WINN FELINE FOUNDATION
For the Health and Well-being of All Cats

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Feline Blood Types (Transfusions and Neonatal Isoerythrolysis)

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Similarly to humans, cats have one major blood group system with three blood types: type A, type B, and type AB. While these sound similar to human blood types, it is important to remember that the naming is coincidental and there is no relationship between human and cat blood groups. These blood types represent different proteins that are present on red blood cell surfaces. These blood types have significance in feline breeding and blood transfusions. Confusingly, type AB simply represents a universal recipient and is not a combination of types A and B. Cats do not have a "null" blood group (equivalent to humane type "O").

Blood type is determined by which blood type gene a cat carries on each copy of its chromosome. The *A*-allele is dominant over the *b*-allele so that cats with *A/A* and *A/b* combinations are type A, while cats with *bb* are type B. A third allele, *Ab* is very rare and is considered to be recessive to the *A*-allele and dominant to the *b*-allele, yet the exact inheritance is controversial. Type A is the most common feline blood type, present in up to 94%-99% of all domestic shorthair and longhair cats in the United States. Type B makes up most of the remainder, with AB cats being very uncommon.

Siamese cats and related "Oriental" breeds have thus far all been shown to have type A blood. The American Shorthair breed, due to its close relationship to non- pedigreed shorthair cats, is also largely blood type A. However, some other breeds may have astoundingly high numbers of type B cats. The distribution of blood types varies by geographic region and breed.

The frequency of the feline blood groups in non-purebred cats varies both by breed and by location. In North America, the lowest frequency of type B cats is in the Northeast and North Central/Rocky Mountain regions. Higher frequencies of type B cats are found on the West Coast, peaking in the Northwest with 6% type B cats. Frequencies also vary worldwide, with portions of England and Australia having up to 35% type B cats.

Besides the A/B system, cats also have a minor blood system called "*Mik*". This system has not been fully described, and while *Mik* incompatibilities can likely lead to severe transfusion reactions, these do not seem as common as A/B incompatibilities. It is likely that most cats are *Mik* negative.

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Frequency of Blood Types in Pedigreed Cats

(From surveys conducted by the University of Pennsylvania)

Breed	% Type A	% Type B	Any AB?
Abyssinian	86	14	No
American Shorthair	100	0	No
Birman (U.S.)	82	18	No
British Shorthair	41	59	Yes
Burmese	100	0	No
Cornish Rex	67	33	No
Devon Rex (U.S.)	51	49	No
Exotic Shorthair	73	27	No
Himalayan	80	20	No
Japanese Bobtail	84	16	No
Maine Coon	96	4	No
Norwegian Forest Cat	93	7	No
Oriental Shorthair	100	0	No
Persian	86	14	No
Ragdoll (Italy)	72	8	Yes (20%)
Russian Blue	100	0	No
Scottish Fold	85	15	Yes
Siamese	100	0	No
Somali	78	2	Yes
Sphynx	83	17	Yes
Tonkinese	100	0	No

Blood types are significant in medicine for several reasons. Transfusion of blood (or blood products) is employed in cats with severe anemia, low protein levels, low blood pressure, sepsis, or many other causes. This may entail administration of whole blood, packed red cells, plasma, platelet-rich plasma, or several other products. Blood typing of both donor and recipient cats is essential to minimize the risk of transfusion reactions. In many situations a “cross-match” is necessary beyond blood typing to ensure full compatibility between cats. Transfusion reactions may range from minor fevers through vomiting, diarrhea, and mild respiratory distress, to full anaphylaxis and death.

Cats having transfusions should receive blood from a cat of the same type whenever possible. Type A cats are often able to receive a B type product once with minimal risk of reactions; however red cells will not survive very long. After the first transfusion, antibodies against type A blood will form and future

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transfusions will likely result in severe reactions. Type B cats can only receive type B blood, as they have naturally occurring antibodies against type A. Even a small volume of type A blood administered to a type B cat can lead to potentially life-threatening hemolysis within minutes of the transfusion. Type AB cats are universal recipients who may receive blood from either type A or B cats.

Recent data suggests that cats may be able to receive a single transfusion of canine blood in emergency situations, however transfused canine red blood cells have a very short life span and the risks of reactions means that this should be reserved as an absolute last resort.

Neonatal isoerythrolysis (NI) is an immune mediated and genetic problem seen in cats and humans, but not dogs. It may be responsible for a large proportion of so-called "fading kittens" and neonatal deaths in some pedigreed catteries, where the blood type of breeding cats is unknown. NI occurs in type A kittens born to a type B queen. This occurs when the tom is type A. If the tomcat is "homozygous" (genetically A/A), then all the kittens in the litter will be blood type A and at risk for NI. If the male cat is heterozygous (A/B), then 50% of the offspring would be expected to be heterozygotes with blood type A (genotype A/B) and at risk for NI. This problem can also occur in type AB kittens born to type B queens. NI does not occur in type B kittens born to type A queens, unless the queen has previously received a type B transfusion.

When kittens nurse from the queen after birth, they receive colostrum that contains antibodies to protect them against common viral infectious diseases, but also antibodies against blood types. The kitten's digestive tract is able to absorb these antibodies, which pass into their bloodstream, for about the first 12-24 hours of life. After that time, "gut closure" occurs in the neonate and prevents absorption of further antibodies. When type A or AB kittens nurse on a type B queen during the first day of life, they receive anti-A antibodies in the colostrum, which in turn enter the blood stream and bind to their red blood cells and destroy them (this is known as isoerythrolysis).

Urine from a normal kitten (left) and a kitten with NI (right)

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Clinical signs of NI are variable due to multiple factors, including the amount of antibody ingested. Typically, kittens are born healthy and nurse well. Clinical signs may appear rapidly, with some kittens dying within hours. Other kittens will stop nursing within the first three days of life with signs including failure to thrive, red-brown urine, jaundice, and anemia. As they deteriorate, lethargy, weakness, rapid breathing, very slow or rapid heart rates, collapse, and eventually death may occur. Some kittens appear to have subclinical disease with no obvious signs other than mild anemia. Surviving kittens may develop damage to the skin of the tail tip up to two weeks later.

Kittens with signs of NI should immediately be removed from the queen to prevent further absorption of antibodies. Removal only needs to occur for the first 24h of life, when gut closure occurs. The kittens should be foster-nursed by a queen with type A blood if available, or hand-fed a kitten milk replacer. Kittens removed before colostrum is absorbed may receive injections of plasma from a healthy type A cat in order to provide innate immunity. Kittens with severe anemia may require a transfusion, however kittens with severe disease are rarely treated successfully.

Since the mortality rate with NI is high, the condition should be avoided by blood typing of breeding pairs in high risk breeds. In breeds with low type B frequencies and catteries with mostly type A cats, type B animals should not be used for breeding in order to minimize future problems with NI. Many breeders are now recording each cat's blood type on pedigree charts to facilitate breeding decisions. Blood typing can be done in a referral laboratory or by using in-clinic blood typing cards. As type AB results are very rare, they may be due to autoagglutination or other technical difficulties and should be confirmed in a reference laboratory by a tube assay. Most major veterinary laboratories offer feline blood typing, often through university labs.

If breeding a type B queen with a type A tom must be done, the breeder should endeavor to be present at the birth of the kittens to prevent nursing from the queen. A second queen with type A blood should be bred a little earlier, so that the litters from the 2 queens can be exchanged after birth. The second queen's litter should be over 24 hours old in order to exchange litters. The other option is to hand feed the kittens with a commercial milk replacer. In either case, the kittens can be returned to their own mother in 18-24 hours. Methods to prevent kittens from nursing while remaining in their mother's care are often unsuccessful.

In 2006, the genes responsible for Type A and Type B were identified in the cat. A genetic test is now available for these blood types from the Veterinary Genetics Laboratory, University of California, Davis (http://www.vgl.ucdavis.edu/).

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For more information:

Veterinary Genetics Laboratory
http://www.vgl.ucdavis.edu/service/cat/bloodgroup.html

Feline Advisory Bureau
http://www.fabcats.org/blood_groups.html

International Cat Care
http://icatcare.org/advice/cat-health/feline-blood-groups-and-blood-incompatibility

References

1. Cattin RP. Distribution of blood types in a sample of 245 New Zealand non-purebred cats. N Z Vet J. 2015 Nov 15;PubMed PMID: 26539731.
2. Balakrishnan A, Drobatz KJ, Reineke EL. Development of anemia, phlebotomy practices, and blood transfusion requirements in 45 critically ill cats (2009-2011). J Vet Emerg Crit Care (San Antonio). 2015 Aug 11;PubMed PMID: 26264778.
3. Pennisi MG, Hartmann K, Addie DD, Lutz H, Gruffydd-Jones T, et al. Blood transfusion in cats: ABCD guidelines for minimising risks of infectious iatrogenic complications. J Feline Med Surg. 2015 Jul;17(7):588-93. PubMed PMID: 26101310.
4. Proverbio D, Spada E, Perego R, Della Pepa A, Bagnagatti De Giorgi G, et al. Assessment of blood types of Ragdoll cats for transfusion purposes. Vet Clin Pathol. 2013 Jun;42(2):157-62. PubMed PMID: 23654225.
5. Silvestre-Ferreira AC, Pastor J. Feline neonatal isoerythrolysis and the importance of feline blood types. Vet Med Int. 2010;2010:753726. PubMed PMID: 20631821; PubMed Central PMCID: PMC2899707.
6. Javinsky E. Hematology and Immune-Related Disorders. In S. Little, *The Cat, Feline Medicine and Management.* St. Louis:Saunders. (2011): 643-703.