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life is the first week of age, which is the interval of highest mortality; weaning is the second most stressful time. The breeder can help a pup cope with stressors by examining it shortly after birth to detect for the presence of any obvious congenital defects, which may impair development and hinder survival. Some of the more common congenital abnormalities in pups are cleft palate, open anterior fontanel, hydrocephalus, heart disease, umbilical hernia and inborn errors of metabolism.

Within hours after birth, the pup should begin to consume colostrum, which is the source for over 90 percent of the maternal antibodies the pup receives. Prior to breeding, the bitch should have been brought up to date on her vaccinations, thereby maximizing the presence of maternal antibodies in her colostrum.

Because of their immature glucose storage systems and renal function, pups are prone to hypoglycemia and dehydration. Hence, adequate nutrition is critically important. The pup's growth rate is a sensitive indicator of nutritional status. Pups should be weighed daily for the first three weeks of life, during which time it gains about ten percent of its body weight daily. If weight gain is inadequate, the dam's mammary glands should be expressed to ensure adequate milk production, and her nursing behavior should be observed. Supplementation with milk replacers and bitches' milk should be considered in cases of poor weight gain. In nursing pups, weaning can begin at three to four weeks of age, but should not be completed until six weeks.

Neonates also have undeveloped thermoregulatory systems. Because of their large surface area-to-body mass ratio, sparse body fat, high water composition, poor blood flow to the extremities, and immature shivering and panting responses, pups have difficulty regulating their body temperatures. During the first weeks of life, the ambient temperature in the nesting area should be kept at 86-90F, with gradual reductions to 75F over the next three weeks. Maintaining normal body temperature—which is 96-97F during the first two weeks of life, and

increases to 100F by four weeks of age—is important for normal function of the pup's metabolic pathways. Normal body temperature is also a deterrent to infectious diseases, many of which grow best at low body temperatures.

Neonates can fall prey to a variety of infectious agents. Canine herpesvirus, most common in pups under three weeks of age, can cause depression, diarrhea, respiratory disease and sudden death. If contracted during pregnancy, it can cause abortion. Affected pups should be kept warm and well hydrated, and any electrolyte imbalances should be corrected. Although no vaccine is available, an affected dam's subsequent litters are usually immune if they've received adequate colostrum.

Canine parvovirus type 1, seen primarily in pups aged 5-21 days, causes diarrhea, pneumonia and death, as well as abortion and infertility in infected bitches. Like canine herpesvirus, treatment is symptomatic and no vaccine is available.

Pups of all ages are subject to bacterial infections. "The young animal is prone to these because the immune system is not yet what it should be," said Dr. Melniczek. Pups can develop bacterial respiratory infections through aspiration secondary to cleft palate, vomiting or

regurgitation. Kennel cough, caused by *Bordetella bronchiseptica*, is also frequently seen in neonates. Puppy pyoderma, usually caused by *Staphylococcus*, is a common skin affliction in pups.

Vomiting and diarrhea is often seen in pups aged three to five weeks. Usual etiologies in the pup are parasites (roundworms and hookworms), *Coccidia*, *Campylobacter*, *Clostridia*, *Salmonella*, distemper, metabolic disease (i.e., liver shunt) and dietary indiscretion.

Genetic diseases cause a variety of syndromes in pups, such as cystinuria in the Newfoundland, copper toxicosis in the Bedlington terrier and phosphofructokinase deficiency in the English springer spaniel. Sensitive metabolic screens and genetic tests for the identification of affected and carrier animals have been developed at the School. J.C.

January 27, 2000
31st Canine Symposium
VHUP, Philadelphia

March 24, 2001
24th Feline Symposium
VHUP, Philadelphia

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If you have any questions regarding the Conference, please call the Office of Continuing Education at (215) 898-1882 or e-mail us at: penn-conference@vet.upenn.edu