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Studies on reproduction and prenatal mortality of the Common-Shrew *(Sorex araneus* L.)

Part I. Foetal regression

Badania nad rozrodem i śmiertelnością zarodkową u ryjówki aksamitnej *(Sorex araneus* L.)

Część I. Regresja płodów

Исследования над размножением и эмбриональной смертельностью *Sorex araneus* L.

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1. Introduction.

The aim of the present work is to investigate the course of regression of foetuses in the Common Shrew *(Sorex araneus* L.) under natural conditions. The problem is treated exclusively on the morphologic — histological plane. Biologic analysis of the phenomenon will

be found in the paper „Studies on reproduction and prenatal mortality of the Common Shrew. Part II. Reproduction under natural conditions (Tarkowski, 1956).

Regression is a process connected with the death of a foetus in the postimplantation period due to a gradual necrobiosis and disintegration of the tissues of the embryo and embryonic structures in situ. This phenomenon, a characteristic of polytocous animals, is of great biologic value to them, because it enables the continuation of pregnancy and the carrying of the remaining, not dead foetuses to full ferm. It is most commonly defined in the literature by the term „resorption", „reabsorption" (of the Anglo—Saxon authors). This term suggests that the organism of the mother absorbs products derived from the disintegration of the embryo. But this remains still an open question. Present data rather do not support the possibility of the existence of such a phenomenon. Henderson (1954) found in her studies on an artificially produced regression of foetuses in the rabbit, that using stilboestrol an insignificant part of the necrotic embryonic material may be brought onto the area of the uterine tissue. Such a fact, however, is not yet tantamount to acceptance of the existence of resorption in the physiological sense. In such a situation the acceptance by the authoress of the term „regression" seems to be justified and following her the term is used also in this work.

Present literature on spontaneous regressions of foetuses in mammals is relatively scarce. Although the phenomenon was known in the past to occur in polytocous mammals both in wild as well as in the domesticated breeding animals there are scarcely several works which deal with the histological side of the process of regression. Strahl and Henneberg (1901, 1902) discuss cases of regression found in the mole, *Mustela putorius* var. *alba,* rabbit, hamster, Meyer (1917) in the guinea pig, Fortuyn (1920) in the mouse.

There is also a number of experimental works on the influence of surgical treatments, rise and drop of the environmental temperature of the pregnant females, and injections of various chemical substances on the development of foetuses. The works are confined solely to the conclusion that the applied treatment proved to be effective, but no attempt was made to analise closer the histological phenomena connected with the effected death. A number of loose observations present in some works of this type and related to the investigated problem will be taken into consideration in the discussion of the results.

The sole experimental works focussed strictly on the process of regression are works of Henneberg (1903) and Henderson (1954) on rabbits and that of Kerr (1947) on the mouse. The first of the above cited authors employed surgical treatment as a lethal agent, the second — injection of stilboestrol and surgical treatment, the third — injection of colchicine.

A work based on material of regressions spontaneously occurring, or artificially produced involves serious consequences in the arrangement of the work and the character of the deducted conclusions. Works based on material of spontaneous regressions are dependent fundamentally on the delivery of the material, which in case, when the subject of investigation are wild living animals is many a time not easily accessible. This as well, as complete casualness of the collected material may cause serious difficulties in the presentation of the whole process. A work based on a limited number of cases does not guarantee exclusion of eventual abnormalities of a totally different character from the material. On the other hand, want of informations concerning the rate of necrotic lesions may cause fundamental difficulties in the arrangement of accessible cases of regression in a consequent, natural row. Because works of this type are concerned with a process spontaneously occurring in the organism, the obtained results may have an essential value for the understanding of the phenomenon.

Works of the experimental type, although more accurate in view of the fact, that there is a possibility to deal with breeding material and a possibility to investigate the whole process, which may be initiated at a deliberate, by the investigator chosen period of pregnancy cannot, on the whole, have any general value. The use of artificial agents, which are many a time totally foreign to the organism does not give any guarantee, that the reproduced picture is identical to spontaneously occurring regressions. Similarly, in employing various lethal agents the course of the post — mortem changes in embryos of the same species may run in a more or less different mode. Confrontation of data from the present literature confirms this assumption. Truly, it may be expected, that certain general mechanisms and the course of the process may be similar, independently of the employed agent. Nevertheless, however, a deduction of generalised conclusions without their comparison with data obtained from cases of spontaneous regression is misleading.

On the regression of foetuses in the *Insectivora* here is up to now only one work of Strahl and Henneberg (1901) on the mole. In the *Soricidae* this problem has not been yet elaborated.

2. Material and method.

The material is derived from the collection of the Departament of Investigation of Mammals, Zoological Institute, Polish Academy of Science and it was collected on the terrain of the Białowieża National Park in 1954 and partly in 1953. The whole material of the Common Shrew of the 1954 season forms a basis of the general work on the reproduction and foetal mortality of this species. A detailed description of the technique of trapping and dealing with the material in the laboratory is presented in the above work.

Foetal chambers observed in the course of the post—morten examination were fixed in Bouin's fluid most often in toto, without opening the uterus. Using a binocular in several cases the uterus was opened and the content of the chambers was macroscopically examined. After the inspection both the wall of the uterus as well as the content were fixed for subsequent histological examinations. In litters, in which cases of regression were found, histological examinations of the vagina and either of the whole normal foetal chambers, or the placenta only were also conducted. The vaginae were examined in order to determine, whether they may serve as a way for removal of the necrotic material. Normal chambers or placentas were studied to define the state of advance of pregnancy. Sections, 10 microns in thickness, were made of all histological preparates and stained with Meyer's acid hemalum and erythrosin.

The material was derived from 14 females collected in 1954 and 2 females collected in 1953. The number of cases of regression in the separate pregnancies ranged from 1—3, therefore the total number of all regressive foetal chambers amounted to 26. The whole of the material is represented in table I. The arrangement of positions in the table corresponds to the order, in which the separate cases of regression are described. The criteria for such an arrangement will be analised later. Additional data related to the quoted material (biotop in which the animal was trapped, body weight, lactation state, number of ovulated ova etc.) will be enclosed in the previously cited work prepared for publication.

Possibilities of macroscopic identification of regression of foetuses in the initial periods after implantation are not abundant. The uteruses were histologically not examined starting from the moment, when swellings on the uterus were sufficiently visible to enable the foetuses

to be counted. Histological control was run in several cases, because it appeared commonly enough, that foetal chambers within the same litter differed somewhat as to their size. It proved, that differences in the size were caused by not uniform rate of growth of the foetuses and not by the initiation of the necrotic process. In such a situation a detection in the early postimplantation stages of foetuses undergoing regression would command cutting the whole material of early pregnancies into sections, because at this stage it is still impossible to perform a dissection.

The situation changes starting from the stadium of pregnancy described in the female 6326. More or less since this period the embryos were removed from the foetal membranes, whereby particular attention was turned to the smaller foetal chambers.

Both the macroscopic examination as well as in certain cases the microscopical examination proved, that foetal chambers classified on the basis of their external picture as normal, never represented early stages of regression. In spite of this it must be agreed, that post — mortem and macroscopic examination form a method not sensitive enough to detect early signs of necrosis. Permanent lack of any macroscopically detectable symptoms of regression, even in the smallest foetal chambers in a given litter rendered necessary, similarly as in cases of early pregnancies, to perform histologic examination of all accessible foetal chambers. But such a procedure would involve a considerable expenditure of technical work. There are, however, as will be seen later, motives, which indicate that the procedure would give very frail results. In the somewhat later stages of regression the external picture of the foetal chamber is so striking, that its correct classification does not offer any difficulties.

There are also difficulties of a similar kind as regards to very advanced cases of regression. For instance, in several cases it was impossible to find externally any sings of a previous existence in a given place of a regressive foetal chamber and only when the uterus was cut and the normal foetuses were removed a detached placenta or a lump of tissue detritus was found within the uterus. In spite of this one must take into consideration that in the extreme stages of regression expressed solely by a small amount of loose tissue detritus ovelooking might be possible. The final stages in view of the previous completion of basic regressive processes do not, however, represent in this work any special value.

In the course of histological analysis of the process of regression use was made of the work on the development of foetal membranes in the Common Shrew *(Sorex araneus L.)* and the Lesser Shrew *(Sorex minutus* L.) (Brambell & Perry, 1945) and the development of the placenta in the Common Shrew (Hubrecht, 1894), *Blarina brevicauda* Say and *Sorex fumeus* (Wimsatt & Wisiocki, 1947).

3. Macroscopic and microscopic pictures of the course of regression.

I. Macroscopic observations.

All regressive foetal chambers observed in this work were characterized by strikingly smaller dimmensions in relation to normal foetal chambers of the same litter. In all cases (with the exception of the foetal chamber of pregnancy in the female 5689) there was a lack of a swelling occupied normally by a foetus thus the placenta drops directly down on the lewel of the uterus (Photo. 1). A pale colour of the placenta, distinctly different from the intensively red colour of placentas of normal foetuses is the second characteristic feature of the process of regression.

In case, when foetal regression started already after the deposition of the green pigment in the walls of the yolk sac, a dark mass of tissue debris, shining through the uterine wall is often observed. This detritus is seen below the placenta and in the free segments of the uterus, laterally. In the final stages of the necrotic process, in connection with the detachment of the placenta and its move towards the lumen of the uterus the regressive foetal membranes loose their characteristic features and present only a slight dilatation of the uterus. In such cases the tissue detritus is often invisible from without due to the contraction and thickening of the wall of the uterus.

II. Microscopic appearance of the course of regression.

a) Arrangement of the material.

The arrangement of material in a work on the problem of spontaneous foetal regression is a basic factor for the analysis of the process and conclusions relating to the rate of regression. It should fulfil two

fundamental assumptions. Firstly — the order of the row should illustrate the progressing regression. Secondly — the succession of positions should be chronologic, it means that it should correspond to successions of states of advance of pregnancies at the moment of initiation of the process of regression. It would be methodically incorrect to take into consideration only the first assumption. In such a case it is a priori accepted, that processes of regression initiated at different stages of pregnancy have a similar course and lead to likewise final effects. To the acceptance of such an assumption there is no foundation.

Works of Kerr (1947) and Henderson (1954) and some observations to be described in this paper can give evidences of the existence of a certain diversity of regressive processes in the various periods of pregnancy.

I have tried in the first line to arrange the succession of all cases of regression on the basis of time, at which necrotic changes were initiated. In a situation, when the differences of age of the regressive foetal chambers were small, or when it was impossible to determine accurately the initial moment of necrosis, they were arranged according to the degree of advance of the process.

In view of the absence in the elaborated regressive foetal chambers of fragments of foetuses suitable for the estimation of their stadium of development at the moment of death, the main criterion in the determination of the time of initiation of necrotic changes was the degree of the development of the placenta (in respect to its microscopic structure). To this purpose a standard row composed of several placentas from normal foetuses was arranged. It included the period ranging from the initial formation of the allantoic placenta to the most late accessible to me pregnancies. This method offers a reliable way of estimation only up to the time of the final formation of the placenta, what takes place, most likely, judging on the size and form of the corresponding foetuses on the beginning of the second half of pregnancy. At the same time the common phenomenon of the not uniform rate of development of foetal chambers within one litter must be kept in mind. In certain cases this may influence the correctness of the evaluation. The described criterion looses its value in the more advanced cases of regression at the moment, when complete necrosis of the placenta takes place.

Certain informations are obtained by measurements of the size of the placentas in the regressive foetal chambers. However, in view of the fact, that necrosis of the placenta is accompanied by a decrease

of its size the result of measurements may only indicate, that the process of regression did not start previous to such a state of pregnancy, at which placentas of normal foetuses attain similar size. This method particularly in regards to cases of regression considerably advanced and arisen in the later stages of pregnancy, when placentas cease to increase their size is not sufficiently accurate and has no major value.

The last criterion (easily applied to the majority of cases, but not too accurate, because it allows to subdivide the whole material only into two groups) depends on the finding of the presence of the green pigment in the tissue debris in the chamber. This pigment is formed in the entodermal cells of the area vasculosa of the yolk sac. In cases of very advanced regressions, when the total necrosis of the placenta masks completely its previous structure, indications may be obtained only in this way. However, it should be stressed, that in the final stages of regression the absence of any pigment may be caused secondarily. It may get removed together with the tissue detritus from the area of a former foetal chamber.

Because at present we are in possession of no temporal information, as regards to the rate of foetal development in the Common Shrew the determination of the age of foetuses can be expressed only by means of a morphological description. Determination of the duration of the separate periods of pregnancy, or stages of regression can in this situation be expressed only by a description of morphologic differences.

Application of the above discussed criteria enabled to classify the material represented in table I.

b) Description of the material.

Female 5689. Her normally developing foetuses (photo. 2) are 1.1 mm. in length. Only the anterior half of their bodies is sunk in the yolk sac. The annular curtain of the decidua lateralis is relatively thin. Between it and the wall of the uterus there appeared already a cleft and the epithelium on the new surface is regenerated. The vascular chorio — allantoic villi reached no more, than 1/4 of the thickness of the placenta.

The regressive foetal chamber (photo. 3) is of considerably smaller size than a normal one. Its uterine epithelium is strongly folded and runs deep into the interior of the foetal chamber. The foetal material, represented very poorly, appears partly in the form of not large frag-

ments, partly in a form of a loose detritus mixed with cells with no evidences of necrosis. Most likely the cells are derived mainly from the annular curtains of the decidua lateralis. Fragments of Reichert's membrane are present. The annular curtain of the decidua lateralis is considerably thicker than that in a normal foetal chamber. Between the annular curtains and the uterine wall there are also clefts and the thin layer of mucosa is covered by a new epithelium. The internal surface of the allantoic placenta (photo. 4) is completely exposed because of the absence of any fragments of the chorion. The internal rim is not continuous because of the presence of finger — like depressions, separated by intercryptal septa. Depressions localized on the terrain of the epithelial crypts are relatively shallow and filled up with large cells of a pale plasma and small, compact nuclei. These cells pass gradually in the deeper parts into typical cells of the epithelial crypts. They are also observed in a not large number in the chamber below the placenta. The intercryptal septa are very broad and appear to be quite normal. Erythrocytes reach the internal surface of the placenta. In the marginal part of the epithelial crypts, similarly as in placentas of normal embryos mitoses often are seen.

Female 1794. There are in the litter three regressive foetal chambers. In the normal foetal chamber (photo. 5) the foetus is completely sunk in the yolk sac. In the entodermal cells of the area vasculosa there is a beginning of deposition of the pigment, temporarily of yellow—green colour. The annular curtains of the decidua lateralis are not large. In the placenta the villi reached a hight corresponding more or less to 2/3 of the thickness of the placenta. The intercryptal septa are narrow, limited in places only to the capillary endothelium.

In the largest regressive foetal chamber (p_1) (photo. 6) there occur simultaneously compact fragments of the foetus and loose tissue detritus. Beside the totally necrotic foetal material there appear also parts of the tissue little changed and of a cellular structure clearly preserved. Large fragments of Reichert's membrane are visible. There is also a disintegration of the allantochorion exposing the internal surface of the placenta. The tissue of the villi is visibly degenerating, but still preserves a certain cohesiveness, although in some places it breaks down into loosely lying cells and plasmatic structures deprived of nuclei. In the maternal elements of the placenta, even in the zone occupied by the villi, no necrotic changes are seen. The upper border

Table 1.

Female No.	Length of embryos in mm.	Number of embryos	Number of regressive foetal chambers	State of advance of the process similar + different −	Position of regressive chamber in the uterus	Green pigment present + absent −
5689	not removed	5	1		p_1 *)	−
1794	nor removed similar to 6326	3	3	−	p_1	−
1794	„	3	3	−	p_3	−
1794	„	3	3	−	1_3	−
6326	3.6	4	2	+	1_1 1_2	−
14195	8.2	6	2	+	1_1 1_2	−
6687	9.9	5	1		1_2	−
6668	5 0	5	1		1_2	+
3760	not removed similar to 14316	3	3	−	p_3	+
6578	6.9	4	1		p_1	+
14316	7.0	4	2	+	1_1 1_2	+
14083	8.0	7	2	−	1_1	+
3760	s e e	a b o	v e		1_2	+
6638	7.1	3	1	−	1_1	+
14083	s e e	a b o	v e		1_2	+
4813	11.8	4	3	−	1_1	+
6175	9 9	5	1		p_3	+
14342	8.5	5	1		1_1	+
3760	s e e	a b o	v e		p_2	+
6622	13.0	7	1		1_1	+
4813	s e e	a b o	v e		1_3	+
6742	14.0	4	1		p_2	+

Notes *) p — right uterine horn, 1 — left uterine horn. Number at a letter denotes position in the horn, counting from the ovary.

Table 1.

Character of necrotic material from embryo and foetal membranes	Position of placenta	Diameter of placenta of regressive chamber in mm	Degree of necrosis of placenta
detritus and fragments	normal	1.9	necrosis of foetal tissue
fragments and detritus	normal	3.1	„
detritus and fragments	normal	3.0	necrosis of foetal tissue and septa
detritus	„	2.2	necrosis of foetal tissue
„	„	3.4; 3.5	necrosis of foetal tissue and septa
detritus (in small amounts)	„	1 8; 1.9	total necrosis
absent	detached in lumen of uterus		„
detritus	normal	2.9	total necrosis except extern. zone
detritus	normal	1.8	total necrosis except extern. zone
detritus	normal	2.8; 3.2	total necrosis
detritus	normal	2.8; 3.0	total necrosis
detritus	normal	2.1	total necrosis
detritus	normal	1.9	total necrosis
detritus	absent		
detritus	detached in lumen of uterus		total necrosis
detritus	„		total necrosis
fragments and detritus	„		total necrosis
absent	„		totel necrosis and fragmentation
fragments and detritus	normal	3.3	total necrosis of internal zone
fragments and detritus	detached in lumen of uterus		total necrosis
total necrosis no disintegration into tissue detritus	normal	2.7	total necrosis of internal zone
total necrosis no disintegration into tissue detritus	normal	3.7	total cecrosis of internal zone

reached by the villi lies more or less half way of the thickness of the placenta.

In the medium, as regards size, regressive foetal chamber of the same female (p_3) the foetal material appears in the form of a compact mass, in which only here and there are observed small, not disintegrated fragments of the foetus. The foetal material is almost completely necrotic and nuclei appear in a greater number only in the part lying beneath the placenta. Allanto-chorion is broken down. In the placenta the border reached by the villi lies somewhat more shallow than in the previously described case. The degenerating tissue of the villi looses its compactness and in some parts it appears in the form of freely lying cells and anuclear plasmatic structures. Cells of the epithelial crypts above the necrotic tissue of the villi also undergo degeneration. The maternal tissue of the placenta (intercryptal septa) within the zone occupied by the villi is almost completely necrotic.

In the smallest regressive foetal chamber (l_3) the foetal material is completely necrotic and deprived of compact fragments. Only beneath the placenta there are in the tissue detritus cells with nuclei. Allantochorion is broken down. The upper limit reached by the villi lies somewhat above the 1/3 of the thickness of the placenta. The degree of degeneration of the tissue of the villi is lesser than in the preceding case. The intercryptal septa do not show any signs of necrosis. The external zone of the placenta, similarly as in the two previously described regressive foetal chambers remains unchanged.

Female 6326. Here are two cases of regression in an equal state of advance. They will be described jointly.

The stage of advance of pregnancy is similar to that described in the female 1794; normally developing embryos are 3.6 mm. in length.

The tissue detritus in the regressive foetal chamber (photo. 7) is directly under the placenta loose, below — partly compact. There is already an absence of fragments of the foetus. In the loose tissue detritus there appear numerous cells with pale nuclei but in the compact part, there is a complete lack of them. The placenta is in the one — third part of its thickness on the internal side completely necrotic. This necrosis involves both the maternal, as well as the foetal elements and leaves behind a structureless zone, in which the former intercryptal septa can be differentiated with difficulty. The single nuclei lying in this zone belong to the former

tissue of the villi. The extent of the villi cannot be accurately determined because their necrotic tissue is not separated by a clear borderline from the necrobiotic cells of the epithelial crypt. The tissue of the external zone of the placenta is unchanged.

Female 14195. Foetuses normally developing are 8.2 mm. in length.

Both regressive foetal chambers are in the same degree of advance. In the chamber there are only small amounts of loose tissue detritus. The placenta (photo. 8) is completely necrotic and structureless. There is a complete lack of nuclei and the former foetal parts connot be differentiated from the maternal elements. The whole mass is distinctly eosinophilic. On the borderline between the necrotic placenta and the muscular layer there appear large cells, with large, strongly basophilic nuclei. They are the marginal cells of the epithelial crypts (see page 407).

Female 6687. Foetuses normally developing are 9.9 mm. in length.

The regressive foetal chamber being in an atrophied state formed only a slight, 1.6 mm. in hight swelling of the uterus. The diameter of the neighbourly segments of the uterus was 0.7 mm. The lumen of this segment is almost completely occupied by the necrotic, structureless placenta. There is a complete lack of foetal necrotic material. The wall of the uterus is regenerated not only on the antimesometrial side, but possesses on the whole periphery a thick layer of mucosa.

Female 6668. Foetuses normally developing are 5.0 mm. in length.

The regressive foetal chamber is occupied by tissue debris in part loose, — partly in the form of a compact peg. There is a lack of compact fragments of the foetus. In the tissue detritus there is the green pigment. The placenta (photo. 9) is necrotic with the exception of a narrow zone, lying on the periphery. From this unchanged zone take origin centripetal bands of degenerating nuclei; however, they are seen only in the external part of the placenta. The localization of those bands in relation to the elements of the not destroyed external zone indicates, that they are the nuclei of the tissue of the villi, eventually, in the deeper parts—nuclei of cells of the epithelial crypts. Below the lower border of those bands the placenta is structureless, homogeneous and completely deprived of nuclei. In view of the far advanced necrosis it is difficult to determine the state of advance of the placenta at the moment of the beginning of the necrotic processes. Taking, however,

into consideration its thickness and the localization of the bands of nuclei, as also in view of the presence of large amounts of the green pigment, the villi must have passed at least one half of the placenta.

Female 3760. Her normal foetuses were not removed from the foetal membranes. External dimensions of the normal foetal chambers indicate that there is an analogous state of advance of pregnancy to the state in females 6578, 6638, 14316.

The foetal material in the regressive foetal chamber p_3 appears in large amounts and is completely necrotic. The placenta has preserved on the periphery a narrow zone of tissue not completely necrotic. The remaining part has undergone complete necrosis. The green pigment is present in large amounts.

The four successive cases of regression to be presently described represent a similar state of complete necrosis of the placenta.

Female 6578. Foetuses normally developing are 6.9 mm. in length.

The regressive foetal chamber (photo. 10), situated solitarily in the half length of the right uterine horn, has been dissected longitudinally together with the whole horn. The tissue detritus accumulated beneath the placenta reaches as a broad strip the part of the horn localized between the chamber and the vagina. The green pigment is present in large amounts. On the external rim of the placenta there are large cells, mentioned already in the description of the regressive foetal chamber of pregnancy in the female 14195.

Female 14316. Foetuses normally developing are 7.0 mm. in length.

Both regressive foetal chambers represent a similar state of regression. In the fairly abundantly represented loose tissue detritus, there appears one compact green structure, which cannot be closer identified. Beside this there appears the green pigment in large amounts in a loose form. In the necrotic placenta there are on the external border beside large cells, small, degenerating nuclei.

Female 14083. Foetuses normally developing are 8.0 mm. in length.

In the regressive foetal chamber (l_3) the foetal material is represented only by small amounts of loose tissue detritus. The green pigment appears only in traces. Between the placenta and the uterine wall there is a narrow cleft, most likely secondarily formed in the course of the fixation of the material. Large cells tear off jointly with the

placenta. The muscular layer around the placenta possesses a compact, healthy tissue of an unchanged appearance.

In the second regressive chamber (l_1) of pregnancy in the female 3760 there appear only small amounts of loose tissue detritus with traces of green pigment. The placenta similarly to the three preceding cases is completely necrotic.

Female 6638. Foetuses normally developing are 7.1 mm. in length.

The regressive foetal chamber (photo. 11) is situated in the terminal part of the horn and is in the final stages of regression. In the lumen of the former chamber there appears only loose tissue detritus mixed with the green pigment. The complete absence of the placenta is somewhat disturbing. The wall of the uterus is of an insignificant thickness on the whole periphery and consists fundamentally of a muscular layer and the epithelium. The mucosa is extremely thin. As may be observed, in this case there is a complete regeneration of the epithelium on the antimesometrial side.

In the regressive foetal chambers of pregnancy 14083 (l_2), 4813 (l_1) and 6175 the completely necrotic placentas lie loosely in the lumen of the uterus. In consequence of its dissection on the post-mortem examination it is difficult to express an opinion on the preservation of the necrotic material. In cases of regression 4813 and 14083 it appears in insignificant amounts only in the form of a loose tissue detritus, in the case of regression 6175 — in the form of a compact mass, attached to the placenta. In the first two cases the green pigment is represented poorly. In the third — it appears in considerably larger amounts both in the diffusive form on the area of the whole necrotic material as also locally in a considerably major concentration. The wall of the uterus is regenerated in all three cases and is relatively thick. Normally developing foetuses of pregnancy in the female 4813 are 11.7 mm. in length, of pregnancy in the female 6175— 9.9 mm. in length. The state of advance of pregnancy in the female 14083 has been given previously.

Female 14342. Foetuses normally developing are 8.5 mm. in length.

The regressive foetal chamber situated in the terminal part of the horn forms only a slight swelling of the uterus. In its lumen there are several fragments of the placenta. The largest of them is semilunar in shape (photo. 12) and forms the external part of the placenta. In the preserved fragments clearly not constituting the whole placenta,

there appear numerous clefts. The green pigment is present in traces only on the edges of the fragments of the placenta.

In the regressive foetal chamber (p_2) of pregnancy in the female 3760 the necrotic foetal material appears partly in the form of compact fragments, partly in the form of loose tissue detritus. Among the tissue detritus there appear large amounts of the green pigment. Around the compact fragments there appear pieces of Reichert's membrane. Both ends of the placenta are rolled up to the interior of the foetal chamber and are almost in touch with each other. The internal surface of the placenta is covered by the necrotic allantochorion. Only both ends of the placenta and a narrow zone adhering to the allantochorion are affected by complete necrosis. In the remaining part of the placenta both the endothelium of maternal vessels as well as the tissue of the villi do not show clearly marked signs of degeneration. The villi are separated from the muscular layer by a relatively wide zone of the external parts of the epithelial crypts. This is somehow peculiar in comparison with the large mass of the foetal material and the structure of the placenta, which is characteristic of considerably later stages of pregnancy.

Female 6622. Foetuses normally developing are 13.0 mm. in length.

The necrotic material formed as a result of regression of the foetal chamber was found only after the dissection of the uterus. A structure lying in the lumen proved to be the placenta with the attached foetal material from beneath. The placenta is large, 2.8 mm. in diameter, completely necrotic, and only on the periphery there are small degenerating nuclei. The foetal material is composed partly of structureless tissue detritus, partly of not yet disintegrated, although completely necrotic fragments of the foetus. The green pigment appears on the area of the necrotic foetal material both loosely dispersed both in preserved fragments of the yolk sac.

The second regressive foetal chamber (l_3) of the female 4813 represents in certain respects pictures hitherto not observed. This refers mainly to the state of preservation of the foetal material. Unfortunately owing to post-mortem dissection of the uterus the natural arrangement of the foetal parts cannot be accurately reproduced. The necrotic umbilical cord is still preserved and joined to the placenta (photo. 13 a). The foetus (photo. 13 b) is preserved in toto and

in no place is it submited to a break down. The tissue of the foetus has a typical necrotic character of a strongly expressed eosinophilia and complete lack of nuclei. The foetus occupies very little space owing to strong compression. Fragments of Reichert's membrane are seen around the foetus and the umbilical cord. In the placenta (photo. 13a and 17) the total necrosis affected both its rolled up rims and a narrow zone on the internal surface. The placenta adheres closely to the embracing it wall of the uterus. Above the zone affected by necrosis both foetal as well as maternal elements do not show any striking signs of degeneration. The maternal capillaries possess a hypertrophic endothelium and the erythrocytes, present in them reach almost the necrotic part. In the centripetal parts of the villi there can be seen in the tissue abnormally hollow spaces. The terminal parts of the villi, situated on the periphery of the placenta do not show any signs of necrosis. On the area of the placenta there is a striking lack of foetal erythroblasts. The placenta is by the degree of its development similar to placentas of normal foetuses of pregnancy in the female 14195. The villi are separated, from the muscular layer by a zone composed of marginal parts of the epithelial crypts.

Female 6742. This is one of the most advanced pregnancies observed in the whole material. The foetuses normally developing are 14.0 mm. in length. The placentas of the normal foetuses show in histological preparates a loosening of their connection with the uterus, caused by the formation of a loosely woven border zone.

In the regressive foetal chamber, similarly as in the preceding case, the tissue of the foetus is necrotic, but not disintegrated into loose tissue debris. The foetus, having preserved outlines, lies pressed to the internal surface of the placenta (photo. 14). Around the foetus are the foetal membranes partly preserved (most likely the amnion and the invaginated splanchnic wall of the yolk sac), and fragments of Reichert's membrane. On the whole area of the necrotic foetal tissue there are spots of the green pigment. In the placenta (photo. 14) the total necrosis, advancing from the internal surface reached one half of its thickness. Above this level the placenta has little changed structure and only on the area of the villi no erythrocytes are seen. There is also an absence of the maternal erythrocytes in the capillaries. Between the placenta and the tissue of the uterus, similarly as in placentas of normal foetuses, a loosely woven border zone was formed.

c) Histological analysis of the process of regression.

The above given description of all regressive foetal chambers enables to draw a picture to show to what a degree the regressive processes, initiated at various stages of pregnancy are similar and in what respects they are different.

Practically, one regressive foetal chamber is different from the other in a major or lesser degree by the time of initiation of the necrotic changes and therefore by the degree of the development of the foetus, foetal membranes and the placenta. However, a comparison of the presented pictures shows, that if differences of „age" of the regressive foetal chambers are not too large then the course of the necrotic process is similar. This permits to treat jointly some of the cases.

Necrotic changes in the foetus foetal membranes.

The first external effect of the process of regression is a rapid decrease of the size ol the foetal chamber. The placentas were in all cases dropped down and lying directly on the uterus (photo. 1), or at the most — the uterus beneath the placenta was slightly dilated. This is observed even in regressive foetal chambers exhibiting signs of slight necrosis (1794, 6326), in which the placentas in respect to size and structure differ only insignificantly from placentas of normal foetal chambers. These facts indicate, that already at the beginning of the process of regression there must take place a decrease of the volume of the foetus and foetal membranes. This may take place as a consequence of the outflow of the foetal fluids. The wall of the uterus, enclosing the foetus and foetal membranes as a consequence of the disappearance of the pressure, which acts on it from within, shrinks and as an effect causes the characteristic dropping of the placenta onto the uterus. It is likely, that this contraction is secondarily a factor, which destroys the body of the foetus in a mechanical way. The decrease of the turgor and the outflow of foetal fluids should be treated as a secondary phenomenon, which might take place in the foetus only in consequence of serious physiologic disturbances and most likely- also as consequence of morphologic changes. It is presently impossible to offer empiric proofs on behalf of these suppositions, because owing to the above described reasons (page 391) there is a lack of material relating to the early stages of the process.

The course of necrosis and the state of preservation of the necrotic material of the foetus and foetal membranes change in a fundamental way in the various periods of pregnancy and depend most likely mainly on the actual mass and compactness of the tissues of the foetus at the moment of death.

In case regression is initiated in the early periods of pregnancy, the necrobiosis of the foetus involves instantly its fragmentation. Fragmentation is not a termination of necrosis but runs simultaneously to it. An indication of this is the regressive foetal chamber p_1 1794 (photo. 6 and 16), in which beside the completely necrotic material appear not completely necrotic fragments of a clear cellular structure. In such parts the nuclei are preserved and the plasma of the cells does not exhibit strong eosinophilia, a characteristic of the necrotic tissue. The compact fragments of the foetus are not maintained for long but jointly with the total necrobiosis of the cells, or even sooner undergo disintegration into the structureless necrotic tissue. At first, most likely due to the pressure exerted by the wall of the uterus, a major or minor part of the tissue detritus may appear in the form of a compact structure. Such a structure does not show the presence of any fragments of the body of the embryo (photo. 7 and 9). At some time it undergoes also a break down and finally the whole necrotic foetal material appears solely in the form of a loose tissue debris (photo. 8). Its amount decreases with the advance of the process.

In case the regression is initiated at a later stage, necrosis of the tissue of the foetus and foetal membranes does not involve complete disintegration into loose tissue debris. The preserved compact fragments are maintained not only in the initial and middle stages of the process (the regressive foetal chamber p_2 3760), but even in the final stages (regressive foetal chambers 6175, 6622), after the detachment of the placenta.

When regression takes place still later (regressive foetal chambers l_3 4813 and 6742) the necrobiotic tissue does not at all undergo fragmentation. Initially the completely necrotic embryo maintains its natural forms. During the further advance of the process, however, it is strongly compressed (photo. 13b and 14) and may be pressed to the internal surface of the placenta (photo. 14).

The state of preservation of foetal mebranes in the necrotic foetuses is also dependant on the time of initiation of the process of regression. In cases of regressions initiated at the early stages of pregnancy,

the foetal mebranes become completely disintegrated prior to complete necrobiosis of the tissues of the foetus. The presence of foetal mebranes could not be proved even in the least advanced foetal chamber (p. 1794). In case of later initiated regression of the foetal chamber the fragments of the invaginated splanchnic wall of the yolk sac are preserved. If the embryo does not undergo a break down the necrotic amnion can be also observed. It is seen as pressed to its edge (regressive foetal chamber 6742, photo. 14).

The element of the foetal membranes, which shows a relative resistance in the course of the advance of necrosis is the Reichert's membrane. It is not preserved in toto, but only in the form of small, separately lying fragments. In the regressive foetal chambers of the early stages of pregnancy the Reichert's membrane disappears at the moment of the passage of the foetal material into the form of a loose detritus. In case the process is initiated later, the Reichert's membrane is preserved for a long time on the area of the compact necrotic material.

The green pigment passes into a loose form jointly with the disintegration of the invaginated splanchnic wall of the yolk sac. In case the fragments of the yolk sac are preserved the pigment remains in a large concentration on their area. However ,it constitutes always only an insignificant part of the total amount, which appears among the tissue debris.

Necrotic changes on the area of the placenta.

The degenerative changes of the placenta have a considerably more complicated character than on the area of the foetus and foetal membranes. Although in all the regressive foetal chambers the general course and the final effect are similar, there are, however, certain differences in details. They arise as a result of differences in the degree of development of the placenta at the moment of the death of the embryo.

The regressive foetal chamber 5689 (page 394, photo. 3, 4) in view of the very early stage of development of the placenta, requires to be treated separately. Due to the total disintegration of the villi in the initial stages of invasion, the placenta is composed exclusively of the maternal elements. The trophoblast of the villi did not manage to destroy the connective tissue of the intercryptal septa and the capillaries are deeply sunk im them. The normal blood circulation is preserved in the whole depth of the septa. The sole changes of an abnormal cha-

racter are: loss of compactness between the cells of the centripetal parts of the epithelial crypts and their occurrence in the lumen of the chamber (photo. 4). In this respect the situation is, as will be seen, somewhat different from that in the remaining cases and therefore the consequent fate of the placenta may be somewhat different. Unfortunately, lack in the material of more advanced regressive foetal chambers, produced at a similar stage of pregnancy, does not allow to explain this problem.

In the placentas of the remaining regressive foetal chambers, independently of the depth reached by the villi, the trophoblast destroyed to a considerable degree the tissue of the septa. The destruction reaches in some places, particularly in the internal parts, directly the endothelium of the maternal capillaries. In this situation the internal part of the placenta consists exclusively of the degenerating tissue of the villi and the endothelium, which are together in a direct contact.

As a rule, the first degenerative changes appear on the area of the foetal elements of the placenta.

In case, when the initiation of the process of regression takes place in the early stages of pregnancy (female 1794, 6326) the necrobiotic tissue of the villi maintains at first its consistency and only subsequently it is disintegrated into cells and anuclear plasmatic structures. The degeneration of the villi takes place simultaneously on their whole depth.

The first necrotic changes in the maternal elements of the placenta are expressed in necrobiosis of cells of the epithelial crypts, which remain in direct contact with the villi. Changes do not involve the external parts of the crypts, which together with the remaining elements form a zone of a completely unchanged tissue (photo. 6, 7, 16).

In this period the endothelium of the maternal capillaries does not show any signs of necrosis and only the erythrocytes are not seen in them close to the upper border of the degenerating villi. The endothelium consists of distinctly hypertrophic cells; this is, however, a normally occurring phenomenon, but usually not as strongly expressed in the development of the placenta.

In cases of regression initiated in the later stages of pregnancy (regressive foetal chambers p_2 3760, l_3 4813, 6742) the tissue of the villi presents a somewhat different view. Degeneration of the villi does not take place simultaneously on the whole depth, and may be, it is not especially far advanced even in the centripetal parts at the

moment of the initiation of the total necrosis of the placenta. A phenomenon invariably observed in all these cases is the absence on the area of the villi of foetal erythroblasts. In parts of the villi localized above the zone affected by complete necrosis there appear free spaces (photo. 13 a, 17). May be, that they were formed in consequence of disintegration, or outflow of erythroblasts, previously present in those places. The most external parts of the villi do not show any signs of degeneration (photo. 13 a, 17).

Mention was made of the phenomenon of total necrosis of the placenta. The phenomenon of complete necrosis of the placenta appears and runs in a similar way in all cases of regression, independently of the stage of pregnancy, at which it was initiated.

In regressive foetal chambers of early stages of pregnancy, a general necrosis of the placenta begins at the moment of complete disintegration of the embryo and marked degeneration of the villi. In the first stage it appears on the marginal rim of the placenta and on the internal surface. From those places it progresses to the periphery (compare photo. 7 and photo. 8). It involves the whole tissue of the placenta, independently of the origin of the constituting elements. It is interesting, that in this case necrosis runs quicker on the area of the endothelium of capillaries, than on the terrain of the villi, degenerating since long time ago. In the zone of total necrosis there are often seen strips of degenerating nuclei of the tissue of the villi on the level, where the elements of the maternal tissue exhibit already signs of complete necrosis (absence of nuclei, very strong eosinophilia, photo. 9). However, towards the periphery the nuclei gradually disappear and the placenta takes a completely homogeneous form (photo. 8 and 11). In a placenta, which reached this stage of necrosis a differentiation of the former foetal and maternal elements is impossible.

When regression of foetal chambers begins in the middle and final stages of pregnancy (the regressive foetal chambers l. 3760, l. 4813, 6742) the difference in respect to the above described cases is, that complete necrosis begins without a preceding degeneration of the villi on their whole length. Because in all the three regressive foetal chambers the internal zone of the placenta is already affected by total necrosis, it is difficult to say, whether the beginning of necrosis is preceded by any fundamental degenerative changes on the area of the centripetal parts of the villi. In spite of the differences in the course

of the process, it leads, independently of the time of initiation of necrotic changes to the same effect — to the total necrosis of the tissue of the placenta. Only in case of a very late appearance of regression of the embryo (the regressive foetal chamber 6742) it may not be completed before parturition takes place.

The process of necrosis of the placenta involves in effect a decrease of its size. This is done by the tucking up of both edges and a general compression of the necrobiotic tissue of the whole placenta. The first distinct decrease of size takes place most likely in the period of the degeneration of the villi, and subsequently it proceeds gradually during the whole period of the necrosis of the placenta.

The degenerative changes on the terrain of the allanto-chorion, which forms on the internal side of the placenta a narrow zone of an exclusively embryonic character run a similar course to changes observed on the terrain of villi and are dependent mainly on the fact, at what a stage of pregnancy they were initiated. In case of an early initiation of regression (female 5689, 1794, 6326 and other) the necrotic allantochorion is disintegrated exposing thus the intercryptal septa (photo. 4, 6, 7, 16). In regressive foetal chambers from later stages of pregnancy (regressive foetal chambers l_3 4813, 6742) the allantochorion, similarly to the embryo, while undergoing necrosis, still preserves its consistency. In these cases a layer of necrotic tissue of the former allantochorion remains preserved on the foetal surface of the placenta.

In the regressive foetal chambers of early stages of pregnancy, at the moment, when the zone of general necrosis reaches the periphery of the placenta, the border cells of the epithelial crypts begin to show very strong basophilia of the nuclei and the plasma. These cells persist in not significant numbers on the rim of the totally necrotic placentas. It is somewhat peculiar, that in spite of their presence on the area of the necrotic tissue, they remain alive for a very long period of time.

Detachment of the plancenta from the wall of the uterus

The necrotic placenta becomes detached and is moved towards the lumen of the uterus. However, this may take place only at a time, when the wave of complete necrosis reaches the very periphery, when the necrotic tissue of the placenta comes directly in touch with the muscular layer of the uterus. The detachment of the placenta is effected

most likely on a mechanical way, as a result of a contraction of the wall of the uterus. In some cases, when the regressive foetal chamber is localized between two, normally developing embryos, a certain role may play also the distension of the wall of the uterus, whereby the dilatation, which includes the necrotic placenta, is levelled. The moment the placenta is moved towards the lumen of the uterus and the wall of the antimesometrial side is regenerated, the process of regression is essentially completed. The fate of the placenta in the lumen of the uterus will be described in the next chapter, which deals with the fate of the necrotic material (page 410).

The detachment of the placenta in not much advanced regressive foetal chambers, which appear in advanced stages of pregnancy takes place in a different way. Such a situation is represented by the case of regression 6742. The pregnancy is almost completed and in the placenta necrosis reached barely its one half, leaving the external part of the tissue little changed. Between the placenta and the muscular layer, similarly as in placentas of normally developing embryos, a loosely woven border zone is formed (photo. 14). In such a situation the placenta of the regressive foetal chamber will be removed at parturition, before the completion of the necrotic processes in a similar way, as the remaining normal placentas are discharged.

The wall of the uterus during the process of regression

Due to the contraction of the uterus after the death of the foetus the wall of the regressive foetal chambers exhibits, a somewhat greater thickness, from that found around normal foetuses. This is caused mainly by a better development of the mucosa (photo. 8). The uterine epithelium is slightly folded on the whole periphery. In regressive foetal chambers, in which the detachment of the placenta did not yet take place, there appear under the placenta large folds of the epithelium, left since the period of the normal development (photo. 8). In the course of the process the epithelium is not destroyed in any place.

The uterine epithelium of the regressive foetal chambers is the element of the wall of the uterus, which is submitted to most profound changes. Cells, particularly in the later stages of the process, are very high (up to 40 μ) and have a pale, eosinophilic plasma, often vacuolized. On the external surface there are seen light vesicles, which protrude into the lumen of the uterus. In the cellular

vacuoles there appear sometimes small structures either eosinophilic or basophilic. The height of the epithelium decreases as a rule in the direction of the mesometrial side. At the present moment it is difficult to say to what a degree the observed phenomena can be regarded as phenomena connected with the process of regression, because control investigations proved, that the uterine epithelium around the normal foetuses possesses also similar properties, but they are expressed not so distinctly. Anyway, it is certain, that the observed morphologic changes are an indication of a functional (apparently secretory) character of the epithelium. Until further and more precise studies are conducted any conclusions relating to this theme should be regarded as premature.

The regeneration of the uterus following the detachment of the placenta is expressed, first of all, by a covering of the placental side by the epithelium and a thin layer of connective tissue of the mucosa. Such a state is represented in the wall of the regressive foetal chamber 6638 (photo.11), in which the regenerated antimesometrial side becomes similar to the uterus on the opposite side of the cross-section. The uterus shows an insignificant thickness due to the very poor development of the mucosa. In the remaining cases, related to this period, it possessed a thick layer of mucosa with glands sunk in it. Finally, the uterine wall in the place of the former regressive foetal chamber takes an aspect of being on the way to accept the apperance of segments of the uterus situated between embryos.

All regressive foetal chambers were studied to find leucocytes both in the tissue detritus as well as in the mucosa of the uterus. In the necrotic foetal material on no occasion were there found any cells, which would in any degree correspond to leucocytes. In the tissue of the uterus there were observed only eosinophilic granulocytes in not great numbers. They were present in regressive foetal chambers of early stages of pregnancy, whereby the state of advance of the process did not play here any role. The presence of eosinophilic granulocytes appears not to have any relation to the process of regression, because they are also found in the same places around normal foetal chambers. The presence of other types of granulocytes could not be determined with certainly. Though in this respect there are not sufficient observations available, it seems almost certain, that leucocytes do not play any essential role in the process of regression.

d) The fate of the necrotic material.

In the course of post-mortem examinations certain observations were made on the fate of the necrotic material. Macroscopic observations were subsequently completed by histological studies.

In case of an initiation of regression in early stages of pregnancy, the whole material of the foetus and foetal membranes long before the termination of pregnancy passes into a form of a loose tissue debris. The placenta is a more resistant structure and possesses still a compact form even after its passage into the lumen of the uterus. In time, however, it also is submitted to fragmentation and disintegration follows. Such a situation is represented by the regressive foetal chamber 14342 (photo. 12), in which the placenta is represented only by few fragments. Clearly they alone could not possibly constitute the whole mass of the former placenta.

However, in case of regression initiated at a later stage only a part of the necrotic material, derived from the foetus and foetal membranes passes into the form of a loose tissue debris.

The tissue detritus, seen initially only beneath the placenta, moves subsequently towards the neighbourly free segments of the uterus. A serious obstacle on the way to farther spreading constitute the normal foetal chambers. The lumen of the uterus around the normal foetuses changes in the course of pregnancy. Initially there is a cleft around the suspended yolk sac, but in time its lumen becomes completely obliterated. In spite of this there is a possibility of movement of the necrotic material between the wall of the uterus and foetal membranes. This is evidenced by several, below given observations.

In the histological preparates of normal foetal chambers of pregnancy in the female 3760, there is in some places, between the wall of the yolk sac and the wall of the uterus a thin layer of tissue detritus.

Placentas of normal foetal chambers of pregnancy in the female 4813 were excised together with a part of the foetal membranes and the uterus. The uterine epithelium, which ingrows between the edge of the placenta and the muscular layer forms deep diverticula of the lumen of the uterus. In these divercula (photo. 15), between the epithelium and the loop of the trophoblastic annulus, which penetrated to this place, there is the green tissue detritus.

In the course of the removal of embryos from the uteruses of the females 6622 and 6742 the presence of the green tissue detritus was found between the walls of the uterus and the foetal membranes in the neighbourly foetal chambers. In the case of regression 6622 the tissue detritus reached in the cleft up to the one- half of the neighbourly foetus and foetal membranes (l_2). In the uterus of the female 6742 the detritus spread to both sides, entering between the wall of the uterus and foetal membranes of the embryos p_1 and p_2. In this case it was present also behind the foetus p_3, above the vagina and partly even in the left horn of the uterus.

The spreading of the necrotic material in the uterus is then possible, but the passage through the normal foetal chambers must take place at a considerably slower rate, than in the free segments.

The passage of the necrotic material does not show any specially marked directness, if around a regressive foetal chamber are normal chambers. In segments of the uterus, which are directed towards the vagina, the tissue debris is somewhat more abundantly represented, but this phenomenon does not appear in a convincing form to regard it as essential. A different and exceptional in this respect situation is represented by the regressive foetal chamber 6578. It appears solitarily in the middle of the right horn. From underneath the placenta there takes origin a compact strip of the green tissue detritus, which is directed towards the vagina (photo. 10). The opposite part of the horn is almost completely deprived of it. In this case the possibility of passing of the necrotic material are, however, completely exceptional.

The amount of the loose necrotic material of the uterus decreases markedly in the course of the process of regression. There is no evidence to regard this as a result of a resorptive activity of the uterus. In view of the absence in the regressive foetal chambers of leucocytes, the sole element, which could be possibly involved in this process is the uterine epithelium. But its character (see page 408), indicating a functional state, does not suggests, that it might possess phagocytic properties.

In this situation the discharge of the loose necrotic material from the lumen of the uterus may take place only by way of the vagina. To confirm this possibility histological examinations of vaginae in transverse sections were conducted. It is striking, that already at

superficial macroscopic examination there is an absence of the dark strips of the detritus in the vagina. This is particularly disturbing in cases, in which are observed large amounts of the necrotic material in the uterus, many a time even in segments close to the vagina. Histological analysis of the vaginae proved a lack, or only small amounts of the tissue detritus. Discharge of the necrotic material through the vagina may be rendered partly difficult in view of the strong decrease of its lumen. However, it never reaches such a state, which would make the use of this way altogether impossible. May be, that lack of convincing pictures is caused by a very rapid passage of the tissue detritus through the vagina. It is also possible, that the necrotic material lies behind in the uterus for a long time and passes through the vagina gradually in not large amounts. In any case, although the removal of the tissue detritus by this way seems to be most likely, at the present moment there are no proofs beyond discussion to comfirm it. It can be, however, stated with certainty, that in case of the initiation of the process of regression in the early stages of pregnancy, the necrotic material derived from the regressive foetal chambers leaves the genital tracts of the female in a loose form. It is not yet decided, to what a degree this takes place during pregnancy, and at what a degree at the moment of parturition.

The fate of the necrotic material in cases of regressions not too advanced, and which appear in the later stages of pregnancy, is somewhat different. In this case two possible situations should be discerned.

The first is represented by the regressive foetal chamber 6622 in which the totally necrotic placenta together with a part of the foetal material is detached and moved towards the lumen of the uterus. The detachment took place in a normal way, described in the preceding chapter. In view of the late stage of pregnancy and the state of preservation the placenta (no tendency of any fragmentation), it is most likely, that the placenta, together with the foetal material attached to it, would leave the uterus in a compact form at parturition.

A completely different situation is represented by the regressive foetal chamber 6742. In this case, in connection with the formation of a loosely woven border zone (page 401 and photo. 14) the placenta would not be detached sooner than at parturition and removed in a similar way, as the placentas of normal foetuses. If it is added, that

the foetus in spite of total necrosis does not disintegrate and most likely in such a state it will leave the uterus together with the placenta, it should be concluded, that this case represents in the whole material rather a separate position.

4. Distribution of cases of regression in the course of pregnancy and the rate of the process

The accessible material of regressions is too scanty to be able to say finally, whether the initiation of the process is possible throughout the whole period of the postimplantation development, or whether it possesses a limited upper border. Anyway, the case of regression 6742 indicates, that there is a possibility of the initiation of the necrotic process in a relatively late period. On the basis of the histological structure of the not-necrotic part of the placenta, it should be, however, assumed, that it might take place in the period, which corresponds to the state of advance of pregnancy in the female 4813 (the length of the embryos 11,8 mm) (see nevertheless page 416).

Although it is at present difficult to take a final decision as regards the question, whether there appear during pregnancy critical moments, in which the initiation of the regression of foetuses is likely to occur with special intensity, it should be pointed, that the overwhelming majority of cases is connected with the early periods of the development. If four cases be excluded (the regressive foetal chambers p_2 3760, l_3 4813, 6622, 6742) then out of the remaining 22 cases, 9 refer to the period, which precedes the accumulation of the green pigment in the yolk sac. In 13 regressive foetal chambers, in which the green pigment appears, 12 of them have completely necrotic placentas. An exception is the regressive foetal chamber 6638, which appears in the least advanced pregnancy (sic). It should be added, that within that group the successive stages of the process are seen on the whole in pregnancies more and more advanced (see table I). In our opinion this is an indication that the discussed cases of regression refer also to the early periods of development.

The criteria of the estimation of the rate of the process of regression and the difficulties encountered in connection with it were described previously (see page 393 and 394). The problem may be discussed in its two aspects. Firstly — to estimate the relative rate of the process of necrosis in the various elements of the same foetal chamber.

Secondy — to estimate the duration of pregnancy required to complete the process of regression, expressed by the detachment of the placenta and regeneration of the given placental site.

As regards to the first aspect of the problem it can be stated, that in all cases, independently of the time of the initiation of the process of regression, the necrosis on the area of the foetus and foetal membranes runs very rapidly and is completed already at the moment of the appearance of the first necrotic changes on the area of the placenta (compare regressive foetal chambers p_3 1794 and l_3 4813; photo. 6, 16 and 13 a, b).

Considering the second aspect of the problem attention is drawn mainly to the placenta as to the most permanent element of the regressive foetal chambers. In cases of early initiated regressions (regressive foetal chambers p_3 1794, 6326, 6668) the necrosis of the placenta has a very rapid course. Placentas of the first two regressive foetal chambers are both in respect to histological structure as also as regards to dimensions very similar to placentas of normal chambers. In spite of this there is already on their area a zonal necrosis initiated. In the regressive foetal chamber 6668, necrosis affected with the exception of the external zone, the whole placenta and among the tissue debris there is a large amount of the pigment. Both these facts indicate, that the stage of necrosis is a result of a process lasting from the moment of accumulation of the green pigment (not earlier than at the stage represented by normal embryos of pregnancy in the female 1794, — photo. 5).

The rate of the process of regression differs somewhat in the individual cases. An illustration of this statement may be a comparison of the regressive foetal chamber 14195 with the regressive foetal chambers 6578, 14316, l_1 4813). In spite of the fact, that in the first case the regression started earliest (absence of the green pigment) and the pregnancy of the female 14195 is more advanced than in the remaining three cases, all the four regressive foetal chambers are in the same stage of the necrotic process (a totally necrotic placenta in the normal position). This is an indication, that the period of necrobiosis must be considerably shorter, than the period of the retention of the placenta in this form in the normal position.

On the other hand, in view of the presence of the green pigment in the tissue debris of the foetal chamber l_2 14083, in which in spite of the later initiation of the necrotic process than in the case

of regression 14195, the placenta is detached at a similar stage of pregnancy, it appears, that the rate of the process in the regressive foetal chamber 14195 is exceptionally slow.

In any case, on the basis of pictures represented by the regressive foetal chambers l_2 14083, 14342, 6175, 6687 it can be stated with certainty, that in cases of early initiated regressions the termination of the process takes place previously to such a stage of pregnancy, at which the embryos reach 10 mm in length.

A separate position constitutes the regressive foetal chamber 6638 (page 399 and photo. 11), which would be an indication, that there might be a possibility of termination of the process already at a stage of pregnancy, which corresponds to the length of embryos 7.1 mm. However, in view of the fact, that this case presents a very specific picture, difficult to explain (absence of the placenta, or its fragments in the initial period of regeneration of the wall of the uterus), this case should be treated with great reservation.

5. Discussion

A comparison of the course of regression of foetuses in the representatives of various orders of mammals may involve only the most fundamental points and the final effect of the process. Considerable morphologic differences in the development of the foetal membranes and the placenta create an obstacle to a more close comparison.

There is only one work (Strahl and Henneberg 1901) on the mole, dealing with the regressions of foetuses in *Insectivora*. However, the authors described only several cases, therefore it is impossible to make a comparison of the course of the whole process. In the mole, similarly as in the Common Shrew, degeneration of the placenta takes place initially in the zone, occupied by the villi, while deep parts remain at this period unchanged. In the Common Shrew the villi do not leave their depressions and there is no detachment of the chorion from the maternal tissue of the placenta, as described by Strahl and Henneberg. The authors associate this process with a secretive activity of the uterine glands, which are preserved for a long time on the area of the placenta and have their terminal portions on its internal surface. The different course of the necrotic process on the area of placentas of both animals may be caused among others, by the absence of uterine glands in the placenta of the Common Shrew.

Agreement of results obtained in this work with descriptions of the process of regression in other mammals concerns mainly the succession of necrobiosis, in which the elements of the regressive foetal chambers are involved.

Necrosis involves in the first line the foetus and foetal membranes, next the foetal elements of the placenta and lastly — its maternal elements. A certain deviation in this rule is observed in regressive foetal chambers in the advanced stages of pregnancy. The differences include an initiation of necrosis of maternal elements of the placenta (capillaries), before the degeneration of the villi on their whole length takes place. Independently of differences in the course of the process, it leads always to the same effect, — to the necrosis of the placenta and to a contact of the necrotic tissue with the muscular layer of the uterus. Only in case of a very late initiation of regression of the foetal chamber, this process may not be completed before parturition takes place.

All hitherto conducted works are in agreement, that necrobiosis of the embryo is the first process in the succession of events. An exception is the work of Burack E. et all. (1939) according to which in the studied spontaneous regression of foetal chambers in the Albany strain of rat a degeneration of the placenta preceded the death of the embryo.

The necrobiosis of the placenta was found in all examined cases of spontaneous regressions. (Strahl and Henneberg, 1901, 1902, Fortuyn, 1919, Meyer, 1917, and Kerr, 1947, page 561).

In the Common Shrew in case of the initiation of regression in the initial stages of pregnancy, the degeneration of the placenta takes place immediately after the beginning of the process. In the later stages of pregnancy the placenta is more resistant to necrotic changes. Degeneration of the placenta does not take place before the complete necrobiosis of the foetus and it cannot be excluded, that in the initial period of regression the placenta undergoes a progressive development. Such a state persists only for a short period of time and the placenta invariably is affected by necrobiosis. Results of the present work are in this respect in agreement with results of studies of the above cited authors.

However, results of experimental works are not in agreement. Henneberg (1903) and Henderson (1954) in the rabbit and Kerr (1947) in mice found, that during the process of regression the

placenta is affected by necrosis. Different results were obtained by Newton (1935) in mice and Huggett and Pritchard (1945) in the rat. They state, that there is a possibility of survival and development of the placenta after the death of the embryo, whereby Huggett and Pritchard relate this to the fact, that the death of the embryo takes place at a time, when the blood vessels passed already from the allantois onto the chorion. In case of death of the embryo at an earlier period, (series of experiments and the observed „natural" regressive chambers) the placenta, in spite of the initial differentiation, is destroyed before the termination of pregnancy. It is at present difficult to make use of the results in view of the fact, that various authors dealt with a various experimental material and employed different methods.

A number of investigators (mainly Pritchard and Huggett, 1947) draws attention to the ability of survival of certain of the foetal membranes after the death of the embryo. In the Common Shrew such a phenomenon is not observed, except at a short, may be, period, which follows immediately after the death of the embryo. This does not concern the trophoblast on the area of the placenta, which in certain cases may for a long time after the death of the embryo maintain a character of a live tissue (see the preceding lines — notes on the necrobiosis of the placenta).

The necrobiosis of the foetus and foetal membranes runs a very rapid course and is far advanced already at the period of the initial necrotic changes on the area of the placenta. May be, that it is (besides limitations of the method, page 391) a factor, which influences in a fundamental way the lack in the material of cases, related to early stages of the process.

The detachment of the placenta from the wall of the uterus is only possible after its total necrobiosis and a contact of the necrotic tissue with the muscular layer. A placenta moved towards the lumen of the uterus not too late may undergo before the parturition a total disintegration into a loose tissue detritus. Following the detachment of the placenta there takes place a regeneration of the mucosa and the epithelium on the placental surface. In time the uterus takes in place of the former regressive foetal chamber an aspect of being on the way to accept the appearance of segments of the uterus situated between embryos.

The necrotic material after its passage into a loose form spreads in the uterus. Normal regressive foetal chambers are at no stage of pregnancy any obstacle to the passage through them of the tissue detritus. Because the amount of the necrotic material decreases with the advance of the process and there are no proofs of any resorption of it (see below), therefore it should be accepted, that, the only way of its removal is through the vagina. The occurence of such a phenomenon in mice (Kerr, 1947) and the rabbit (Henderson, 1954) was proved beyond any doubt. In this respect the present material does not offer incontestable proofs. May be, that this is caused by the rapid passage of the tissue detritus through the vagina, or by the passage of the material gradually in insignificant amounts.

The present work does not offer any proofs of the existence of resorption of the necrotic material by the tissue of the uterus. This conclusion is fundamentally in agreement with the present results of works on the process of regression in other mammals. However, Henderson (1954) regards as possible, that a part of the necrotic material may pass into the uterine tissue. This is done by enclosure of fragments of the necrotic material under the regenerating uterine epithelium and, may be, by way of leucocytic phagocytosis of small particles, whereby the leucocytes return subsequently into the wall of the uterus. However, attention should be drawn to the fact, that conditions favourable to the apperance of such a phenomenon exist only in case of the death of all embryos. In a series of experiments, in which only several foetuses were killed in a litter, there was no necrobiosis of the uterine epithelium, the mucosa was not exposed and there was no leucocytosis. Several spontaneous regressive foetal chambers studied by Henderson were exactly similar to this group of cases.

In the regressive foetal chambers of the Common Shrew in view of the absence of leucocytes there cannot take place any phagocytosis. The sole element, which might eventually play any role in the process of resorption is the uterine epithelium. Althogh its character rather does not indicate that it might possess phagocytic properties, neverheless it should be very interesting to explain the background of the appearing morphologic changes.

In this place a certain hypothesis can be here suggested but only of a pure speculative character. In the foetal membranes of the Common Shrew there appears the so called trophoblastic annulus, composed of cells, which possess phagocytic properties (Brambell

and Perry, 1945; Hubrecht, 1894; Wimsatt and Wislocki, 1947). The large cells of the annulus resorb erythrocytes and products of disintegration of the decidua lateralis. From a theoretical point of view resorption in this way of a part of the necrotic material derived from regressive foetal chambers seems possible. This could take place in the course of the passing of the tissue detritus through the normal regressive chambers. Towards this hypothesis no attitude can be assumed before experimental studies are conducted. However, if even the results were positive to this phenomenon no serious nutritive meaning should be attached.

The presence of leucocytosis on the area of the regressive foetal chambers appears to be dependent only on the fact, whether the regression involves some, or all embryos in the litter. However, no dependence is seen on the systematic position and in experimental works — on the character of the applied lethal agent. The only exception may be Fortuyn's results, because he described „eosinophilic phagocytes" in the regressive foetal chambers, present beside the normal chambers. However, the presence of eosinophilic phagocytes was not confirmed in Kerr's material. In the several spontaneous regressive foetal chambers examined marginally by this author there was no leucocytosis. In this situation Kerr's supposition, that leucocytosis is not directly connected with the process of regression and appears to be related with the termination of pregnancy as one of the characteristic symptoms of a new oestral cycle seems to be convincing. Unfortunately at present there is a lack of comparative studies on the course of the spontaneous regression in respect to its dependence, whether it affects only some embryos, or the whole litter*).

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*) After the completion of this work a female was trapped, in which all foetuses in the litter (3) were in regression. The picture of the regressive foetal chambers does not differ in any way from pictures described in the text and only the uterine epithelium is in some places degenerated. This would indicate, that in the Common Shrew the process of regression, at least in the initial stages runs a similar course under conditions of maintained and interrupted pregnancies (death of the whole litter). It is interesting, that no leucocytosis was found in spite of the fact, that in this case leucocytosis could be expected. May be, that this is connected with the fact, that the female was already completing the reproductive season and a new oestrus was not to appear in her. In any case, the problem of the role of leucocytes in processes of regression remains still very obscure.

Conclusions as to the rate of the process of regression cannot be accurate, taking into consideration inaccurate informations we have concerning the time of the initiation of necrosis and in view of the impossibility to make use of the criterion of time. The most concrete result is the finding, that in the case of an early initiation of the process of regression of the foetus there is a possibility of complete termination of the process already at the stage of pregnancy, at which the embryos reach 8—10 mm in length. This should be taken into account, when the intensity of regression on the background of the total prenatal mortality of the species is considered.

The distribution of cases of regression in the various stages of pregnancy is an indication, that in the Common Shrew the intensity of regression takes place in the early stages of the development. Although a precise determination of this stage is impossible it undoubtedly appears after the vascularization of the chorion by the blood vessels of the allantois.

Brambell and Mills (1948), found, that in the rabbit there is also in the postimplantation period a critical point, at which there is a special increase of intensity of regression. May be, that in the Common Shrew this point coincides with the moment of transition from the activity of the vascular yolk sac to that of the allantoic. It appears, that such a period may be in the embryonal development the critical moment. Ewart (1897) explains in a similar way the increased occurrence of abortions in the horse, which takes place between the 6 and 9 week of pregnancy. In further studies on the regression of foetuses in the Common Shrew it will be essential to confirm this supposition and to draw special attention to conditions prevailing in the foetus and foetal membranes and in the uterus at this period of time. May be, that such studies will result in obtaining observations, which will enable to initiate investigations on the mechanism of the process of regression. Up to the present moment both the causes of regressions in mammals and the mechanism of the process are not yet clear.

Although studies on the phenomenon of foetal mortality in the wild living population of the Common Shrew (Tarkowski, 1956) may offer certain preliminary indications, further advance of the problem seems impossible until observations, made on breeding material, are collected and physiological studies are more advanced.

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EXPLANATIONS OF THE TABLES

Table XX

Photo. 1. Reproductive organs in the female 3760 ca 3 x.
Photo. 2. Normal foetal chamber from pregnancy in the female 5689 ca 16 x.
Photo. 3. Regressive foetal chamber 5689 ca 28 x.

Table XXI

Photo. 4. Fragment of the regressive foetal chamber 5689 (marked by a rectangular in photo. 3 ca 150 x.
Photo. 5. Normal foetal chamber from pregnancy in the female 1794 ca 10 x.
Photo. 6. Regressive foetal chamber p_1 1794 ca 22 x.

Table XXII

Photo. 7. Regressive foetal chamber 6326 ca 21 x.
Photo. 8. Regressive foetal chamber 14195 ca 25 x.
Photo. 9. Regressive foetal chamber 6668 ca 20 x.

Table XXIII

Photo. 10. Regressive foetal chamber 6578 ca 15 x.
Photo. 11. Regressive foetal chamber 6638 ca 29 x.
Photo. 12. Regressive foetal chamber 14342 ca 34 x.

Table XXIV

Photo. 13. Placenta (a) and (embryo (b) of the regressive foetal chamber l_3 4813 ca 25 x.
Photo. 14. Regressive foetal chamber 6742 ca 22 x.

Table XXV

Photo. 15. Diverticulum of the lumen of the uterus on the rim of the placenta of a normal foetal chamber from pregnancy in the female 4813 ca 150 x.
Photo. 16. A fragment of the regressive foetal chamber p_1 1794 (photo. 6) ca 82 x.
Photo. 17. A fragment of the placenta from the regressive foetal chamber l_3 4813 (photo. 13a) ca 75 x.

EXPLANATIONS OF THE TABLES

List of Abbreviations

AC. Allantochorion.
AM. Amnion.
C. Cleft between decidua lateralis and uterine wall.
CP. Capillaries.
CN. Normal foetal chamber.
CR. Regressive foetal chamber.
D. Tissue detritus.
DL. Decidua lateralis.
E. Epithelial crypts.
EC. Cells derived from epithelial crypts.
EM. Embryo.
EN. Embryo necrotic.
FE. Fragment of embryo.
M. Mesometrium.
MS. Miometrum.
OO. Ovary with oviduct.
P. Chorioallantoic placenta.
PF. Fragment of placenta.
PI. Internal surface of placenta.
PN. Placenta necrotic.
PU. Unchanged part of placenta.
SI. Intercryptal septum.
TC. Ectoderm of trophoblastic annulus.
TN. Entoderm of trophoblastic annulus.
UC. Umbilical cord.
UE. Uterine epithelium.
UL. Lumen of the uterus.
UR. Regenerating uterine epithelium.
UW. Uterine wall.
V. Villus.
VA. Vagina.
VB. Upper boundary of villi.
VD. Degenerating villus.
VE. Villus, part with empty spaces.
VN. Villus, normal part.
VS. Strips of nuclei of necrotic villi.
YC. Yolk sac cavity.
ZB. Boundary zone.
ZN. Zone of total necrosis.
ZV. Zone not occupied by villi.

Streszczenie.

1. Celem pracy było poznanie procesu „spontanicznej" regresji płodów u ryjówki aksamitnej (*Sorex araneus* L.). Materiał stanowią regresywne komory płodowe, znajdowane u samic ciężarnych, odłowionych w terenie. Zagadnienie potraktowane jest na płaszczyźnie morfologiczno-histologicznej.

2. W pracy przyjęto określanie zjawiska terminem „regresja" zastępując nim używany często w literaturze, ale zupełnie nieuzasadniony termin „resorbcja".

3. Autor zwraca szczególną uwagę na właściwe uszeregowanie materiału, które powinno, z jednej strony, oddawać kolejność etapów procesu, z drugiej zaś — uwzględniać wiek zarodków w momecie rozpoczęcia regresji. Pominięcie tego drugiego warunku jest metodycznie nie słuszne, gdyż przebieg regresji, rozpoczętej w różnych okresach ciąży nie jest identyczny.

4. Materiał pozwala na względnie pełne odtworzenie całego procesu, z wyjątkiem najwcześniejszych jego etapów. Brak materiału odnoszącego się do tych etapów, wywołany jest, zdaniem autora, bardzo szybkim tempem przebiegu procesu w tym okresie oraz wynika, być może, częściowo ze stosowanej metodyki badań.

5. Pierwszym zewnętrznym efektem regresji jest zanik wybrzuszenia obejmującego zarodek i przesunięcie łożyska na poziom wolnych odcinków macicy (fot. 1).

6. Nekroza obejmuje w pierwszym rzędzie zarodek, następnie elementy płodowe łożyska, a w końcu tkankę matczyną łożyska.

7. Obumierający zarodek ulega fragmentacji, a jego tkanki przechodzą w luźny detryt (fot. 3, 6, 7, 8, 9, 10, 11), jeśli regresja płodu następuje we wczesnych okresach ciąży. Ewentualnie — zachowuje się w zwartych fragmentach, lub nie ulega wcale rozpadowi, jeśli regresja płodu następuje w późniejszych okresach ciąży (fot. 13 b, 14).

8. Na terenie łożyska pierwszym objawem regresji jest degeneracja kosmków, występująca od razu na całej ich głębokości (fot. 6, 16). Następnie zaczyna obumierać tkanka matczyna i teren łożyska objęty przez całkowicie zmartwiałą tkankę, rozszerza się koncentrycznie ku obwodowi (fot. 7, 9). W późniejszych okresach ciąży łożysko jest bardziej odporne na zmiany nekrotyczne. Distalne części kosmków nie wykazują początkowo zmian martwicowych (fot. 13 a, 17) i degene-

rują dopiero w momencie zbliżenia się fali ogólnej nekrozy. Efektem tych procesów, niezależnie od czasu rozpoczęcia regresji, jest obumarcie całej tkanki łożyska i zetknięcie jej z mięśniówką macicy (fot. 8, 10). Dopiero wtedy łożysko ulega odłączeniu i przesunięciu do światła macicy, gdzie podlega fragmentacji (fot. 12) i może całkowicie rozpaść się na luźny detryt. Niezwłocznie po odłączeniu łożyska, powierzchnia łożyskowa w macicy pokrywa się warstwą śluzówki i nabłonkiem (fot. 11, 12). Jeżeli łożysko nie zdąży całkowicie obumrzeć przed nastąpieniem porodu, zostaje odłączone i usunięte w podobny sposób, jak łożyska normalnie rozwijających się zarodków.

9. Materiał nekrotyczny po przejściu w luźną postać rozchodzi się w macicy (fot. 10). Ilość jego zmniejsza się wraz z przebiegiem regresji. Prawdopodobnie jest on, przynajmniej częściowo, usuwany przez pochwę w czasie trwania ciąży. Nie uzyskano jednak pod tym względem ostatecznych dowodów.

10. Nie stwierdzono żadnych oznak resorbowania przez tkankę macicy materiału pochodzącego z regresji komory płodowej.

11. Funkcjonalny charakter nabłonka macicznego w regresywnych komorach płodowych sugeruje właściwości wydzielnicze, nie przemawia natomiast za posiadaniem zdolności fagocytarnych.

12. W czasie trwania regresji leukocytoza nie występuje.

13. Charakter materiału wskazuje, że nasilenie zjawiska regresji ma miejsce we wczesnych okresach ciąży. Moment ten przypada, jak się wydaje, na początkowy okres funkcjonowania łożyska omoczniowo-kosmówkowego.

14. W przypadku rozpoczęcia regresji płodu we wczesnych okresach ciąży, proces może zostać całkowicie zakończony na długo przed nastąpieniem porodu (w okresie gdy normalnie rozwijające się zarodki osiągają 8—10 mm długości).

РЕЗЮМЕ

1. Материал составляют регрессивные плодные камеры беременных самок, словленных на территории Бяловежского Национального Парка.

2. Вопрос рассматривается с морфологически - гистологической точки зрения.

3. Материал позволяет на сравнительно полное представление целого процесса за исключением самых ранних его стадий.

4. Первым наружным эффектом регрессии является исчезновение выпячения матки, захватывающее эмбрион, а также перемещение плаценты до высоты свободных участков матки (фото 1).

5. Некроз наблюдаем в первую очередь в зародыше, затем в плодовых элементах плаценты, и наконец на утеральной ткани плаценты.

6. Умирающий эмбрион подлежит фрагментации, а его ткани подвергаются распаду (детрит) (фото 3, 6, 7, 8, 9, 10 11).

Если регрессия имеет место в позднейшем периоде беременности, то подлежащий некрозу эмбрион или сохраняется в плотных фрагментах, или даже совершенно не подвергается распаду (фото 13 б, 14).

7. На поверхности плаценты первым признаком регрессии является дегенерация ворсинок, сразу охватывающая всю их глубину (фото 16).

Затем начинается омертвение материнской ткани и участка плаценты, полностью занятого омертвевшей тканью, распространяясь концентрично к переферии (фото 7, 9).

На дистальных частях ворсинок сначала не наблюдаем некротических изменений (фото 13а, 17) и дегенерация наступает только в момент начала общего некроза.

Эффектом этих процессов, независимо от срока начала регрессии, является омертвение всех тканей плаценты (фото 8, 10). Лишь тогда плацента отделяется и передвигается к просвету матки, где подвергается фрагментации (фото 12) и может даже целиком образоваться детрит. Сейчас же после отделения плацентарная поверхность в матке покрывается слоем слизистой оболочки и эпителием (фото 11, 12).

8. Некротический материал после перехода в разжиженное состояние распространяется по матке (фото 10). Количество его уменьшается параллельно с ходом процесса регрессии. Вероятно, по крайней мере частично, материал этот удаляется через влагалище во время беременности.

9. Не обнаружены никакие признаки резорбции маточной тканью материала, образующегося путем регрессии плодовой камеры.

Во время процесса регрессии лейкоцитоз не выступает.

11. Характер материала показывает, что явление регрессии сильнее выступает в начальных периодах беременности. Этот момент, как полагает автор, совпадает с начальным периодом функционирования аллантоидной плаценты.

12. В случае начала регрессии плода в начальных периодах беременности, процесс может остаться полностью законченным задолго до наступления родов (в период, когда нормально развивающиеся эмбрионы достигают 8—10 мм. длины).

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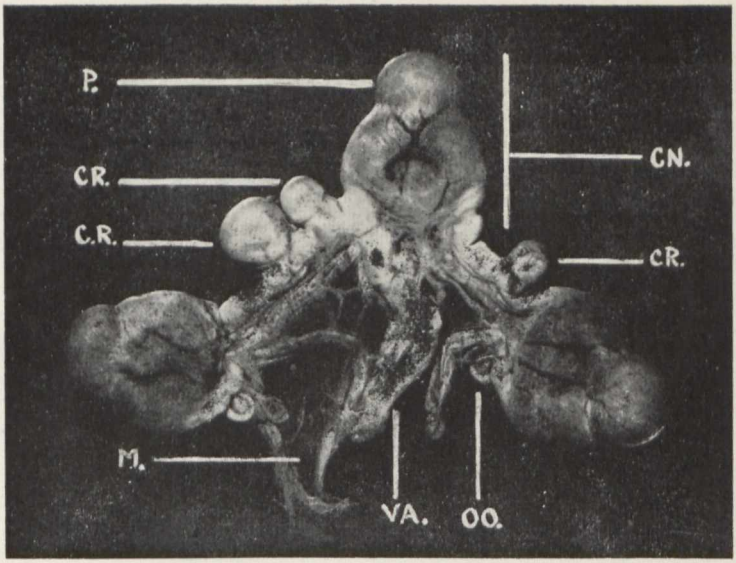

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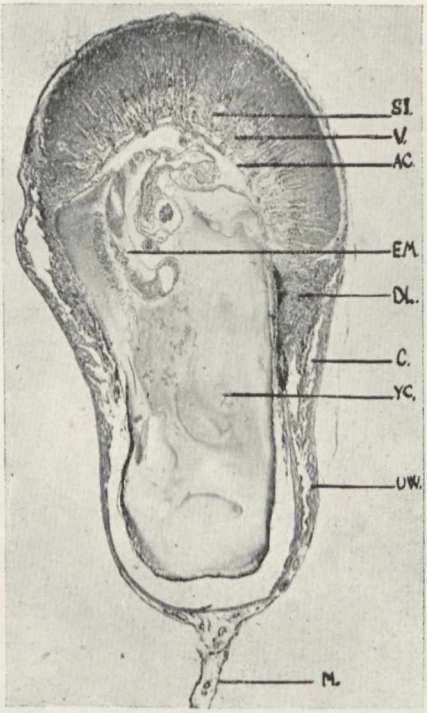

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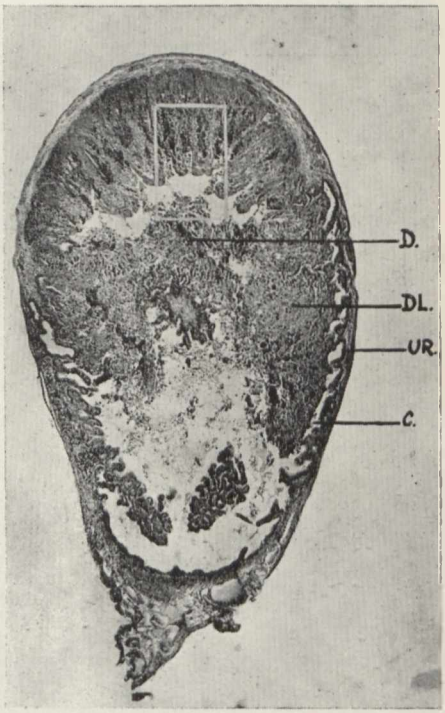

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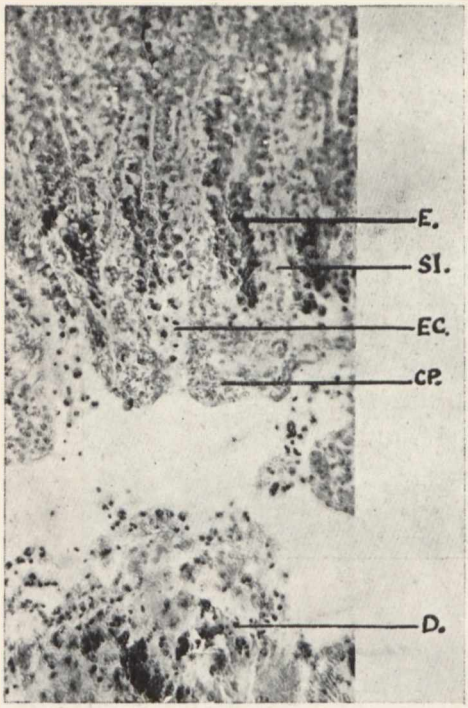

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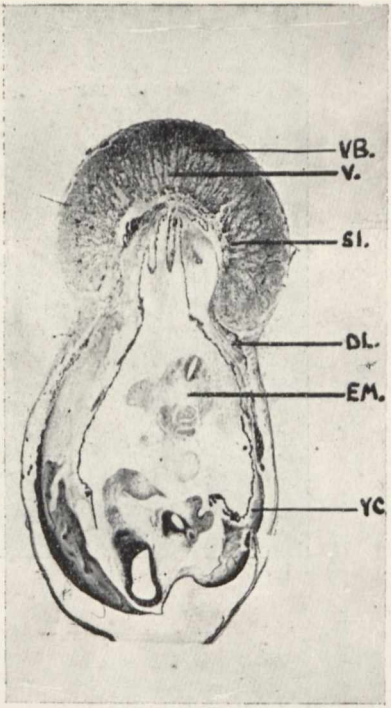

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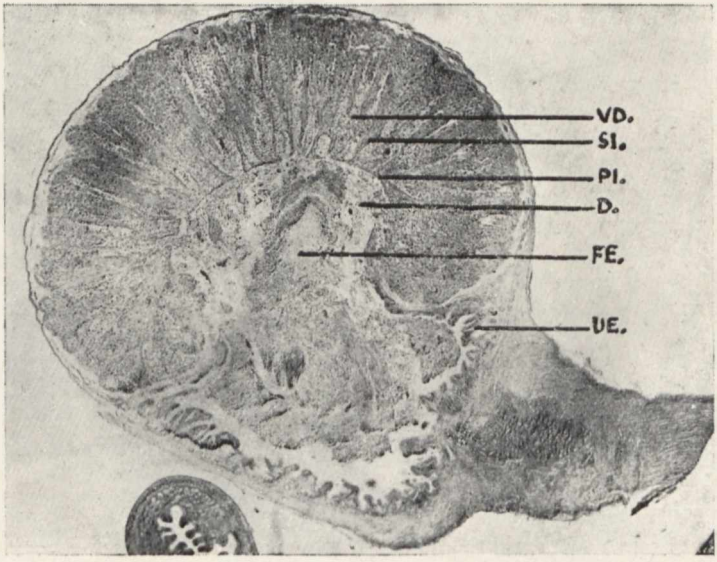

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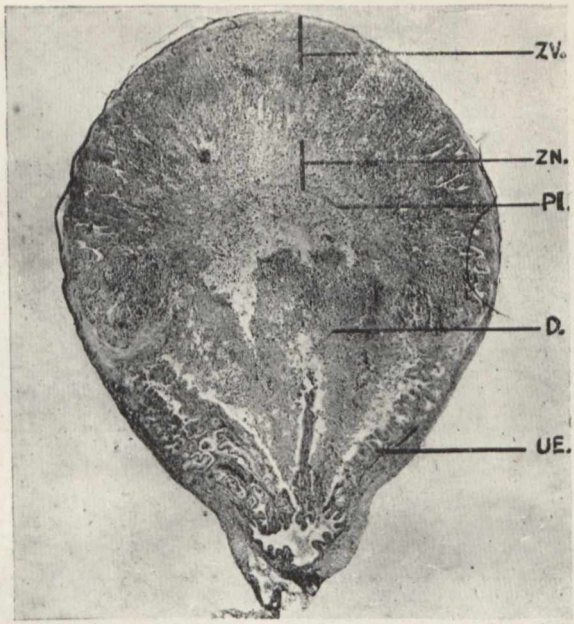

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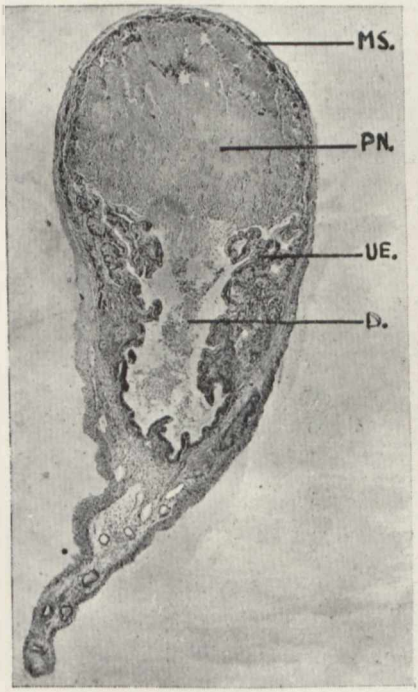

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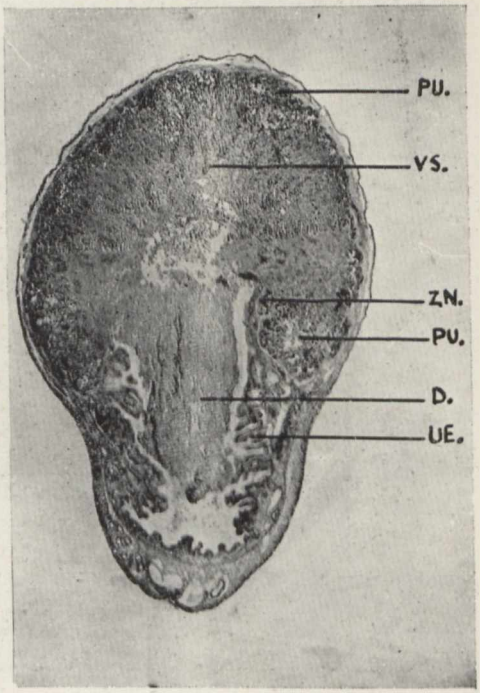

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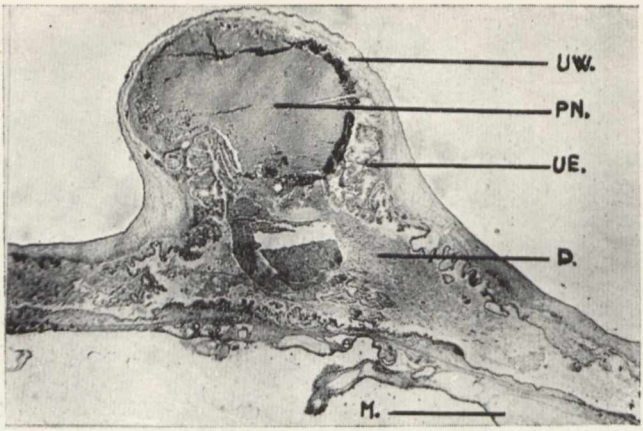

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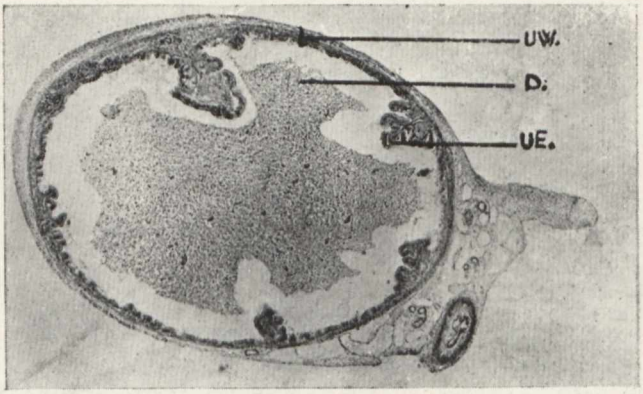

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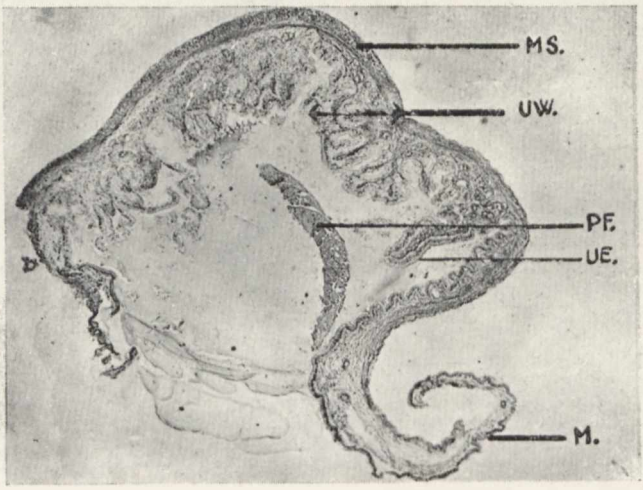

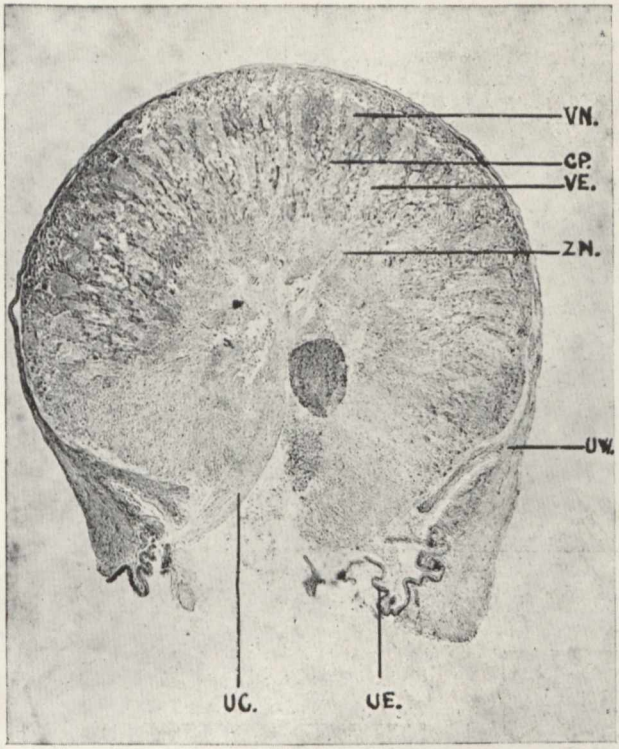

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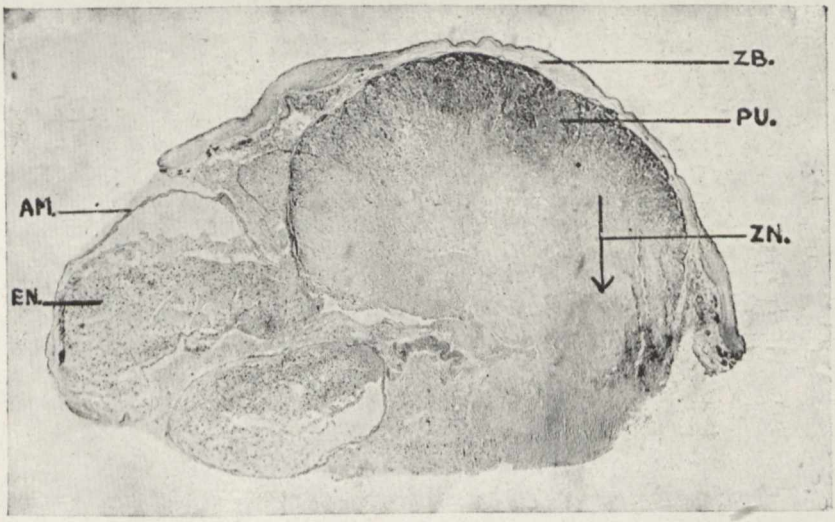
13 b



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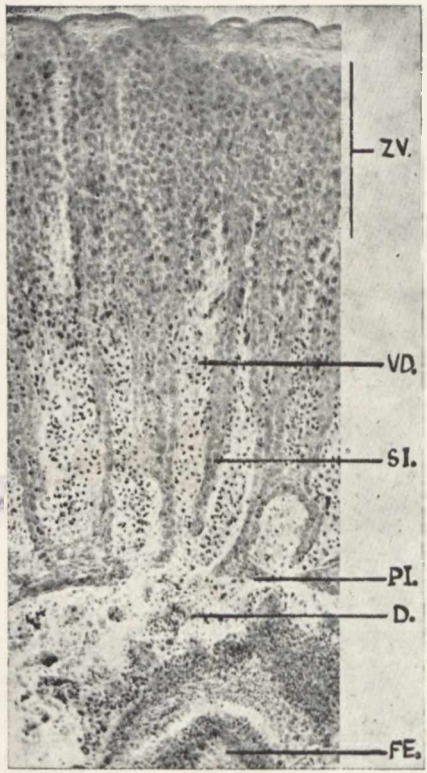

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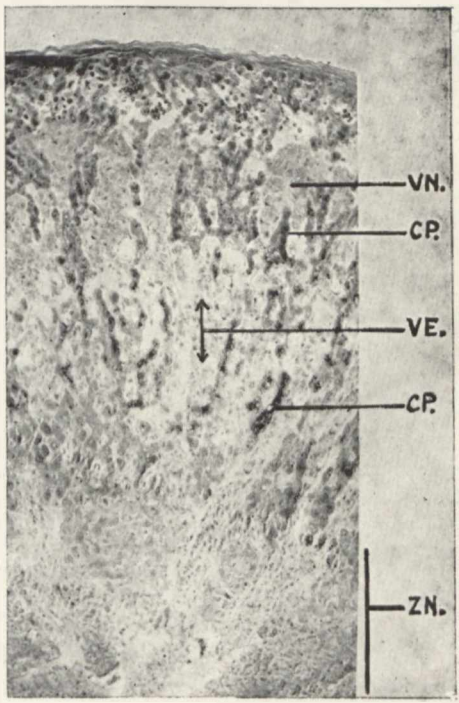

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Biologische und morphologische Untersuchungen über die Birkenmaus im Naturschutzpark von Białowieża.

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Saisonale Veränderungen der Behaarung der *Soricidae*.

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Histomorphologische Veränderungen der Schilddrüse im Lebenszyklus *S. a. araneus* L.

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6. St. Baranowski i A. Dehnel: Maetriały do biologii *Soricidae*.
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The participation of the intestinal microflora in the nourishing processes of larvae of *Galleria mellonella* L.

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