

Canine Breeding and Reproduction

Introduction

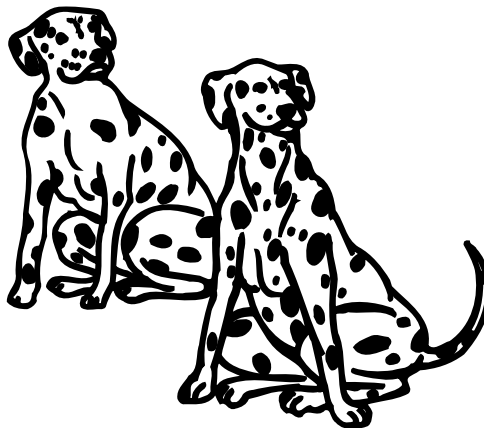
Allowing the female dog (bitch) to have puppies can be a wonderful experience. However, dog owners must understand the responsibility that comes with breeding since overpopulation is a tremendous problem. There are too many abandoned and unwanted mixed and purebred dogs in pounds and shelters all across the country that have to be euthanized (put to sleep) each year. Unless every newborn puppy is guaranteed a loving home, dogs should be spayed or neutered before they reach sexual maturity (6 to 16 months of age, depending on size and breed).

Factors to Consider Before Breeding

- **Availability of Good Homes.** Owners should identify loving homes for puppies before breeding decisions are made.
- **Health Status.** Prior to breeding, the bitch and the male dog should be in good physical condition. Dogs should have up-to-date vaccinations and be free of diseases and physical abnormalities, including

healthy reproductive tracts. A canine brucellosis test should also be conducted before breeding occurs, even if it is an uncommon disease among dogs.

- **Hereditary Disorders.** Clearances from any hereditary disorders that are common to the dog's breed (e.g. canine hip dysplasia) should be obtained before breeding.
- **Behavioral Problems.** Both the bitch and the male dog must be of sound temperament.
- **Registration.** Both dogs should be registered with a national kennel club, especially if the puppies are going to be registered before they are sold.



The Reproductive Tract of the Bitch

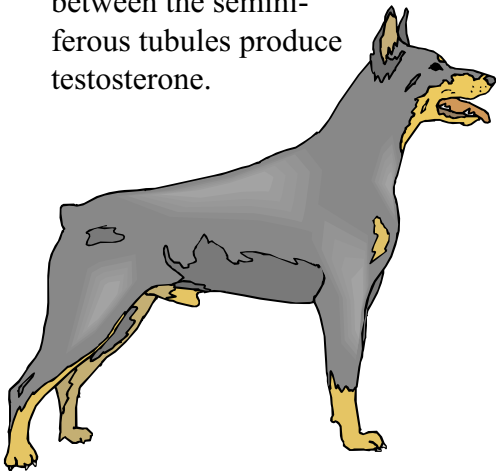
- **Ovaries.** These organs produce ova (eggs) and certain reproductive hormones. The eggs in the ovaries develop within fluid-filled sacs called follicles.
- **Oviducts.** These tubes move the ovulated and released eggs from the ovaries to the uterus in approximately two days. Moreover, the oviducts are the sites of egg maturation and fertilization.
- **Uterus.** This organ consists of two long horns and a short body. The uterus is the site of implantation and placental and fetal development.
- **Cervix.** This structure is a constricted orifice that serves as a channel from the uterus to the vagina. During pregnancy the cervix closes the birth canal and serves as a barrier against the entry of microorganisms into the uterus.
- **Vagina.** This hollow organ extends from the cervix to the vulva. The inner lining

of the vagina is made up of cells that undergo particular changes during the estrous cycle.

- **Vulva.** This structure is composed of the external genitalia, which includes the clitoris (sexual organ) and two vertical lips.

The Reproductive Tract of the Male Dog

- **Testicles.** These masses of seminiferous tubules are responsible for the production of sperm cells and the male sex hormone testosterone. Cells lining the seminiferous tubules produce sperm, while cells found between the seminiferous tubules produce testosterone.



- **Epididymis.** These ductules are the sites of sperm maturation.
- **Vas Deferens.** This is the ejaculatory sperm duct that is also called ductus deferens.
- **Prostate.** This accessory sex gland is responsible for the production of the fluid portion of the semen.

- **Urethra.** This hollow tube originates at the neck of the bladder and runs through the penis to transport urine. During mating, it transports semen.

- **Penis.** The dog's penis contains two rather unique characteristics:

- **Os Penis.** The objective of this small bone within the free extremity of the penis (glans penis) is to direct the male's non-erect penis into the bitch's vulva and vagina during the early stages of mating.

- **Bulbus Glandis.** This swelling of the penis is located toward the rear end of the os penis. As soon as the male dog inserts his penis into the bitch's vagina and begins to thrust, the bulbus glandis enlarges to a firm spherical shape, resulting in the so-called "coital tie." This tie prevents the male dog and the bitch from separating immediately after ejaculation and may last from 5 to 60 minutes.

- **Prepuce.** This foreskin or outer covering is where the external opening of the penis usually lies.

- **Scrotum.** This sac of skin is where the testicles are suspended outside of the peritoneal cavity.

The Estrous Cycle of the Bitch

Bitches become sexually mature when they exhibit their first heat period, usually between 6 and 16 months of age, depending on the size and breed. Most bitches come into heat twice a year. The exceptions to this rule are wolves and basenjis, which typically exhibit only one heat cycle per year. The estrous or heat cycle of an intact (unspayed) and nonpregnant bitch is divided into four separate phases:

- **Proestrus.** The most reliable indicator of the beginning of this phase is the bloody vaginal discharge. This bloody discharge is due to the leaking of red blood cells from capillary vessels lining the uterus into the lumen of the uterus. Other indicators are swelling of the vulva and frequent licking of the external genitalia. During proestrus the bitch will attract male dogs but will not allow mounting or mating. Proestrus usually lasts between 6 to 11 days, but generally lasts for nine days. During this phase the follicle-stimulating hormone (FSH) and the luteinizing hormone (LH), both secreted by the pituitary gland, stimulate growth and development of follicles within the ovaries. Furthermore, the levels of the hormone estrogen, which is primarily produced by the

follicles, rise gradually in the bloodstream causing behavioral estrus in the bitch.



- **Estrus.** This phase begins when the bitch allows mounting or mating. To indicate sexual receptivity, the bitch crouches, elevates the rear quarters toward the male and moves the tail to one side. During this phase the vaginal discharge becomes a straw or light pink color. The average duration of estrus is about nine days, but it can last from 2 to 21 days. During this phase estrogen levels decrease and progesterone levels increase. Furthermore, it is during estrus that ovulation (release of eggs from ovarian follicles) takes place. A surge in LH from the pituitary gland triggers ovulation, which occurs 1 to 3 days after LH levels peak in the bitch's bloodstream. All mature ovarian follicles rupture and release their eggs into the oviducts within 24 to 48 hours. Generally, larger dog breeds ovulate more eggs than smaller breeds. Released eggs undergo maturation in 2 to 3 days and remain viable for a period of 12 to

72 hours. Following ovulation, each ruptured follicle changes to corpus luteum, a yellow body responsible for increasing progesterone levels during estrus. It is worth mentioning at this point that extreme care must be taken during the estrus phase in order to prevent unwanted pregnancies. The bitch must be supervised when she is allowed to go out into the yard or taken out for walks.

- **Diestrus.** This phase, which lasts about two months, begins with the bitch becoming unattractive to the male dog and lasts until the corpora lutea (plural of corpus luteum) regresses. Hence, diestrus is under the influence of the hormone progesterone. If the bitch has been bred, this phase is the beginning of pregnancy. However, whether or not the bitch has been bred and becomes pregnant, the corpora lutea are maintained and remain functional, secreting progesterone, which is important for the maintenance of pregnancy.
- **Anestrus.** This phase is considered to be a quiet rest stage in the estrous cycle. Factors such as breed, age, size, and health condition will influence the duration of anestrus. The length of anestrus varies, lasting on average about 3 to 5 months. During this phase, the bitch shows no signs of

heat and no sexual interest in males. Following anestrus, the heat cycle begins again.

The Reproductive Cycle of the Male Dog

Male dogs, like bitches, reach sexual maturity at varying ages, depending on the size and breed of the dog. Most males are sexually mature and capable of producing sperm at about 10 months of age. The hormones FSH and LH, secreted by the pituitary gland, stimulate the production of sperm (spermatogenesis) and testosterone by the testicles. Testosterone is necessary for the development and maintenance of male sex characteristics, male sexual behavior, and spermatogenesis, which occurs throughout the year and lasts for a period of 62 days.

Mating

The best rule to follow when breeding dogs is to be certain that they are physically mature. This means that both the bitch and the male dog should be 18 to 24 months of age, by which time the bitch should be in her second or third heat period. Since ovulation usually occurs on the second day of estrus, it is highly effective to breed the bitch as soon as she is sexually receptive to the male dog and again two days later.

The bitch is usually brought to the male dog for breeding. Courtship behavior begins with the male dog sniffing at the

bitch's face and flank and licking of the vulva. When ready, the bitch presents her hindquarters to the male dog and stands still with her tail toward one side. The male dog then clasps the flanks of the bitch with his forelegs, inserts his penis into the vagina (intromission) and begins to thrust. The enlargement of the bulbus glandis occurs at this time, resulting in the coital tie. With the penis firmly in place, ejaculation begins. Then with their genitalia still "locked," the male dog will dismount by placing both front feet to one side and lifting one hind leg over the bitch's back so that they are facing in opposite directions. The enlarged bulbus glandis of the male dog prevents separation from the bitch for about 5 to 60 minutes. Do not interfere with a coital tie as injury could result. Separation occurs naturally and both dogs usually wash themselves afterwards.

When artificial insemination (AI) is properly performed, conception rates are equal to those attained by natural breeding. However, the American Kennel Club (AKC) has regulations concerning the registration of dogs produced by AI. Therefore, before using this technique, check with the AKC or the local kennel club for information about AI and registration of puppies.

Pregnancy

The pregnancy or gestation period extends from the time of

successful mating to parturition. Sperm cells will reach the eggs in the oviducts of the bitch within 30 seconds of ejaculation and have a viable life span up to seven days. Fertilization (union of sperm and egg) takes place in the distal portion of the oviducts and occurs a few days after mating.

The resulting zygotes (fertilized eggs) begin cell division growth, and the growing organisms are then called embryos. The developing embryos move from the oviducts into the uterus 6 to 10 days after conception and implant or attach to the uterine walls 17 to 21 days after fertilization. As they implant and their placenta develops, the embryos are then called fetuses. The fetuses are usually evenly spaced throughout the two uterine horns.

The pregnancy or gestation period of the bitch lasts between 56 to 66 days, with an average length of 63 days. As mentioned previously, during this period the corpora lutea are maintained and remain functional, secreting progesterone, which is important for the maintenance of pregnancy. To confirm pregnancy, palpation of the bitch's abdomen for the presence of evenly spaced swellings can be conducted by an experienced person between 20 and 30 days after the last mating. However, improper procedure or excessive prodding can cause a miscarriage. After confirming that the bitch is pregnant, make sure you become familiar with

the basics of prenatal care, parturition (whelping), and emergency procedures.

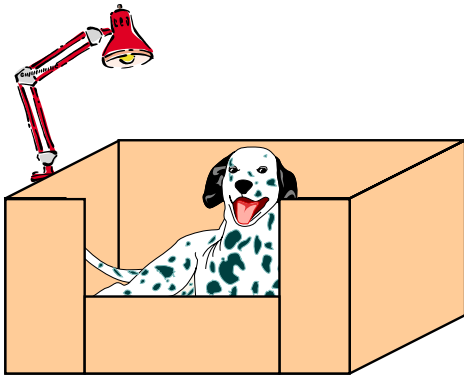
A pregnant bitch requires additional food to support the growth of pups inside her and to produce the milk that pups will need after birth. Feed her the same amount of the usual adult maintenance diet for the first 4 weeks of pregnancy. Then gradually increase the amount of food so that by whelping time she is eating about one and one-half times her maintenance diet. Consider switching to a commercial dog food that is specifically formulated for pregnancy and lactation. However, due to possible whelping problems, make sure that the bitch does not gain any excessive weight during this period.

Very few physical changes occur until the fifth week of pregnancy. By the fifth week of pregnancy, the nipples and mammary glands swell and darken in color. Between the sixth and seventh week, the bitch's abdomen is enlarged due to the growth of the pups. At about 8 weeks into the pregnancy, the bitch's mammary glands will enlarge considerably and milk may appear on the nipples.

Whelping

About a week before the estimated date of parturition, the bitch should be introduced to the whelping area and the whelping box. The whelping area should be a place that is

dry, warm, draft-free, secluded, and quiet. The whelping or nesting box may be constructed of a variety of materials but should be designed to accommodate the bitch fully stretched out on her side and have room to spare for the pups. The bitch should be able to step into it, but the pups should not be able to climb out. The whelping box should include an interior shelf around the periphery to prevent the bitch from smothering or crushing a puppy. This shelf should be high enough to accommodate a puppy, but low enough to prevent the bitch from stepping or rolling on a puppy. The bedding of the box should include fresh, flat newspaper laid at the bottom for fluid absorption and heavy towels, mattress pads, or pieces of carpeting laid on top of the newspaper for good traction.



If necessary, a source of supplemental heat should be placed in the whelping box for the puppies, especially after the first few weeks of birth. Supplemental heat can be furnished by using heat bulbs either suspended or mounted above the floor of the whelping box. However, make sure to leave an

area of the box without supplemental heat, so the bitch and puppies can move away from the heat if they get too hot.

The whelping process usually does not require assistance. However, for emergency purposes, the following supplies should be kept on hand:

- A clean, small plastic syringe to aspirate secretions from the mouth and nose.
- A spool of dental floss to tie the umbilical cords.
- A pair of sterilized, straight, blunt-tipped scissors, in case it becomes necessary to cut the umbilical cords.
- A small bottle of iodine solution to apply to the umbilical cords.
- Several clean, laundered towels for drying the puppies.

Approximately 12 to 24 hours before labor begins, the rectal temperature drops from a normal of 101.5° F (38.6 ° C) to less than 100° F (37.7° C). In addition, the bitch loses her appetite, becomes restless and lethargic, and her abdomen becomes more distended. An increase in the production and secretion of the hormone prostaglandin F-2-alpha by the placenta and uterus causes regression of the corpora lutea and a subsequent decrease in progesterone. The decrease in progesterone permits uterine contractions to occur. The hormone relaxin is important for the preparation of the uterus

for parturition and the separation of the pubic bones for passage of the puppies through the birth canal.

The labor and delivery process in dogs usually does not require human intervention, and it entails three stages.

- **Stage I**, which lasts about 6 to 12 hours, is characterized by mild uterine contractions and dilation of the cervix. At this time the bitch displays external signs such as intense nesting and constant lying down and standing up.
- **Stage II** is characterized by intense uterine contractions, which causes the expulsion of the puppy. Bitches usually deliver lying down, but some may assume a squatting position. Most puppies are born with feet and head first. The bitch should instinctively start to lick the fetal membranes away from the puppy's face, and then sever the umbilical cord with her teeth. There should be no interference with this maternal process. However, if the bitch does not act, you should step in and break the membrane with your fingers, so the puppy can breathe. Similarly, the umbilical cord needs to be tied, cut, and disinfected with iodine.
- **Stage III** is characterized by expulsion of the placenta. The bitch usually expels a placenta within a few minutes after the expulsion

of each puppy. It is normal and instinctive for the bitch to eat the placentae. However, you may want to reach and take some of them from her to avoid undesirable adverse effects. Make sure that the bitch has expelled a placenta for each puppy. If she retains any, she may develop postpartum metritis and need veterinary help. In general, the bitch will deliver her entire litter over a period of several hours. The uterus usually returns to its normal size (involution) within 12 weeks of whelping.

Postpartum and Postnatal Care

Since the bitch's appetite returns within 24 hours after whelping, she should be fed a highly palatable food, moistened with water. Furthermore, at about 20 to 30 days after whelping, the bitch needs three to four times more food than she normally does. Although the eyelids of the puppies are not open at birth, they can still locate the bitch's nipples in order to feed. This is of extreme importance since the puppies must consume



colostrum (dam's first milk) within the first 12 to 24 hours after birth. Colostrum contains high levels of antibodies that are absorbed intact into the bloodstream and provide protection against infectious diseases. Hence, make sure that each puppy has access to a nipple and is able to suckle. Remember that the most important indicator of puppy health during the first few days and weeks of life is regular and normal weight gain. If a puppy does not gain weight during the first 72 hours of life, you should start supplemental feeding immediately. Commercial milk formulas, which can be obtained from pet supply stores, should be fed warm in a small bottle with a hole in the nipple.

Handle the puppies daily to get them used to human contact, and change the bedding often to prevent urine burn. As you handle them, inspect for cleft palates, umbilical hernias, *Atresia ani* (absence of an anal opening), and any other abnormal conditions.

At about three weeks of age, puppies should be given access to dry dog food mixed with warm water (gruel) in a large bowl several times a day. Gradually, the water content should be reduced so that by 4 to 6 weeks of age the puppies are meeting most of their requirements with the dry food. By this time there is less demand on the bitch's milk, and her food intake should be reduced. This initiates the

process of stopping milk production and helps to normalize the bitch's food intake. After about 6 or 7 weeks of age, puppies are ready to be weaned and placed into new homes. Before sending them off, make sure they have been treated for parasites and vaccinated for distemper, hepatitis, leptospirosis, parvovirus, coronavirus, and kennel cough.

Some Common Reproductive Problems

- **Silent Heat.** This term refers to a bitch that is in estrus but is not exhibiting vulvar swelling and vaginal bleeding.
- **Prolonged Heat.** This term refers to a bitch that remains in estrus for more than 21 days. This condition is usually the result of excessive levels of estrogen due to ovarian tumors or follicular cysts.
- **Vaginitis.** This infectious disease occurs when pathogenic bacteria invade the vagina and cause infection.
- **Pyometra.** This disease occurs when the uterus has been under the sustained effect of high levels of progesterone and ideal conditions for bacterial growth.
- **Cryptorchidism.** This inherited trait is the failure of one or both testicles to descend. Dogs with neither testicle descended are sterile.

- **Orchitis.** This is an infection of the testicles.
- **Balanoposthitis.** This is an infection of both the penis and prepuce.
- **False Pregnancy.** This condition refers to a nonpregnant bitch acting as if she was pregnant. The condition is caused by progesterone produced by corpora luteal cysts in the ovaries.
- **Dystocia.** This term refers to prolonged or difficult labor caused by a physical blockage or uterine inertia.
- **Mastitis.** This term refers to an infection and inflammation of the bitch's mammary glands (normally five pairs).
- **Brucellosis.** This disease, which is caused by the bacterium *Brucella canis*, is a well-recognized cause of abortions and stillbirths.

Conclusion

It is advantageous to have knowledge of canine reproductive anatomy and physiology, the estrous cycle of the bitch, mating, pregnancy, whelping, and postnatal care of pups if you are planning to breed dogs. Furthermore, your objective should be to improve the standard of the breed. Remember, pounds and shelters all across this country are already full of unwanted dogs.

References

- Case, L.P. (1999). *The Dog: Its Behavior, Nutrition, and Health*. Ames, Iowa: Iowa State University Press.
- Currie, W.B. (1988). *Structure and Function of Domestic Animals*. Stoneham, MA: Butterworth Publishers.
- Giffin, J.M. and L. Carlson. (2000). *Dog Owner's Home Veterinary Handbook*. New York, NY: Hungry Minds, Incorporated.
- Marder, A. (1997). *The Iams Company Complete Dog Owner's Manual*. Australia: Weldon Owen Private Limited Company.
- Pond, W.G. and K.R. Pond. (2000). *Introduction to Animal Science*. New York, NY: John Wiley & Sons, Incorporated.
- Rice, D. (1996). *The Complete Book of Dog Breeding*. Hauppauge, NY: Barron's Educational Series.
- Whitehead, S. (1999). *Dog: The Complete Guide*. London, UK: Team Media, Limited.



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New November 2002; UNP-52