shaped structures or conglomerations of fine nerve fibers were encountered, presumably representing motor end-plates.

**Eccrine Sweat Glands.** The secretory portion of the sweat glands was surrounded by abundant ramifications of reactive nerve fibers. The exact termination of these fibers in the glandular cells was unrecognizable not only because of a decrease in reactivity of the fibers near their terminations but also because of the masking of the fine terminal fibers by the strong reaction within the secretory cells. The myoepithelial cells could not be differentiated from the secretory cells because of an equally intense staining reaction.

**Tactile Hair** As described in Part III (3), the histologic appearance of the tactile hair is quite different from that of the coat hair (16, 17). As in coat hair, the inner and outer root sheaths were strongly reactive (Fig. 5). The strongly reactive hair bulbs enclosed moderately stained hair papillae. The capsule (Cap) did not stain except for a faint coloration of the sparsely distributed cellular elements (Fig. 5). The sebaceous glands of tactile hairs stained intensely. An intensely reactive large nerve bundle of myelinated fibers (N) penetrated through the capsule into the cavernous sinus at the lower third of the capsule (Fig. 5). The strongly staining superior enlargement (SE) of the outer root sheath was supplied with many branches from this large ascending nerve bundle as well as with...
epidermis, as well as the true enzymatic reaction in all cutaneous structures. However, a final concentration of 0.01 M, though strong enough to inhibit the reaction due to sulfhydryl groups, did not inhibit the enzymatic activity in sebaceous glands, in nerve elements and sometimes in dermal muscles. The addition of Coenzyme Q, or phenazine methosulfate did not enhance the activity of MAO in the skin.

Embryos and Premature Rats

Epidermis. The staining reaction in the three layers of the embryonic epidermis, namely periderm, stratum intermedium and stratum germinativum, was moderately strong in 12-day-old and 14-day-old embryos. The intensity

![Fig. 4. Adult rat, sole. The epidermis shows considerable MAO activity, especially the granular layer. The stratum corneum is not stained. In each dermal papilla there is a weakly reactive Meissner tactile corpuscle to which thin nerve fibers lead, arising from the subepidermal plexus. A strong reaction is present in the secretory as well as in the ductal portions of the eccrine sweat glands. (X 150)](image1)

some fibers from the subepidermal plexus. These nerves ended on the tactile cells of the outer root sheath as strongly reacting round structures. Small muscles extending in various directions outside the capsule stained strongly and uniformly without distinction of two types. The ringwulsts usually stained only weakly.

Other Structures. Connective tissue cells, mast cells and the peripheral part of subcutaneous fat cells stained quite intensely.

The Effects of Inhibitors and Coenzymes. Sodium cyanide, even in a final concentration of $10^{-3}$ M, had no inhibitory effect on the activity of MAO. Iodoacetic acid in a final concentration of 0.1 M or 0.05 M inhibited the reaction attributable to sulfhydryl groups in the keratogenous zone of the hair and in the subcorneal layer of the epidermis, as well as the true enzymatic reaction in all cutaneous structures. However, a final concentration of 0.01 M, though strong enough to inhibit the reaction due to sulfhydryl groups, did not inhibit the enzymatic activity in sebaceous glands, in nerve elements and sometimes in dermal muscles. The addition of Coenzyme Q, or of phenazine methosulfate did not enhance the activity of MAO in the skin.

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![Fig. 5. Adult rat, tactile hair. The following structures show a strong reaction: the inner and outer root sheaths of the hair follicle, nerve fibers (N) ascending to the ring sinus (RS), nerve fibers arising from the subepidermal nerve-plexus (SN), cellular elements in the capsule (Cap.), and the pericapsular muscles (M). The ringwulst (Rw) is only weakly positive. C: conical body. H: hair. SE: superior enlargement of the outer root sheath. (X 150)](image2)
FIG. 6. 18-day-old embryo, skin of the back. MAO activity is present in the epidermis, in the primary epithelial germs which are already quite well developed, in the sebaceous glands and in the dermal muscles which are seen in the lower portion of the field. In one of the primary germs a strongly staining hair cone has already formed (arrow). The blood vessels are barely visible. (× 150).

of the reaction increased gradually through the embryonic period and reached full intensity in 5-day-old rats. The reaction in the cells of the stratum intermedium and stratum germinativum was a true enzymatic reaction. In the cells of the periderm, however, the reaction was non-enzymatic because these cells stained not only in substrate media but also in substrate-free media and the staining reaction could be inhibited by the addition of iodoacetate in a final concentration of 0.01 M. In the 18-day-old embryo and in older specimens also the granular layer and upper portion of squamous layer stained non-enzymatically (Fig. 6). The intracytoplasmic localization of the reactive granules in the large embryonic epidermal cells was clearly evident.

Hair Follicles. In the 12-day-old embryo the early buddings of the primary epithelial germs stained weakly. As the primary epithelial germs developed into bulbous pegs in the 14-day-old embryo the reactivity increased in them. As the hair cone appeared within the hair follicle of the 18-day-old embryo (Fig. 6), both the hair follicle and hair cone stained strongly. However, the staining reaction of hair cone was revealed to be non-enzymatic, due to SH groups. The bulges showed a moderate reaction during their transient appearance between about the 18th day of gestation and 5th postnatal day.

Sebaceous Glands. The sebaceous glands began to develop in 18-day-old embryos and stained as soon as they appeared (Fig. 6). The reaction gradually increased as the acinar cells developed and matured. In immature sebaceous glands, the peripherally located undifferentiated cells contained a greater concentration of fine reactive granules than the centrally located sebaceous cells. Mature sebaceous glands, as seen in 5-day-old and older rats, showed a heavy concentration of reactive granules throughout their acini.

Dermal Vessels. The vascular network in the dermis stained faintly in 12-day-old embryos. The number of reactive vessels and the intensity of reaction in the vessels increased in older embryos. The greatest intensity of reaction in the blood vessels occurred at the time of their full maturation and of their most compact distribution in the 5-day-old rat, before the dimensional expansion of the dermis began.

Dermal Nerve Fibers. It was quite difficult to differentiate between nerve fibers and blood vessels in specimens obtained from rats less than 5 days old because the nerve fibers did not yet show the typical beaded appearance of their axons. However, in 18-day-old embryos one could definitely identify in the sole nerve fibers extending from the subepidermal nerve plexus to weakly reactive early formations of Meissner tactile corpuscles in the dermal papillae. The increase and subsequent decrease in the density of the dermal and perifollicular nerve plexuses occurring during the embryonic and postnatal stages were similar to the increase and decrease seen in the vascular system. Meissner tactile corpuscles first stained faintly while still premature in the 18-day-old embryo. They stained but weakly even in their mature form in 5-day-old rats.

Dermal Muscles. The staining reaction of the
dermal muscles was weak in early embryonic life but later increased gradually. A differentiation into two types of muscle fibers first became apparent in 5-day-old rats. A linear arrangement of the reactive granules in accordance with the distribution of mitochondria, as seen in adult rats, was not apparent in embryos.

Arrector Pili Muscles. The enzyme reaction in the arrector pili muscles was first noted in 10-day-old rats, although the muscles were already present in 5-day-old rats.

Motor End-Plates. It was difficult to detect these structures in their immature forms in embryos because their staining reaction was minimal.

Eccrine Sweat Glands. Although the earliest formation of eccrine sweat glands occurred in 14-day-old embryos, they first showed MAO activity in 5-day-old rats. From the beginning the secretory, myoepithelial and ductal cells showed an equal intensity in staining.

Tactile Hair. A weak reaction was observed in the epithelial germs of tactile hairs in 14-day-old embryos. The large nerve bundle which penetrated the capsule and its branches stained very faintly in 14-day-old embryos but stained fairly well in 18 and 19-day-old embryos and stained strongly in 5-day-old rats. The inner and outer root sheaths and the hair bulb showed a gradual increase in their intensity of staining as they matured. The hair papilla of tactile hair always showed a stronger reaction than the papilla of coat hair.

DISCUSSION

The findings in the present study on the distribution of MAO in the skin of the adult rat are in essential agreement with the results obtained on human skin by Shelley et al. (5) and by Yasuda and Montagna (6). The probable reason for Hellman's inability to prove the presence of MAO activity in the skin of the rat was his choice of a method with low sensitivity, employing tryptamine hydrochloride as substrate. This method uses the formation of a brown pigment as direct indicator instead of using tetrazolium salt as indirect indicator.

While it was formerly assumed (18–21) that MAO activity was related to the oxidative deamination of norepinephrine and epinephrine, evidence recently obtained (22–24) indicates that MAO activity is concerned mainly with the deamination of O-methylated metabolites of catecholamine, such as normetanephrine or metanephrine, and thus contributes only indirectly to the degradation of norepinephrine and epinephrine. An enzyme other than MAO, namely catechol-O-methyl transferase, seems to initiate the catabolism of catecholamines (23, 24). In addition to deamination, other pathways such as oxidation (25) and dehydrogenation (26–28) have been postulated for the catabolism of catecholamines.

In the present investigation, MAO activity was found to be present in both adrenergic and cholinergic nerve fibers. Similarly, Koelle and Valk (29) and Yasuda and Montagna (6) had found no selective association of MAO activity with adrenergic nerve fibers. The rather ubiquitous distribution of MAO suggests its participation in some phase of amine metabolism in nerves as well as in other tissues. Nevertheless, the possibility that MAO is specifically concerned with neurotransmission cannot be completely dismissed, particularly since 5-hydroxytryptamine (serotonin) is a physiological neurotransmitter substance in lower animal (30) and MAO is involved in the oxidative deamination of serotonin (31).

Cyanide in a final concentration of $10^{-3}$ M, sufficient to inhibit the cytochrome oxidase system, did not inhibit MAO activity, an observation already reported by Yasuda and Montagna (6). In addition, Davidson (32) has found, on biochemical testing, that cyanide even in a concentration of $10^{-4}$ M did not inhibit MAO. These findings, together with our observation that co-factors such as Coenzyme Q and phenazine methosulfate did not increase the intensity of reaction, allow the conclusion that neither these co-factors nor cytochrome oxidase are involved in the electron transfer system between the tetrazolium salt and MAO. It appears quite likely that the tetrazolium salt is reduced directly by indoxyl-3-acetaldehyde (10).

The inhibitory effect of iodoacetate on the activity of MAO probably is exerted through an inhibition of sulfhydryl groups present in the enzyme (33). It seems, however, that the sulfhydryl groups in the keratogenous zones of hair and epidermis are more sensitive to iodoacetate than those incorporated in the enzyme, because we observed that the non-enzymatic reaction in the keratogenous zone of hair and epidermis was
already inhibited by a concentration of 0.01 M of iodoacetate; while the true enzymatic reaction in other structures, such as sebaceous glands, nerve elements and dermal muscles, was inhibited only after the concentration of iodoacetate was raised to 0.05 M.

In the following, the function of MAO in each organ will be discussed.

**Epidermis and Hair Follicles.** During embryonic development as well as in the adult stage the hair follicles showed about the same degree of reactivity as the epidermis. The intensity of the enzymatic reaction increased in both gradually at the same rate with maturation. This similarity of reaction is understandable because the hair follicles are derived from the epidermis and, in particular, the outer root sheath is a continuation of the surface epidermis. The hair papillae did not stain appreciably, except for those of tactile hair, in which the staining probably was due largely to the abundant vascularization (17). The intracytoplasmic localization of the reactive granules in epidermal cells could best be observed in the large cuboidal cells forming the outer layer of budding epithelial germs. The same distribution of the formazan granules in the epithelial germs had been observed also on staining for the succinic, malic and lactic dehydrogenase systems (2), which too are mitochondrial enzymes. The innermost cell layer of the bulb which rests on the hair papilla stained more intensely than the cells in other parts of the bulb. The same observation had been made on staining for the succinic dehydrogenase system. In addition, Ogata (43—45) and Hashimoto et al. (2) have demonstrated an intermediary type of muscle fiber not only by staining for the succinic dehydrogenase system but also by staining for the malic and lactic dehydrogenase systems, for cytochrome oxidase and for DPN and TPN diaphorase. In most dermal muscles a difference in MAO activity could be noted, in that MAO activity similar to the activity of the succinic dehydrogenase system. In addition, Ogata (43—45) and Hashimoto et al. (2) have demonstrated an intermediary type of muscle fiber not only by staining for the succinic dehydrogenase system but also by staining for the malic and lactic dehydrogenase systems, for cytochrome oxidase and for DPN and TPN diaphorase. In most dermal muscles a difference in MAO activity could be noted, in that MAO activity similar to the activity of the succinic, malic and lactic dehydrogenase systems was stronger in the small-sized than in the large-sized muscle fibers. The strongly staining small-sized muscle fibers probably correspond to the red muscle of Ranvier (46) and are concerned with slow tonic movement; while the weakly staining large-sized fibers probably represent the so-called white muscle involved in fast phasic movement. In the small muscles of the upper lip and of the sole all muscle fibers were rather uniform in size and the staining reaction was very strong. These muscles, therefore, seem to be composed predominantly of red muscle.

**Sebaceous Glands.** The functional significance of MAO activity in this organ is not clear.

**Dermal Vessels.** Thompson and Tickner (7), by titrating the concentration of MAO in large and small blood vessels of the rabbit and of the rat had found greater MAO activity in larger arteries than in smaller arteries or in veins. We could confirm their findings in our investigation since the large vessels in the deep dermis usually stained more intensely than the small perifollicular and subepidermal arteries or veins.

**Dermal Nerve Fibers.** MAO activity was observed in motor and sensory nerve fibers as well as in autonomic nerve fibers. No difference existed between adrenergic and cholinergic fibers in regard to the intensity of the reaction. In particular, MAO activity was found also in cholinergic nerve fibers surrounding the eccrine sweat glands of the sole, as had been observed previously by Yasuda and Montagna (6) in human skin. Thus, we concur with Yasuda and Montagna (6) and with Koelle and Valk (29) that the old view of adrenergic nerves containing MAO, and of cholinergic nerves containing cholinesterases, no longer can be maintained. It is likely that MAO plays a more general role in the amine metabolism.

The tactile corpuscles in the sole and in the nerve fibers leading to them were weakly positive. However, it is difficult to assess the role of MAO in the transmission of perception in the tactile corpuscles in view of the fact that already many other active transmitter substances have been reported (3, 35—40).

**Dermal Muscles.** Padykula (41) and Cogan and Kuwabara (42) have described two types of striated muscle fibers in regard to the activity of the succinic dehydrogenase system. In addition, Ogata (43—45) and Hashimoto et al. (2) have demonstrated an intermediary type of muscle fiber not only by staining for the succinic dehydrogenase system but also by staining for the malic and lactic dehydrogenase systems, for cytochrome oxidase and for DPN and TPN diaphorase. In most dermal muscles a difference in MAO activity could be noted, in that MAO activity similar to the activity of the succinic, malic and lactic dehydrogenase systems was stronger in the small-sized than in the large-sized muscle fibers. The strongly staining small-sized muscle fibers probably correspond to the red muscle of Ranvier (46) and are concerned with slow tonic movement; while the weakly staining large-sized fibers probably represent the so-called white muscle involved in fast phasic movement. In the small muscles of the upper lip and of the sole all muscle fibers were rather uniform in size and the staining reaction was very strong. These muscles, therefore, seem to be composed predominantly of red muscle.

**Arrector Pili Muscles.** The arrector pili muscles showed an intermediate intensity of staining. A linear arrangement of the reactive granules in the sarcoplasm was apparent on staining for MAO, but it was not as clearly evident as on staining for the succinic, malic and lactic dehydrogenase systems (2). The linear arrangement
of the reactive granules is in accordance with the linear distribution of the mitochondria and indicates the localization of the MAO reactive granules within mitochondria (47–49). Since arrector pili muscles contain cholinesterase activity (3) and give a cholinergic response (50) it is difficult to decide whether cholinesterase or MAO is of greater importance in the catabolism of the contractile substance in these muscles.

**Motor End-Plates.** The presence of MAO in the motor end-plates, which are cholinergic in response, invalidates the view of MAO being present only in adrenergic nerve structures.

**Eccrine Sweat Glands.** The eccrine sweat glands of the sole stained intensely, both in their secretory and in their ductal portions. The presence of MAO in the secretory cells may be related to the production of ammonia in these cells through oxidative deamination of primary amines (5). However, the presence of the enzyme in the ductal cells is poorly understood and can be explained only as part of the general reaction present in all skin appendages derived histogenetically from the epidermis. The myoepithelial cells, which are contractile and are assumed to be in contact with adrenergic fibers (51), stained as strongly as the secretory and ductal cells.

**Tactile Hair.** The sensory nerve endings in the superior enlargement were found to be reactive for MAO, as they had been found in previous work to be reactive for cholinesterase (3). At present, it is difficult to decide which of these two enzymes is the more important one in the transmission of sensory function by these endings.

**Other Structure.** MAO activity in mast cells may be due to a participation of MAO in the histamine-metabolizing system II (52, 53).

**Histogenetic Development of MAO Activity.** MAO activity was demonstrable in most reactive organs as soon as they began to form in the course of embryonic development, except in the eccrine glands and in the arrectores pilorum in which appearance of MAO activity was delayed until the fifth and tenth day of post-natal life, respectively. Just as had been observed with the succinic, malic, and lactic dehydrogenase systems, the intensity of the reaction gradually increased in most reactive organs up to the attainment of full maturity. Only in the motor end-plates and Meissner corpuscles the MAO activity remained weak throughout embryonic development and adulthood. In the blood vessels and nerve fibers, including the nerve plexuses around the eccrine sweat glands, the enzymatic reaction was strongest at the time of their full maturation and of their most compact distribution in the 5-day-old rat, before the dimensional expansion of the skin began.

MAO activity was found in nearly all organs of the skin. This is due to the fact that MAO is one of the mitochondrial enzymes which generally are widely distributed (32). This is also the reason that MAO shows the same distribution as the succinic, malic, and lactic dehydrogenases, except that MAO is located also in nerve elements. It is possible that MAO, as one of the mitochondrial enzymes, is concerned with the general amine metabolism in living cells. MAO probably plays a role also in the oxidative deamination of the sympathomimetic catechols in nerve fibers and in the deamination of the primary amines in the secretory cells of eccrine sweat glands.

**SUMMARY**

1. The activity of monoamine oxidase was followed from the embryonic to the adult stage in the skin of the rat.

2. There were no essential differences in the enzyme distribution between the embryonic and the adult stage. The enzyme reaction became apparent in most organs as soon as each reactive organ began to form in the course of embryonic development. The intensity of the reaction gradually increased while these organs matured to adulthood. In the eccrine sweat glands and in the arrector pili muscles, however, the detection of enzyme activity was delayed until after attainment of a certain degree of maturity.

3. Enzyme activity was most pronounced in nerve fibers, with the reaction equally strong in adrenergic and cholinergic nerve fibers. MAO activity could be demonstrated in all living cells. Thus, enzyme activity was found in the cellular epidermis, in hair follicles, sebaceous glands, dermal muscles including the arrector pili muscles, eccrine sweat glands and ducts, connective tissue cells and mast cells. Certain types of sensory receptors, such as Meissner tactile corpuscles and the tactile receptors of tactile hairs, also were reactive. MAO activity was absent in non-living, fully keratinized cells.
4. It appears that MAO, as one of the mitochondrial enzymes, is concerned with the general amine metabolism in living cells. In addition, MAO may play a role in the deamination of the sympathomimetic amines. However, in the deamination of the primary amines in nerve fibers and in the deamination of the primary amines in the secretory cells of eccrine sweat glands.

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