the interstices of the mass and the rapid deposition of salts upon these portions.

The facets about the spines would be caused by the friction of the calculi between which the spines projected. The occasional appearance of a ridge with facets on each side of it strengthens this view.

The points which at first sight are not sufficiently explained by this theory are: *firstly*, the fact that each and every one of the larger calculi possesses a spine; *secondly*, that this spine is almost invariably situated at or near the middle of one of its flat sides; and, *thirdly*, that in but one instance are there spines upon opposite sides of a stone. This latter seems an almost insuperable objection, for it would naturally appear that the calculus lying in the midst of the mass would possess spines projecting in various directions into the interstices about it.

These inconsistencies are explained, however, if we consider that the smaller calculi which are found to be evenly rounded or faceted on several sides occupied the centre and lower part of this mass, and that the larger calculi lay upon the surface.

That the mass of calculi does tend to take on this arrangement can be demonstrated by gently turning them about for some time in a bag or bottle.

If we once accept the probability that the calculi were thus arranged in the bladder, it can be readily understood that each of the larger calculi lying upon the surface would have one or more spines or ridges projecting into the interstices of the underlying mass, and these spines would naturally occur on one of the flat sides upon which the calculus would necessarily rest.

That the spines do not occur on opposite sides of any of the calculi shows that there was so little motion among them (owing largely, no doubt, to the enveloping mucus) that they did not often turn over and present what had been the free side to the action of the mass of other calculi.

The greater thickness of the outer crust on the spinous side as compared with the smoother side, which was exposed to the action of the urine and friction of the bladder wall, shows the greater rapidity of deposition upon the side buried in the stagnant mass, and is one of the many bits of confirmatory evidence which go to support the explanation which I have endeavored to give of this most singular phenomenon.

While this paper was awaiting publication, Mr. U., after four or five months of perfect ease, had a recurrence of his cystitis and a return of pain which caused him again to apply for advice. A sound revealing the presence of a stone, he was etherized July 24, 1884, and one hundred and twenty-seven grains of calculous matter were removed. The greater part of this was contained in a soft phosphatic stone about the size of a hickory nut.

There were, besides, about a dozen calculi, each of the size of a bean, and resembling in consistency those removed at the previous operation, but differing from them in the absence of the regular projections. One or two of them only possessed little protuberances, distributed irregularly over their surface and of insignificant size.

Their small number, making mutual attrition less close, prevented, no doubt, the molding which shaped their predecessors.

THE ADVANTAGES OF MASSAGE IN RHEUMATIC GOUT.¹

BY DOUGLAS GRAHAM, M. D., BOSTON, MASS.

"I'll knead him; I'll make him supple." — SHAKESPEARE.

RHEUMATIC gout, rheumatoid arthritis, or arthritis deformans is too familiar to us all to need any lengthened description. We readily distinguish it in most cases by its slow and progressive character; by its chronic or subacute course with frequent exacerbations and remissions; by its spreading symmetrically from the small joints to the larger, usually in the upper extremities first; by the thickening, permanent enlargement and often deformity it occasions; by its never affecting the heart and not being hereditary; and by its attacking females oftener than males. The term rheumatism is often used to cover a multitude of diseases, as charity is to cover a multitude of sins, and when rheumatism assumes a chronic form after an acute attack it may be impossible to see any difference between this and rheumatic gout. Recent views regard arthritis deformans and kindred disorders as possibly of nervous origin. This might seem to be the case when the malady begins with a quiet pulse and clean tongue, and when the patient complains of languor, loss of appetite, pain and stiffness in the joints, and perversion of nutrition. But as to causation, the ground may be easily covered by saying that whatever deteriorates the system, whether by mind or body, in those predisposed to this or any other disease, may, and probably will, precipitate its onset.

It is to be regretted that our success in the treatment of this obstinate affection is not equal to our knowledge of its pathology. An ounce of relief or an extra inch of motion is worth infinitely more to patients and physicians than a foolscap of such information as that the disease is a panarthritis involving cartilage, bone, and synovial membrane; ligaments, tendons, and bursæ, with thickening of the bones and thinning of the cartilages. With strange inconsistency Professor Senator, of Berlin, in his treatise on Diseases of the Locomotive Organs, describes this malady as usually selecting joints which are most continuously and severely overtasked by sewing, knitting, watch-making, and the like, while on another page he tells us that the thumb is generally spared and remains freely movable. For such a description he may be credited for drawing upon his imagination rather than from observation. I am sure we all know that the freedom of motion is longest preserved in those fingers which are used the most: first, in the index, second in the middle finger, while the thumb shows greater signs of being affected, and the ring and little fingers are generally worst of all. Moreover, Senator's description is again at variance with the only remedial course, of which he speaks in unequivocal terms by saying: "It is important in all the forms of this disease to maintain the functional activity of the affected joints as far as possible by means of active and passive movements. Absolute rest promotes stiffness of the joints, fixes the limbs, and atrophies the muscles." If his first statement were correct, then the treatment he so strongly recommends would be veritable homœopathy: disease produced by motion relieved by motion. But unfortunately this is not so, at least with

¹ Prepared for the Section of Practice of Medicine of the American Medical Association.

regard to dosage, for in using massage and passive motion in these cases long and frequent visits and arduous work are necessary; but in my experience they amply repay both patient and physician for time and trouble expended. Led on by gradual improvement from the use of massage in five out of six cases of well-marked rheumatic gout, I kept up this treatment until unlooked for results were obtained, so that four of these cases regained tolerable use of the affected limbs, and in one recovery seemed to take place.

Berghman and Hellday report three cases, Cronfeld one case, and Balfum, of Edinburgh, two cases of rheumatic gout treated by massage and movements with results similar to those I have obtained, and only one of them had a disappointing relapse. The mode of procedure in my cases was deep manipulation without friction or inunction, passive motion, as far as pain would allow and sometimes farther, and resistive motion as soon as it could be done, the details of which I have described more fully elsewhere. If pain disappears soon after it is caused by any of these operations it may be disregarded; if it lasts for several hours and increases after subsequent efforts, they must be suspended. Kneading with one hand so as to break up indurations or disperse effusions, while the other hand pushes along the circulation in the veins and lymphatics above the joint, is often a good procedure, and quickly leads to the absorption of products not too firmly organized. Blisters and powerful derivatives in the neighborhood of joints affected with rheumatoid arthritis are considered more likely to promote than to retard the affection, according to the studies of Senator. Massage of the adjacent skin and muscles acts as a physiological derivative and raises nutrition to a high degree by a rapid interchange of materials, owing to the force and speed of the circulation being increased and obstructed lymphatics and capillaries made permeable. In this manner the soft structures may be made to adapt themselves to nodosities and deformities that cannot be removed.

When the disease is very active, or the muscles fatigably degenerated, the tendons frayed out and thinned and loose cartilages in the articular folds of the fibrous membrane, or when bony ankylosis has taken place we should not expect anything from massage.

All of my cases had been well nigh rubbed to death in the ordinary way, besides having exhausted the resources of the materia medica, baths, and mineral springs of all kinds, electricity, etc., before coming to me for massage.

CASE I. Miss A. was sent to me by Professor Da Costa, of Philadelphia, in 1873. She was then seventy-eight years of age, and had been bedridden for eight months with rheumatic gout. The disease had affected every joint of her limbs and apparently had run its course and done its worst. There was eburnation of the articular surfaces and rattling of the bones, with distortions of almost every joint. There was neither ankylosis nor contracture, but only slight indolent thickening around the joints with great muscular weakness. The patient was nervous and depressed. Pulse 92, and dicrotic. After one application of massage she could put her arms under the bed clothes and pull them up around her neck. Four days afterwards, having had daily massage, she could reach back so far as to get an object behind the pillow on which her head rested, sleep was better, and she was greatly soothed by the manipulation. In seven days her pulse was

down to 79, and steadier, and she walked across the room half supported. The following day she fed herself for the first time since her illness. In three weeks she could walk twice the length of her room with slight support. It seemed cruel to ask this patient to walk, so badly were her ankles deformed. But there was no pain; the sensitive structures of the joints were probably destroyed. This patient had massage twenty-three times in one month, and the use of her limbs and general condition were greatly improved. I fancy there may have been times during her illness when massage would not have been of much use to her. She was the most delicate of a family of six, having suffered from pleurisy, pneumonia, hemorrhages from the lungs, etc., and she outlived them all.

CASE II. Mr. S., about fifty years of age, was sent to me by Dr. Thomas G. Morton, who had clearly explained to him the nature of his affection and told him that benefit might result from a long course of massage. For a year the patient had suffered from periarticular thickening of the finger and wrist-joints of a semi-solid nature, less of the elbows, ankles, and knees, in all of which places there were frequent but not severe attacks of pain of a non-inflammatory character. His general health had greatly deteriorated, sleep was poor, appetite small, and he had lost flesh, but still he could go out every day and attend to some business. Daily massage was used for a while, afterwards every other day. Improvement was slow and almost imperceptible. At the end of ten weeks the periarticular indurations had decreased, the joints were more comfortable and more flexible, sleep and appetite had improved, and the patient had gained flesh. At the end of four months massage was discontinued, the patient being to all intents and purposes well, having regained his natural sleep and appetite and increased in weight to a marked degree. The circumference of his wrists with the improved nutrition being the same as when the induration was present. There was still slight enlargement of some of the phalangeal joints, but the patient could shut his hands firmly, whereas at first they could only be semi-flexed. He said if he thought he could have been cured in this way he would not have sold his house and business with the expectation of going to Europe to seek for relief.

CASE III. Mrs. A. G., thirty years of age, enjoyed good health until she was nineteen years old, when rheumatic gout appeared first by swelling and pain in the last joint of the left thumb, and soon the other joints of both hands and fingers were similarly affected. Four months later the ankles became swollen. Then there was a respite for a year, and at the end of this time there was another exacerbation for five weeks. Six months later it was apparent that the hands and feet were "growing out of shape." About this time she became pregnant, and the disease was in abeyance during this state, but after the child was born the joints were generally affected as before. Again there was a year of improvement, followed by grief and taking cold, which caused a relapse, and in 1877 she walked with great difficulty. Then iodide of potash, arsenic, a sojourn at Caledonia Springs, and electricity were tried, but the patient grew worse. In the summer of 1881 Dr. Goodrich, of Bakersfield, Vt., rubbed the knee joints very hard and hurt the patient a good deal, but she improved so that she could walk with a cane and go up and down

stairs, though the legs were greatly bent. She relapsed again in a few weeks.

This patient came to me in February, 1882, with knees flexed to almost a right angle. There was slight effusion in them, and dry creaking on motion. There was thickening around the ankle-joints, though the motion was free and strong. Hip-joints not affected. The ring and little fingers of both hands were hopelessly deformed, the first row of phalanges being extended far back, the second and third sharply flexed and ankylosed. The thumbs, fore, and middle fingers were somewhat out of shape, but remarkably good use of them was retained. The left wrist was strongly flexed, the elbows and shoulders comparatively free, though they had been severely affected. The patient was bright and cheerful, and looked healthy, notwithstanding that she was suffering from a general bronchitis and weighed but eighty-two pounds. Her appetite was fair and bowels constipated. A tonic pill to increase the appetite and regulate the bowels was given, and general massage used daily. Her joints were not very sensitive, and from the first the massage was agreeable; the aches and pains disappeared in too remarkable a manner for me to ask anybody to believe. In three weeks she was eating very heartily, and taking five goblets of milk daily, and was free from discomfort; and after vigorous extension of the knees, which hurt at the time, they felt better all day, and we had gained one and one fourth inch extension at the ankle. In two months the menses, which had been absent for eighteen months, returned, and they have continued to return ever since with greater regularity than they ever did before. In three months nutrition had improved to a marked degree. At the end of this time, the patient having been in preparation by a variety of impromptu gradual extension apparatus, I put on each leg long lever splints, which made extension from the heel, and pried down the knees by means of wide bandages above them on the anterior aspect of the thighs, while the short arms of the lever rested on the back of the thighs.¹ These were kept on night and day for twelve days, and during the last seven days of their use the limbs made daily extension. After they had been on for twenty-four hours the patient liked them, and later, when temporarily removed, she felt faint for want of their support. They were then removed for eleven days, and light splints applied, and with these the patient stood up. After six days more of the long splints the legs were about as straight as people's usually are in use. By this time the joints had become sore, and the patient was not sleeping well. Two weeks later the patient walked twice across the room, pushing a chair before her to balance herself; ten days later she did this twenty-two times, and in ten days more she walked without anything for support except light wire ham splints. Four weeks later she was going up and down stairs alone, and two weeks after this she frequently took a walk of half a mile with the aid of an arm and her ham splints. It was then six months from the time treatment was begun, massage having been kept up all this time. At the end of seven months and a half the patient returned to her home, wearing the usual supports for weak knees, but unfortunately when these were unfastened there was not much bend to the legs. This, however, has improved by the patient's efforts. It is now eighteen months since the patient went home, and she has continued to gain in every respect without treatment.

¹ I first saw this used by Dr. E. H. Bradford.

The flexed wrist and movable finger joints made good progress under massage.

While I was attending this patient there came to me a report of a somewhat similar case treated in like manner with better results than could have been anticipated, and this inspired us with hope and perseverance.

CASE IV. Dr. Carl Gussenbauer, Professor of Surgery at Prague, gave the massage himself in this case. The patient was a lady, forty years of age, who had suffered from rheumatoid arthritis for twenty-two years. The trouble began in one elbow, and later affected the finger-joints. Rest and local applications were without effect. In the following years all the joints of the body were attacked. During two pregnancies no new joints became affected, and those that had been were more endurable. The malady progressed in spite of medication baths, mineral springs, electricity, etc. The patient had not walked any for eight years. Pains by day and night disturbed her rest, and she had become thin, anæmic, and constipated. The heart's action was irregular, and there were attacks of syncope at times. In this condition Professor Gussenbauer undertook massage with great misgivings. He not only applied massage to the joints, but to the whole body: to the joints for the painful swellings that affected both upper and lower extremities, as well as some of the dorsal and lumbar vertebræ; to the whole body to favor the nutrition of the atrophied muscles. There was but a small range of motion in any of the joints of the limbs, owing to adhesions in them and in the sheaths of the tendons, producing the characteristic contracture, and these he hoped to gradually overcome by passive motion. The deformity of the articular extremities of the bones, of course, could not be removed. He *masséed* the patient daily, and gave her passive and active motion, and after fourteen days he had the pleasure of seeing the swollen joints decreased in size and their motion improved and less painful. At the end of a month the patient could walk about her room with a cane, and the improvement was so great that recovery seemed possible. For the next four months the patient was *masséed* by his assistant, Dr. Schmid. The result was that the pains and swellings of the joints and capsules all disappeared, and they became movable to almost a maximal extent except that of one elbow, which had undergone bony ankylosis. The muscular strength of the patient had increased so that it often tired out the operator to give her the active or resistive movements. She could walk in her garden for fifteen minutes without fatigue. Nutrition improved more and more, the anæmia disappeared, the pulse became regular, and menstruation returned, unaccompanied by fits of prostration, as formerly. *Tapotement*, or percussion with the ulnar border of the hand, with the palm, and with the fist, was freely used in this case.

In several cases of chronic articular rheumatism Professor Gussenbauer reports favorable results from massage.

CASE V. While some patients become thin under rheumatoid arthritis others grow fat. This was the case with Mrs. J. L., fifty-eight years of age, who had suffered with the disease for fifteen years. In seven months under massage she regained free and natural use of her limbs, which she retained until a short time before her death. For the first two years her joints gave her but little trouble, but at the end of this time she was

confined to her bed five months with arms so stiff and painful that when they were out of the bed clothes she could not put them in again alone. Later the trouble left the arms and appeared in other places, but never in the toes. Her history is one of pains and stiffness of joints and muscles, with occasional remissions, the disease all the time slowly progressing. Her condition had been made much more comfortable by alkalies and laxatives prescribed by her physician, Dr. J. P. Oliver, who kindly referred her to me for massage. Previous to her malady she had been very thin and active, but for the last ten years of her illness she had grown very fat and heavy. For the last year her mode of locomotion indoors had been by means of a wheel-chair, and it was with difficulty she could be got in and out of a carriage. On each side of the patella it was evident through the layers of adipose tissue that the capsules of the knee-joints were thickened, and it was to these places the pain of extension was referred, and this was limited to about three fifths its normal range. Flexion was natural, and dry crepitus could be heard and felt on motion. Massage and movements every other day, with the use of curved ham splints, and later straight ones, produced good results. In five weeks she was walking about the house with a crutch and cane, and the legs could be straightened so that the popliteal spaces would touch an applied straight ham splint, and free motion was gained to this extent. The splints proved a support and comfort in walking, and were worn for several weeks longer to overcome the tendency of the posterior femoral muscles to shorten. At the end of three months the patient could walk the length of a room and back again without support of any kind, after getting started by assistance for a few steps. She had then lost the pain in the joints that troubled her by night, and pulling the legs no longer hurt the knees as formerly. When the knees ached, walking relieved them. The indurations and thickening were disappearing, and a hard, painful spot behind the left hip had entirely gone, and the patient could turn easily in bed. In six months the patient walked easily and gracefully without crutch or cane or splint. A month later she got up from her chair alone, and walked as well as any one of her weight could be expected to do, and this improvement continued for six months longer, until an affection of a different kind supervened and suddenly carried her off. I need not say how sorry I was to lose this patient, who did me as much credit as any I ever had. The beneficial change in the knees was an indication of what had taken place in the other joints, in the fingers, wrists, and elbows, thinning of indurations, and increase of motion.

CASE VI. Miss E. P., forty-five years of age, at the change of life, well nourished, and a picture of health, has suffered from rheumatic gout and its variations for five years. During its early appearance, while crossing the Atlantic and returning, all the symptoms disappeared only to return as soon as she landed. Two years after the disease began she was seized with severe gastric disturbance for several months, and during the worst of this the joints were remarkably well. With the disappearance of the stomach trouble the mischief in the joints returned. The patient had derived, and still continues to derive, marked benefit from forty to eighty grains of salicylic acid, given in divided doses during the day with bicarbonate of soda and carbonate of ammonia. This

was prescribed by her physician, Dr. Lucy E. Sewall, who kindly referred her to me for massage. As the patient was improving I could see no need of adding this treatment, for cauterization of the knees was having a good effect, and making them feel better all day afterwards. It was agreed, however, to try massage on the worst limb, the right leg. There was a mass of feebly-organized, indolent tissue in front of the condyles, which was easily dispersed, and its absorption hastened by massage, even the first sitting producing a marked effect, so that the adherent skin became free, and the hyperplastic tissue softer. At the end of a week, with daily massage, this semi-indurated tissue had almost entirely disappeared, and the feeling as if the joint were held by an iron band in front of it had correspondingly lessened; the patient could stand more easily, and push the limb against resistance more vigorously; the œdema of the leg and swelling of the ankle, which were partly controlled by a bandage, had also improved. During the first three weeks daily gain was perceptible, and at the end of this time her physician asked me to apply the same treatment to the other leg, which had not been getting along so rapidly under cauterization as the worse one had been under massage. After this they improved *pari passu*. A splint was worn for twenty hours every other day on the right leg, and this was well tolerated, and soon overcame a tendency to bending of the knee. The hands and arms made progress, and in two weeks she could use them more freely, and write more easily. At the end of thirty-nine days, having had daily massage, the patient took a ride, getting in and out of the carriage with an ease that surprised herself. Three weeks before this she could scarcely take a step, and for a year she had not been able to walk in any way worth mentioning. Massage was then used every other evening, and she always slept well after it, but not when it was omitted. Manipulation made her lame and sore for several hours afterwards, only felt, however, on motion. She continued to gain under massage until she went to the country, two months from the time it was begun. She improved for three months while in the country, but on her return to the city she rather lost ground, which massage scarcely made up for. After two months more of this treatment it was suspended for two weeks, and during this interval she suffered from general stiffness, wakefulness, and fullness in the head, all of which disappeared promptly on resuming massage. And now, in spring time, with the most unfavorable weather, and arduous professional duties, the patient is again improving. She has good use of her arms, and the thickening of the knee-joint capsules is decreasing, and she walks pretty well with very little assistance.

CASE VII. Mrs. C. J.; fifty-two years of age, has had rheumatoid arthritis for eight years, which has pursued a relentless course in spite of twenty-three physicians and all sorts of treatment. The joints of her hips and back are the only places free from the disease, which at present is pursuing its ravages in all the joints of the upper extremities, having for the present got through with the lower ones. Her general health is good, but before this trouble she was delicate and dyspeptic. Massage every other day for six weeks, though removing the peri-articular swellings and thickenings, and extending the knee-joints a little, which are almost bent at a right angle, has had no other apparent effect except to make the joints lame

and sore, and the patient tired. The upper extremities are almost ankylosed, and resent passive motion. The patient perceives no improvement from the massage. This is the most discouraging case I have yet encountered. After the disease has spent itself on the upper extremities there will probably be a chance for massage to do some good.

By means such as we have been considering, Fuller, of London, has told us that when the contracted tendons seem almost to require the surgeon's knife for their relief operative interference will often be rendered needless. In one case, by persevering for nine months, he straightened a leg that had been flexed for four and a half years. Indications for encouragement he clearly expresses in these words: "When, as is usually the case, the contraction depends upon simple gluing together of the structures external to the joint, with thickening of the capsule, and, possibly, some remains of effusion within the cavity, or into the bursæ external to the joint, I see no reason for despair as to straightening the limb, however long contraction may have existed."

CASE VIII. Rheumatoid arthritis of a single joint, resulting from injury, is recognized. I do not think I have seen more than one case that would agree with this. The knee-joint had been injured ten years before, and there was thickening, grating, slight deformity and shortening, but free motion, though walking was exceedingly limited on account of pain, weakness, and the weight of the patient. She had been rubbed an hour a day for a year by a very nice person, with the result of always being tired after the procedure, and getting no better. Twenty minutes' massage with carefully increasing resistive movements every other day, for two weeks, improved her walking to an enjoyable extent. The induration was lessened, and the comfort of the joint increased.

No description of the effects of massage in rheumatic gout would be complete without reference to the case of old Admiral Henry. In 1810 he was seventy-nine years of age, and had suffered from this affliction for twenty-eight years. There were swellings of his knees, ankles, and insteps, which made him quite a cripple, and his fingers were also swollen and contracted. His stomach and bowels were hard, painful, and disordered. By means of various instruments made of bone polished smooth and hammers covered with cork and leather he persevered in the use of deep friction and percussion, night and morning, for three years. At the end of this time, it is said, he had completely succeeded in removing the swellings, and had restored himself to the use of his limbs. His operations were at first painful, but ceased to be so after a little while, and soon they became so pleasant and useful that after having gone through with them in the morning he felt better all day. At the age of ninety-one he wrote to a friend: "I never was better, and at present am likely to continue so. I step up and down stairs with an ease that surprises myself. My digestion is excellent, and every food agrees with me. I can walk three miles without stopping." This was in 1823, and he may be alive yet for anything I know.

The Admiral's pathology and therapeutics are of interest. He considered the chief cause of disease to be deficiency of circulation, and the best means of correcting this to prevent the nerves and muscles from falling asleep and getting fixed, for which purpose they should be kept loose by instruments worked

among them. "By keeping the blood-vessels, nerves, and tendons in constant action by means of these instruments the blood is rendered pure; it passes quickly through the blood-vessels, leaving no *fur* behind it, so that ossification and stiffness are prevented." This quaint remark about the blood leaving no *fur* behind it is a noteworthy illustration of how a layman may express himself better than he is aware of, or, in common language, "hit the nail on the head." This fur of old Admiral Henry corresponds to what we know of the white blood corpuscles which move along so slowly in the circulation, having a tendency to adhere to the walls of the vessels, and which, when the current is retarded, as in points of inflammation, congregate in vast numbers, and often migrate into the extravascular tissues, thence to be resorbed or become the foci of pathological changes.

MENSTRUATION IN WOMAN AND ANIMALS.

BY ROBERT W. LOVETT, A. B. (HARVARD MEDICAL SCHOOL.)

THE great obscurity which still surrounds the process of menstruation makes it desirable for us to use in the study of it every legitimate means, and it may be that a little wider view of the process may be gained by a study of the function as it exists in the lower animals.

In general there is in plants and animals at the season of reproduction a more or less marked manifestation of increased activity. In plants the analogy might be a trifle strained perhaps, yet their flowering season is of course their season of reproduction. We can hardly expect much analogy to menstruation in animals below the mammalia, but there are the foreshadowings of a periodical sexual activity very low in the scale. Birds, fishes, and reptiles have no uterus, although having of course the genital tracts from which the uterus is later developed. In birds "many acquire bright colors and other decorations in the breeding season alone," and "certain ornamental appendages become enlarged, turgid, and brightly colored during the act of courtship." (Darwin.) At the time of the oviposit fishes show a genital excitement, according to Guersant, their sexual orifice swelling and being clothed with a red tint. In the amphibia the oviducts become lengthened and consequently more coiled at the breeding season. Several lizards secrete especially at the coupling season an odorous, fatty liquid from glands at the inside of the thigh. Snakes also show an increased activity of the anal scent glands in the breeding season. But we must go higher in the scale.

In the mammalia, so far as known, every animal is subject to periods of heat. During this time alone will the female admit the male (with the exception of monkeys), and of course at this time only can conception occur. The time of this rut is determined by the surrounding condition of food and climate, so that the young shall be brought forth at the season of the year most favorable to their growth and early sustenance. Among wild animals, as a rule, conception takes place, pregnancy follows, parturition and lactation are accomplished, and at the next suitable season the rut returns to be again gratified. Wild animals are in heat only once or twice a year. When from the absence of the male or any other reason conception does not take place at this time, it is not known in the case of wild