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*Jenny qualified from R(D)SVS in 1998. She worked in mixed practice for four years before moving into the field of small animal emergency and critical care with Vets Now, where she worked for 12 years. Through Vets Now, she ran the practical trial researching canine blood banking in 2005-2006.*

*Jenny has been the veterinary supervisor for Pet Blood Bank UK (PBB) since its launch in 2007.*

*Her role includes advising practitioners on the appropriate use of blood products, overseeing the practical and VMD legislative veterinary aspects of blood collection at PBB and leading research on future development opportunities. Alongside this role she works part time in general practice.*


**Suggested Personal & Professional Development (PPD)*

BLOOD

# Transfusion medicine today

**More and more veterinary professionals are making the shift from whole blood to safe and selective blood products as they recognise the advancements in veterinary transfusion medicine. Pet Blood Bank UK supports this 'sea change' with a reported average increase of 25 per cent in demand for blood and ancillary products year on year.**

Pet Blood Bank UK (PBB) was established in 2007 to provide a canine blood bank service for all veterinary practitioners across the UK. It was the brainchild of Vets Now colleagues, Wendy Barnett DipAVN(Surgical) RVN and Jenny Walton BVM&S MRCVS who, working in emergency and critical care, were constantly reminded of the need for quick and convenient access to blood.

The catalyst for their research into pet blood banking was the UK legislation change in 2005 that allowed the application for a licence to collect, process, store and supply blood within the veterinary profession. With the help of Vets Now, Wendy sought both practical and feasibility advice from the National Blood Service, visited in-house programmes in the UK, as well as visiting many animal blood banks in the United States. Then 2006 saw Jenny piloting the initiative in the north east of England in preparation for the launch of PBB the following year.

After almost 30 years, canine – and indeed feline – blood banking is now well established in the US with over 20 regional and national animal blood banks; one of which is reporting that it distributes over 35,000 canine units every year.

Pet blood banking in the UK is still in its infancy, yet growing at an exponential rate. Last year, PBB supplied over 3,000 units of blood products to the profession, indicating that an increasing number of veterinary professionals are recognising the benefits of quick and convenient access to blood.

***Figure 1.*** *Blood donor 'Tarka'.*


## Blood types

Blood type plays an important role in pet blood banking and transfusion medicine because the use of type-specific blood is recommended to reduce the risk of transfusion reactions, as well as ensuring the demand for certain types of blood is always met.

The different canine blood types are described as dog erythrocyte antigens (DEA). There are eight DEA antigen systems 1.1, 3, 4, 5, 6, 7, 8 and Dal with potentially more to be defined as research continues. The DEA 1.1 antigen has the most transfusion significance in terms of acute immunologic transfusion reactions and this is the only canine blood type that has a commercial test kit widely available for use in practice.

Dogs are either described as DEA 1.1 positive – meaning the 1.1 antigen is present – or DEA 1.1 negative – meaning the 1.1 antigen is absent. It is important to note that a universal canine blood type does not exist and that DEA 1.1 negative dogs have been incorrectly termed universal in the past.

Research findings from PBB's own data report that 70 per cent of dogs are DEA 1.1 positive – compounding the need to 'blood type' recipients to ensure that DEA 1.1 negative blood is preserved and only used when necessary. As awareness has grown, so

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has the split in supply of DEA 1.1 positive versus DEA 1.1 negative packed red blood cells (PRBC). Last year, PBB reported an encouraging 14 per cent increase in positive PRBC orders last year, indicating the veterinary profession is helping to protect the minority DEA 1.1 negative blood supplies.

PBB also reports an increased demand in fresh frozen plasma (FFP) with more and more veterinary practices storing this useful product. FFP has a shelf life of one year from the date it was collected when stored at -20°C or below; and when it has expired, it can be re-labelled as frozen plasma (FP) with a further shelf life of four years.

Having this product available can, in severe haemostatic disorders, make the difference between life and death and its long shelf-life makes it suitable for all veterinary practices to store for such emergencies.

Under licence from the Veterinary Medicines Directorate (VMD), PBB collects blood from canine donors who meet a set of criteria and are registered on the donor programme by their owners, classifying it as a volunteer programme (**Figure 1**).

PBB is working to provide a substantial and sustainable blood supply for the UK's canine population. With almost 10 years of knowledge and expertise, it continuously aims to bring advancements in pet blood banking and transfusion medicine by running long-term veterinary education programmes. With the help of nearly 5,600 registered canine donors nationwide, it holds over 200 collection sessions a year; and with increased recognition from dog owners, the veterinary profession and the media, it is able to invest in ongoing research initiatives.

The following overview covers in brief the PBB collection process, storage and administration of canine blood.

## Collection

The selection of suitable canine blood donors is critical to a successful donation programme. Dogs should:

- Be over 25kg body weight
- Be between one and eight years old
- Have a friendly disposition
- Have no prior medical conditions
- Not be on any medications apart from routine worm and flea treatments
- Be up to date with their vaccinations
- Have never travelled outside the UK
- Never have received a previous transfusion themselves

The donation procedure is similar to that of the human blood service, with donors giving 450ml of blood every 12-16 weeks. All donor dogs have a full history taken and undergo a thorough clinical examination. Blood screens are performed which include blood typing (on first donation only), complete blood count, platelet count and full chemistry profile (first donation and annually) and packed cell volume/total solids (PCV/TS) is performed at every donation.

Blood samples are taken from the cephalic vein or opposite jugular vein to the site of donation.

Collections take place in a quiet room with donors lying on a full-sized, raised table for gravity flow blood collection. A lateral recumbency position is preferred for both donor and assistant's comfort, which in turn increases the likelihood of a successful donation (**Figure 2**).

A collection system with a 450ml collection bag primed with 63ml of citrate phosphate dextrose (CPD) anticoagulant is used routinely. Scales are tared with the collection bag placed on them or their weight is added to the final draw volume. Both methods ensure the correct volume to be collected is known before the needle is placed. Collection volume for a 450ml unit of whole blood weighs 477g (1ml = 1.06g weight) and can be +/- 10 per cent of this weight to be useable.

***Figure 2.*** *Lateral recumbency is the most comfortable position for donor and operator alike.*

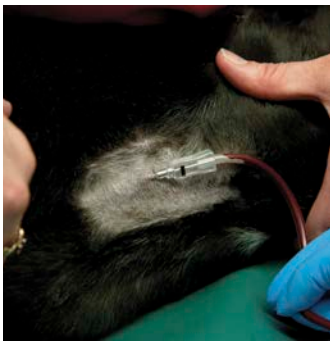

***Figure 3.*** *A correctly placed needle in the jugular vein of a donor.*

It is mandatory if blood is to be stored that a closed collection system is used. This is achieved by ensuring the collection line is clamped prior to uncapping the phlebotomy needle.

Prior to venepuncture the phlebotomy area is cleaned and the jugular vein raised, the needle is placed caudally, bevel up into the vein and advanced to the hub so that as much of the needle lies within the lumen of the vein as possible (**Figure 3**). The collection tubing is unclamped, and the desired amount of blood collected with careful agitation of the collection bag every 50ml to ensure a good mix with the anticoagulant.

When the desired amount has been collected, pressure on the vein is released and the collection line re-clamped. The needle is then removed and sheathed to prevent injury. Firm digital pressure is applied over the phlebotomy site for one to two minutes prior to a bandage being placed and left in situ for a further 30-60 minutes.

Donors are checked for normal mucous membrane colour, heart rate, demeanour, and rewarded with treats, food, and attention (**Figure 4**). Collected blood units are labelled to allow identification and placed in boxes ready for transportation to the processing centre. Normal activity is resumed for all donors after blood donation.

## Processing

The collected blood units are centrifuged at 3,800 rpm for 15 minutes to separate the plasma and erythrocytes. A manual plasma separator is used to remove the plasma into the attached satellite bags within the collection system, thus making two separate products of packed red blood cells and fresh plasma (**Figure 5**). Further processing and division can be performed to allow one donation potentially to aid in the treatment of up to four recipients.

Three aliquots (samples) of each product produced are retained at this stage for cross-matching and quality control purposes.

## Storage

Plasma that is separated and frozen at a temperature of -20°C or below within 24 hours of collection maintains all its coagulation properties and is called fresh frozen plasma (FFP) with a shelf life of 12 months.


***Figure 4.*** *Checking the heart rate of a donor.*

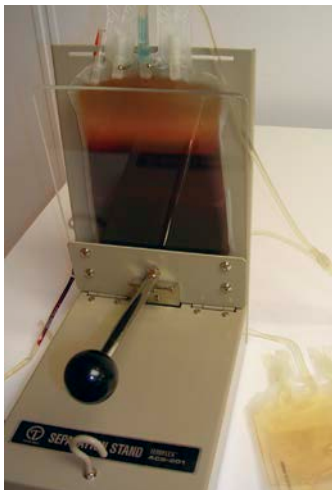

***Figure 5.*** *Plasma separation in progress.*

Plasma frozen after 24 hours is described as frozen plasma (FP) owing to a reduction in coagulation properties. It has a shelf life of five years. Packed red blood cells can be stored at 4°C +/- 2°C for up to 42 days because of the addition of a nutrient solution (SAGM) within the collection system that helps preserve the red blood cell life.

## Administration of blood products

Blood products have a limited life span and must be prepared carefully for use. Once breached, they must be fully used within four hours and any remaining product after this time discarded. Prior to transfusion the warming of blood products to at least room temperature is recommended, although they should never be warmed to more than 37°C.

Warming can be achieved by placing the blood product in a waterproof zip-lock bag and placing this in a temperature-monitored water bath. Gentle and slow warming of products is sensible if time allows.

Blood products should be given intravenously and can be given via both a peripheral or central (jugular) line. In very moribund patients, if intravenous access is not possible, the intraosseous route can also be utilised as an effective and rapid method of administration.

All blood products must be administered via a filtered giving set to reduce the risk of micro-thrombi and given to a calculated dose to prevent hypervolaemia in small or compromised patients. Patients be monitored closely before, during and after transfusion, and regular diagnostic tests carried out to assess the response to transfusion.

Transfusions must not be administered through the same intravenous line that has any solutions containing calcium or glucose. Normal 0.9% saline can be used to flush giving sets and bags of remaining PRBC or to administer concurrent crystalloid requirement.

Plasma transfusions can be administered via an infusion pump or syringe driver, but it is advisable to check with the manufacturer for accuracy of the equipment and giving sets beforehand. Following recent studies, it is recommended that PRBCs are transfused by gravity alone.

## Dose rates and volumes

Transfusions in essence have no 'dose rate'. Blood products should be administered and the recipient monitored until the desired clinical effect is achieved.

When considering volume requirements to prepare for a transfusion these general guidelines to initial transfusion dose rates can be considered:

- A rate of 1ml of PRBC/kg recipient body weight would be expected to raise the recipient PCV by 1%
- In an anaemic but normovolaemic dog, a general dose rate of 10ml of PRBC/kg can be utilised as a starting dose rate and then adjusted according to the required response
- Plasma doses vary according to the condition being treated. The most common use is to treat haemostatic disorders. Recent human literature suggests a dose of at least 20ml/kg of plasma is likely to be required in a symptomatically bleeding patient
- Initial rates of transfusion should be slow for the first 30 minutes of a transfusion. A suggested dose of 1ml/kg of product should be administered. After that 30-minute period, if no acute adverse reactions have been noted, the rest of the breached product transfusion volume should be administered within a four-hour time scale

In a normovolaemic animal, a maximum transfusion rate of 20ml/kg/hr is suggested.

## Monitoring

Parameters routinely monitored are demeanour, mucous membrane colour, heart rate and rhythm, temperature and respiratory rate. If after 30 minutes no concerns have arisen and continuous monitoring is not possible, regular checks of 15-30 minutes are appropriate. ■

# PPD Questions

1. What two routes of administration can be used for blood products?
2. How old should an ideal canine blood donor be?
3. How many millilitres of whole blood do we collect in 'one unit' and how many grams does that weigh?
4. What is the shelf life of fresh frozen plasma (FFP)?
5. What temperature should plasma products be stored at?

Answers
1. IV/IO 2. 1-8 years old 3. 450ml and 477g 4. One year 5. -20°C or below

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