HAND REARING ECHIDNAS by Lynda Staker

SHORT-BEAKED ECHIDNA: *Tachyglossus aculeatus* (*Tachyglossus* means 'fast tongue')

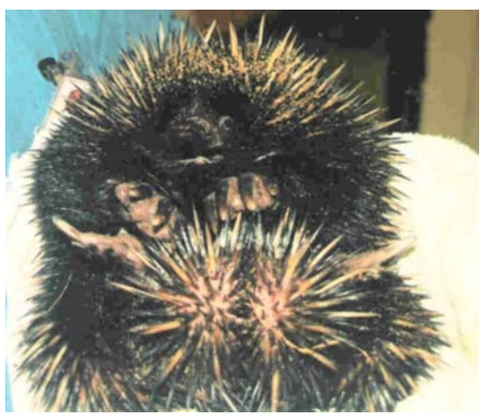
Echidnas are monotremes (mammals that lay eggs) and are often called as ‘spiny anteaters’.
Only three species of monotreme exist in the world, those being the platypus and two species of echidna, one of which is restricted to the New Guinea highlands.

DISTRIBUTION:
Most of temperate Australia is home to the short beaked echidna. They are commonly sighted alongside highways/roads with their characteristic gait, rolling from side to side as they walk. Whether the environment is dry open country or forested, echidnas exist quite well.

DESCRIPTION:
Echidnas can be between 30 cm to 45 cm in length and weigh between 2 kg and 5 kg.
Due to the colder climate, Tasmanian animals are larger than their mainland counterparts and their fur between the spines can be so thick it obscures the presence of the spines. The cream coloured spines can reach a length of 50 cm and are made of keratin (modified hair). These spines cover the body except the underside, face and legs, which are covered in fur. Fur growing between the spines can range in colour from a tan, a reddish brown, or black.
Their short limbs and powerful claws are designed for digging and breaking into termite mounds. The claws on the hind feet are elongated and curve backwards to enable cleaning and grooming between the spines. A sticky 18 cm long tongue draws the termites into the mouth, where they are ground up against the palate and a horny pad at the base of the tongue. Echidnas don’t have teeth.

Like their relative the platypus, male echidnas have a spur on each hind foot, however unlike the platypus, the spur is blunt and the venom gland is not functional. The male also has a slight fold of skin on its abdomen, much the same as the female, except that this fold on the male is muscle, whereas the fold on the female’s abdomen will eventually hold the egg. This area also has the milk producing glands of the female, which swell just prior to the egg hatching.

BEHAVIOUR:
Being a shy animal, the echidna can be approached by doing so quietly. If threatened on hard surfaces, it will roll into a ball with the spines acting as an impenetrable protective barrier **right.**
In cold climates, echidnas have been known to hibernate for up to 6 months. In arid zones, the echidna seeks shelter during the heat of the day and forages in the cool of the night. In temperate areas, it can be seen foraging during the day. In the hotter parts of Australia, the echidna is almost nocturnal, venturing out once the temperature has cooled in the early evening and returning to a cool place to rest before the heat of the day. They shelter in hollowed logs, burrows or under thick bushes. In the cooler climates, particularly during winter, activity and foraging occurs in the daytime. In defence mode, they can wedge themselves tightly into crevices or logs by extending their spines and limbs, or quickly dig themselves into the soil leaving only their spines exposed.



They have a real personality and when hand reared, show a desire to be around you and will follow you as long as you walk slowly!

DIET:
Echidnas receive nutrients and fluids predominantly from ants (64% water) and termites (80% water), but will also eat worms, beetles, larvae, and cockroaches. Their strong forepaws are used to penetrate the ant or termite nest and they use their long sticky tongue to catch the invertebrates. Their sensitive snouts contain electrodes, which are suspected to help them detect invertebrates in moist soil. Food is crushed between horny plates located in the roof of the mouth and the back of the tongue.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BREEDING:

Echidnas mate between the end of June to early September.
Being solitary, echidnas only come together for mating, when an 'echidna train' will incorporate one female and several males following closely behind. The courtship period may last for up to 6 weeks and then the female mates only once with one male.
Between two to three weeks after mating, a single rubbery-skinned egg is laid directly into the folds of skin which form a backward facing pouch. This 'pouch' develops three days before the laying of the egg.
After 10 days, the egg hatches with the young using an 'egg tooth,' which is later discarded, to break the shell. The newborn echidna is blind, without spines and remains in the pouch. The term 'puggle' is used for an echidna young. (This term is believed to have been derived by Helen George, a pioneer in the care of orphaned Australian wildlife).
The mother does not have teats, instead the thick milk is secreted from patches of skin within the pouch and the puggle slurps the milk from the mother's skin. While the puggle is unspined, the mother continues to use the burrow as a safe haven except for her foraging time. When the puggle begins to develop spines, at about 50 days of age, it is ejected from the pouch and is left in the safety of the burrow. Once the puggle has been ejected from the pouch, the mother's pouch retracts and the area where the milk is exuded is accessed by the puggle, as it lies on its back and the mother stands above it.

WEANING OF THE PUGGLE:

Once the puggle is spined, the mother's milk changes to an extremely high fat, rich formula that can sustain the puggle for up to 10 days whilst the mother forages.
The puggle grows rapidly and gradually decreases its need for milk until it weans at between 6-8 months of age.
The young echidna's spines are well developed by the time it leaves the burrow and accompanies its mother.

INTERESTING FACTS:

- Mother echidnas are able to place their young back in the pouch if the puggle is displaced.
- They have a lower body temperature than other mammals, 31-32° C (87.8 - 89.6 F)
- Echidnas are solitary most of the year (except when a young accompanies the mother). They do not fight or defend a territory. When an echidna encounters another echidna or other animal, it basically just ignores it.
- Wild echidnas have been found with what is said to be the world's largest flea -(*Bradiopsylla echidnae)*, which is about 4 mm long.
- An echidna at the Philadelphia Zoo lived for 49 years in captivity. It was an adult when brought to the zoo.
- Echidnas are hosts for ticks.
- Adult echidnas have a good 'homing' and orientation sense. The juvenile echidna makes exploratory trips away from the burrow before establishing its own home ranges. There are reports of hand reared echidnas returning to their surrogate 'home' after being taken to another area and released. There is documented evidence of an echidna travelling over 35 km back to its home range. An echidna's home range may be as large as 100 hectares.
- Echidnas are good swimmers, paddling with only the snout and a few spines above the water. They have been seen crossing wide beaches to swim and groom themselves in the sea.
- If an echidna is seen in a back yard in the country or in town, it knows where it is. Left alone and free of threats, such as dogs and cats, an echidna will move on when it is ready.
- Very young unspined puggles have a 'fresh' odour like tee-tree or eucalyptus aroma. They lose this odour once fully spined. They may make peculiar little grunt-like sounds when hungry whilst slurping. It is rare to hear their vocals, which is a squeak type of sound.
- An echidna's sex cannot be determined without a probe, which is inserted into the vent to determine gender. Male testes are located internally.
- They can go without eating for many days, as 40% of their body weight is fat. In cold climates echidnas have been known to hibernate for up to 6 months, and the fur situated between the spines can actually cover the spines.

RESCUE:

The only time an adult Echidna should be moved is when either its life is in danger or it is seriously injured. If an Echidna is to be moved out of harms way, release it in the immediate vicinity, as being territorial it should not be taken out of its familiar environment.

CONSIDERATIONS:

- Moving a female echidna between August and February may endanger the life of a baby echidna, because a mother leaves the puggle in a burrow for up to 10 days between feeding. If an echidna has to be treated during these months, try to have it back to where it was found within five days.
- If a damaged beak is repaired, the animal should be observed to ensure it can find food prior to it being released back to the wild. The echidna's strong forelimbs are also a crucial factor to survival as they are required to dig into hard clay such as termite mounds and rotting logs to obtain their food source.

RESCUE TECHNIQUES:

An echidna will try to dig-in when threatened. If the echidna is obviously in need of rescue, (if injured) dig in front of the animal with bare hands until the shoulders can be seen, then push your hands under the animal's arms or around the top of the front legs where there is fur (not spines). Before attempting to pick an echidna up, place your hand under the animal and feel around the abdominal area. If there is obviously a baby or bulge in that region, the animal SHOULD NOT be picked up. Instead it should be gently pushed into a container, so the mother does not release a baby (puggle) or egg. If the echidna does not have an obvious bulge, then it can be safely picked up without harm.
Support the animal under the belly and it will most often wrap itself into a ball around your hand. If this is not possible and a shovel has to be used, ensure you dig at least 250mm (10 inches) away from the animal's beak, then use hands to dig closer. If the echidna is on a hard surface and rolls into a ball simply roll it onto a mat or similar, or envelop it with a towel prior to picking it up.

It is not wise to pick up an echidna by the hind legs, their short legs are not designed to support their body weight (upside down) for a long length of time, and to do so may cause injury to the legs. Also, if the echidna is a female and has a baby in the folds of her stomach, the puggle will fall out. Only pick up echidnas when absolutely necessary and then slide something under the animal, or place your hand completely under the stomach to protect a baby if one exists.
The item used to contain the animal must be escape proof as these animals can dig through a cardboard box and climb a 1.8 m (6 ft) chain mesh fence. A canvas bag or cat cage will suffice for transporting. Transport an echidna in an air-conditioned car in summer as they must not be over-heated. If the echidna has been found in the heat of the day, cover it with wet towels or hose down with cool water to bring its temperature down. Echidnas should be kept at 25° C (77° F).

PUGGLES:

Puggles may be found when machinery has inadvertently unearthed the burrow, rescued when the mother has been hit by a vehicle, or brought in by a family's pet dog. They can be unspined with their eyes closed or just beginning to spine and at this stage of maturity may require warmth if found in the colder climates, such as Tasmania.

If found in the colder regions, puggles will require artificial heating to keep their body temperature at the correct level. Normally when unspined, the puggle would be kept warm by the mother, whilst in the skin folds. For an unspined puggle, warmth can be attained by using a hot water bottle, filled with luke warm water from the tap (NOT BOILING). Wrap the bottle with a large towel so that it envelops the water bottle multiple times.

If the puggle is at the growth stage of being left in the nest, it will require only initial insulation by placing the baby in an insulated vessel during the rescue procedure.

4. REARING UNSPINED ECHIDNAS (PUGGLES)

DEHYDRATION:
If an unspined echidna has been found on the ground, it has been dislodged from the mother's pouch. To determine whether the puggle is dehydrated, check the skin for looseness and dryness. Rehydrators may be used to rehydrate orally such as Vytrate, Lectade or any electrolyte replacer. Most often the puggle will slurp the electrolyte replacer from the palm of the hand.
The puggle should be warmed prior to rehydrating with oral fluids, however sub-cutaneous injection of warmed Hartman's (Compound Sodium Lactate) can be used on a cold echidna, at a ratio of approximately 5% of the animal's bodyweight. The volume of fluid can be halved into two subcutaneous injections administered under the skin over the rib cage.

A puggle approximately 50 days old and 165 grams

TEMPERATURE:
Considering that the puggle would be receiving the warmth generated from the mother's body, unspined puggles need to be secure in an insulated pouch whilst still dependent upon this body heat. The mother echidna's body heat inside the skin folds can be between 20° and 33° C, so taking this into account, it is fairly safe to assume that an unspined puggle could be kept comfortable at around the 25° C mark.

Puggle at 56 days.

TROPICAL AMBIENT TEMPERATURES:
In the tropics where the ambient temperature may be between 30-40° C, spineless puggles have been successfully reared in artificial burrows under the soil. Even though this is not how the puggle would be housed when with its mother, the aim is to ensure the animal does not get too hot, but at the same time feels secure.
The mother naturally keeps the puggle's temperature low by staying underground in the cool earth during the hot daylight hours until the temperature drops at night.

SOUTHERN COLDER CLIMATES:
In climates such as the southern regions of Australia including Tasmania, the temperature may be as low as minus -2° C and in this circumstance it may be necessary to actually have a warmed environment. In these situations, a well covered hot water bottle filled with luke warm water may be necessary to ensure the temperature is at the desired 20-25° C. Alternatively, a light bulb pointing towards the opening of a make-shift burrow may also be enough to generate some warmth.

Mother Echidnas use the underground burrow to keep warm in cold climates and cool in hot climates, as the earth underground buffers external temperature fluctuations.

FORMULA:
Echidna milk is so very unique that it resembles no other placental or marsupial milk, due to the fact that besides being almost void of lactose (as in macropod milk), it has completely different sugars namely fucosyllactate and syalyllactose. Their milk is also very high in iron.
With the requirement of such a rich formula it is imperative that the closest formula to mother's milk is used to rear an echidna. The <30 Wombaroo Milk Replacer is the preferred formula which is specifically designed for spineless puggles.

A universal formula could very well cause the death of this unique animal as the contents could not possibly emulate the necessary nutrient requirements.

ECHIDNA MILK REPLACERS [22, 38]
APPROXIMATE COMPOSITION PER LITRE OF PREPARED MILK

Lactation stage Milk Stage	Units	Early <30 days	Mid to late >30 days
Milk Powder Solids	g	210	360
Protein	g	70	115
Fat	g	80	160
Carbohydrate	g	55	40
ME	MJ	4.9	8.6
Tocopherol (Vit E)	mg	28	50
Retinol (Vit A)	mg	2.4	4.3
Cholecalciferol (Vit D_3)	µg	25	45
Phytomenadione (Vit K_1)	mg	1.9	3.4
Choline	mg	100	190
Inasitol	mg	75	145
Ascorbic Acid (Vit C)	mg	65	115
Nicotinic Acid (Vit B_3)	mg	50	90
Pantothenic Acid (Vit B_5)	mg	16	30
Thiamine (Vit B_1)	mg	6	10
Pyridoxine (Vit B_6)	mg	4.3	7.7
Ribolflavin (Vit B_2)	mg	2.3	4.2
Folic Acid	mg	1.4	2.4
Biotin (Vit H)	µg	135	240
Cyanocobalamin (Vit B_{12})	µg	40	70
Calcium	g	2.6	4.6
Phosphorus	g	2.0	3.6
Potassium	g	1.6	2.9
Sodium	g	0.5	1.0
Magnesium	mg	190	340
Iron	mg	30	55
Zinc	mg	3.4	6.0
Manganese	mg	2.5	4.6
Copper	mg	2.4	4.4
Iodine	µg	190	340
Selenium	µg	30	60

AGE ESTIMATION [19, 20, 21,]
Age based on body length becomes inaccurate when applied to more advanced juveniles. Echidna young leave the pouch at similar ages but at vastly different sizes. It is also difficult to accurately measure body length in older juveniles. Age estimation based on body weight is inaccurate after day 50.

WEIGH-IN:
Weigh the puggle on a set of digital scales prior to feeding to determine how much formula to feed.

HOW MUCH TO FEED?
Between 15-20% of a puggle's bodyweight will be required in formula at each feed time.
For example-a 100 g puggle will require 20 ml. (100 X 0•2 ie 20%)
We work on 15-20% of the bodyweight to ensure that the weight at the next feed time is not less than the weight recorded before the current feed time.
#See graph on page 8.

HOW OFTEN TO FEED?
If an unspined, eyes closed puggle drinks really well from the hand and consumes 15-20% of its bodyweight, it can be fed at 48 hourly intervals. However if the same staged puggle does not drink the required quantity and only accepts 10% or less of its body weight from your palm, it may need to be tube fed the remainder of the formula. It is far better to feed at longer intervals than shorter ones because the chance of the echidna not having digested the milk over a shorter period is high and feeding when the previous milk has not been digested can kill a puggle.
By observing the animal you should be able to tell *when* to increase the time between feeds to 3 day intervals, then 4 etc.

ASCERTAINING WHEN DIGESTION IS COMPLETE:
Completed digestion can be ascertained by the absence of the white milk seen in the transparent stomach of these young animals. Digestion may take anywhere from 36 to 48 hours and this observation of complete digestion can be used to determine when the next feed should be offered.

SIGNS OF HUNGER:
Activity by a young puggle can emulate hunger, most especially if the puggle lies on its side or back, as this is a display of readiness to feed under the mother. The puggle may also squeak when hungry, but not all puggles vocalise.

WEIGHING AS A GAUGE:
By weighing the puggle it can be ascertained how much food the animal has digested. The energy used between feeds will be reflected by how much the puggle weighs between feedings. I have found that 1 ml of Wombaroo milk replacer equals 1 gram of body weight. # *See graph on page 8*.

FEEDING:
Prior to feeding, ensure that the puggle is warmed by holding the animal in the hands for 5-10 minutes, to ensure its body temperature is ready for digestion. If the puggle has been active prior to feeding, this is an indication that its body temperature is high enough to digest.

FEEDING TECHNIQUE:
Offer the milk in the palm of your hand, ensuring the milk is only tepid. This can be done by squirting a little at a time from a plastic syringe. If the puggle slurps the formula, continue squirting into your hand until it has had enough.
This could take a while (up to an hour) as they can take up to 4 hours to drink from their mother at one feed time. Echidnas make a kneading and prodding motion with their beaks into the mother's abdomen to persuade her to let down the thick milk, so the palm of your hand will be prodded by the puggle in the same way.
In the event of the echidna not showing an interest in slurping from the hand, check for dehydration. If the puggle is well hydrated, it may require a longer period before becoming hungry, so may need further time in its housing before feeding.
On the other hand, some echidnas will not eat if suffering from a gastrointestinal infection and as this is difficult to clinically diagnose, tube feeding is the only option to ensure that the animal receives nutrients. It is easier to diagnose a problem if the puggle has been feeding from the palm of your hand on a regular basis and then displays listlessness an d an unwillingness to feed. If an infection is suspected, the use of injectable Amoxicillin should be commenced. These may be the only signs to indicate a puggle is unwell. *# See page 11 for dose rate.*

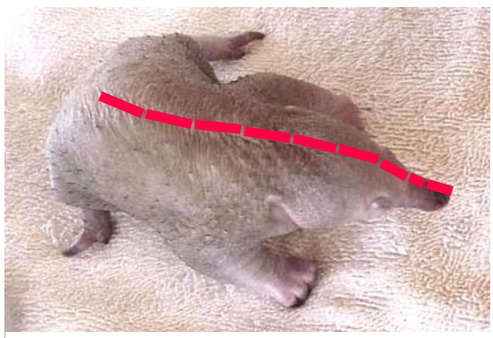
NOTE: It is a normal activity for the puggle to bubble the milk from its nostrils whilst feeding.

TUBE FEEDING PROCEDURE:
You will need a 50-60 ml plastic syringe, a 5 or 8 gauge sterile gastric feeding tube (depending upon the size of the puggle), KY jelly, and a jug of warm water. I use *Argyle* 5 gauge feeding tubes for unspined puggles. To ascertain which sized tube will be required, the tubing should be not too thin as to turn around on itself and not too thick to be able to be inserted into the puggle's mouth.

TUBE FEEDING PROCEDURE:

To establish the length of the tube to be inserted you will need to measure the tube by the following method.

By placing the end of the feeding tube at the front of the puggle's snout, follow the contour of the puggle's skull, up over the head and down the back, until you reach where the last rib extends from the spinal vertebrae. This is an indication of where the stomach is, so mark the spot with a black texta pen, then carry out the procedure once again, just to check that you have not made a mistake with the measurement. Puggles can contract their body to about half their extended length, (they act like a witchetty grub!) so ensure when you are measuring the tube to the contour of the body, that the animal is relaxed. *(This may require patience).*



Measure the tubing from the tip of the snout over the contour of the head and body, to the end of the rib cage.

TUBE FEEDING TECHNIQUE:

1. Draw up the quantity of milk required plus an extra couple of mls into the syringe.
2. Attach the tube to the syringe. Place the syringe and empty tube into the warm water.
3. To check the temperature, pull back and allow air into the syringe and shake. Then push the plunger so that the milk and air comes out of the tube and try the temperature by squirting milk onto your wrist. If the milk is not warm or cold it will be the correct temperature.
4. Now lubricate the tube with the KY jelly to ensure a smooth insertion down the oesophagus. The tube will be filled with milk so as air does not go into the stomach.

5. To open the puggle's mouth, place your thumb and forefinger down each side of the mouth and push them towards each other. Be firm but gentle. Immediately the mouth opens just a little, push the tube down. Initially the insertion will go fairly easily, as the little puggle at this stage is unaware of how to prevent the tube going down. If the insertion stops long before the black texta mark, pull it out a little and push it down again, as it may have gone into the lung. Usually the tube goes down smoothly and easily. There is no chance of the tube ending up in the lung if it goes down to the texta mark.

6. Once at the mark gradually push the plunger. Sometimes it is very hard to push the plunger and it is easier to have someone else doing the pushing, but if on your own, press the plunger against your chest bone, pushing the syringe with your chest. As the milk is so thick, the tube nozzle which is attached to the syringe will need to be held securely onto the syringe, else it will blow off from the pressure. Your other hand has to keep the tube in the mouth and keep the mouth closed. The little puggle will just sit/stand there without struggling. This procedure is more difficult once the puggle is older, and has the ability to push the tube out with its throat and tongue muscles! The procedure should be a relatively slow process, taking about 10 minutes.
7. **Take care to keep the bottom of the syringe where the tube connects BELOW the top of the syringe where the plunger is, to ensure that no air goes into the gut.** Angle the syringe to ensure this.
8. Once all of the milk (except the amount in the tube) is gone, pull the tube out and place the tube and the syringe directly into hot water. If you squirt some hot water immediately through the tube it will make it easier to prevent the milk from sticking inside.

Tube feeding is only required when a puggle will not slurp from the hand. When a regular feeding regime is achieved, the puggle should happily slurp from the palm of the hand.

Continue to offer the milk from the palm of your hand at every feed time. If the puggle has displayed signs of hunger prior to feeding, the chance that it will accept the milk from the palm is high, but some puggles do not readily accept this method for some days and in this situation, tube feeding will have to be continued.

CLEANING THE PUGGLE:


Sandi Cleeland

After each feed clean the puggle with a soft cloth and tepid water. Ensure all milk residue is cleaned from around the snout and the rest of the body where milk may accumulate. They often get their little feet in the milk and into crevices between skin folds. After cleaning, an emollient may be applied to help keep the skin from drying. Greenridge Calendula ointment, Ungvita or any other type of emollient used for furless marsupial joeys can be used.

CLEANING UTENSILS:

The feeding tube will be hard to clean unless it is inserted directly into soapy, boiling water immediately after the feeding. Continually flush the tube with hot, soapy water before rinsing through with hot water. Bash the tube against a hard object to clear all water out of it before hanging it to fully dry. The major factor is to keep the feeding utensils DRY because less bacteria will survive in dry conditions. Considering that feeding only takes place every 48 hours or more, a new sterile tube could be used. If this is not possible, the feeding tube may be placed in human infant sterilizer, but soaked in boiling water prior to using so that the sterilizer is not ingested by the tiny animal.

TOILETING:

There is no need to toilet the puggle, it will pass urine or faeces when the urge dictates. Echidnas may urinate or defecate when first picked up or when they are stressed. As a result of such a slow digestive system, an echidna does not defecate or urinate after every meal. In fact the animal may go for days without passing waste.

One young puggle was observed defecating on top of the soil of his burrow then covering the waste with dirt, just like a cat does. Perhaps this is a natural instinct for echidna, and may explain why we don't get to see echidna droppings in the wild. Another puggle would sometimes pass a soft pellet or urinate at feed time.


Puggles will resemble little fat ticks after a feeding.

WEIGH-IN:

Once cleaning has been completed, weigh the puggle to estimate weight gain. If the puggle took 48 ml of milk, it would be expected to weigh approximately 48 gram more than it did before feeding. Record this weight so as an estimation of energy used between feeds can be ascertained.

HOUSING:

This can be attained by placing the puggle in a small liner made of cotton t-shirting material and placing into a container such as an esky or cardboard box. Alternatively and depending upon ambient temperatures, the puggle can also be housed in a make-shift tunnel under soil. A burrow can be made by filling a large, deep, plastic container with soil, then inserting a ceramic pipe on an angle so that the bottom of the pipe is in the deepest section of soil. Dead leaves can be used to fashion a type of 'nest', and the wrapped or unwrapped puggle can be housed in the bottom of the pipe. If the container is deep enough, the soil should keep the environment cool in hotter climates. A thermometer with a probe can be used by inserting the probe in with the puggle to keep a check on the temperature which should not be above 25° C. The housing in soil allows the puggle to get accustomed to the natural bacteria in soil and may enhance an immunity to these bacteria, in readiness for living in amongst the earth.

WHEN TO CHANGE TO THE TRANSITION FORMULAS:

Once the puggle's eyes are both fully opened and it has developed spines all over its body the <30 and the >30 can be mixed together at a ratio of 3/4 of <30 plus 1/4 of >30 for 3 feeds, then 1/2 of <30 plus 1/2 of >30 for 3 feeds, then 1/4 of <30 plus 3/4 of >30 for the last three feeds before proceeding to full strength >30 . Considering the puggle would be fed every fourth day by this stage, this transition should take approximately 48 days.

The >30 formula mirrors the requirements for a spined puggle, with much more fat available, to ensure that the animal builds up condition in readiness for living outside and enduring cold weather.

If an echidna does not receive this high fat nutrition from its diet, it may fail to survive once outside.

8. By viewing the graph below, you can see that the deciding factor of how much to feed is simply by the amount of weight the animal has used in terms of energy between feeds. When the puggle uses less energy between the feed times, this indicates that longer intervals between feeds can be undertaken. If more energy is used than attained from the last feed, the quantity will need to be increased.

AGE IN DAYS	WEIGHT BEFORE FEED IN GRAMS	MLS FED @ approx 20% B/W	WEIGHT AFTER FEED	FOOD CONSUMED BY WEIGHT	WEIGHT GAIN BETWEEN FEEDS	MILK TYPE	COMMENTS OF PROGRESS FOR 'CACTUS'
50 days	**165 gram**	32 ml	**193 gram**	28 gram		<30	One eye has a tiny opening. Spines just coming through. Tube feeding.
52 days	**187 gram**				22 gram		
		36 ml	**217 gram**	30 gram			Cactus very restless, displays hunger. Makes a clicking sound when held prior to feed. Eyes still closed.
54 days	**205 gram**				18 gram		
		40 ml	**245 gram**	40 gram			Still will not slurp Passed urine after feed.
56 days	**218 gram**				13 gram		
		42 ml	**260 gram**	42 gram			Wouldn't slurp.
58 days	**230 gram**				12 gram		
		46 ml	**276 gram**	46 gram			Left eye half open, right eye just a glint. Almost slurped.
60 days	**233 gram**				3 gram		
		48 ml	**281 gram**	48 gram			Both eyes now open. Began to slurp then stopped after only 4 ml. Continued tube feeding.
62 days	**243 gram**				10 gram		
		55 ml	**298 gram**	55 gram			Slurped 10 ml prior to tube feeding.
64 days	**251 gram**				8 gram		
		43 ml	**294 gram**	43 gram			Cactus slurped 43 ml by herself at a rate of 1ml every 15-20 seconds. Did not tube feed.
66 days	**264 gram**				13 gram		
		36 ml x <30 plus 15 ml x >30	**312 gram**	48 ml		3/4 X <30 + 1/4 X >30	Changing to transition milks. Slurped 48 ml. Did not tube feed.

At the age of 74 days, Cactus did not show an interest in slurping after the 2 day interval and so was fed every 3 days. She developed fur on arms, legs and stomach at 91 days, and her back was covered in very short spines. Once she was slurping herself, it was a matter of observing her activity as to when we needed to go longer between feeds. She progressed to feeding every 4 days by the time she reached 100 days.

When the puggle uses less energy between feeds this will indicate that the feed intervals can be stretched to another day between feeds.
The weight before a feed should never be less than the weight at the weigh-in prior to the previous feed.

CASE HISTORY: CACTUS

When Cactus was still unspined I was surprised to smell her very strong aroma...which smelt really fresh, much like tee tree oil or eucalypt leaves. She exuded this smell as she wriggled around impatiently waiting for her milk. She slurped a few ml then had to have a rest, so I would stimulate her and she sometimes passed urine, then I would offer her more milk in the palm of my hand and she would slurp a little more. Initially she never slurped enough, so I would have to tube feed her the remainder of her allotted feed.
When she was hungry she'd turn on her side or back and would be active, whereas when satisfied, she just slept. Her housing was a deep plastic container filled with dirt and dead leaves, and a large PVC sewer pipe with a diameter of about 16 cms (6 1/2 ") down into the soil on the diagonal. The soil around the pipe and inside the pipe was kept damp, to keep the environment cool and to ensure she did not dry out. I had a thermometer probe in the soil and it fluctuated between 23-26° C. Cactus made a little clicking sound when poking her snout into my hand.

REARING JUST SPINED/SPINED ECHIDNAS (PUGGLES)

Once finely spined all over their back, echidnas are fed a high fat milk once every two to ten days, as it takes up to this amount of time for the mother's milk to replenish, and for the baby to digest. The 2 milks are mirrored by Wombaroo Milk Replacer, the <30 for spineless puggles, and the >30 for the spined puggle.

Sandi Cleeland

CONSIDERATIONS:
It is extremely important that carers, use a HIGH FAT formula specifically designed for spined puggles. Carers have lost puggles after 6 months of care, due to the animal contracting pneumonia once housed outside, because it did not carry enough fat on its body. There is double the fat content in the >30 formula, compared to the <30 formula.

HOUSING:
When rearing a puggle, emulating the animal's natural environment is a vital factor. The bacteria contained in soil seems to be of benefit to the puggle, allowing them to develop a natural immunity to the bacteria that would otherwise be dangerous, if not accessible. Therefore, puggles should be housed in dirt, in a log or similar, as close as possible to their natural habitat. A deep container filled with dirt and leaves is a suitable way in which to house young puggles. A log or large circumferenced water pipe (at least 6" or 16 cm across) can be placed into the dirt on an angle so that the deepest part is under the dirt and the opening sits on the top of the dirt. Place dirt and leaves inside the log. The goal is to ensure that the soil is deep enough to act as a buffer to temperature extremes. Alternatively, if living in a tropical environment, a ceramic bath tub can be filled with soil with a log hollow imbedded into the dirt on an angle, the puggle can then choose to either go into the log or burrow into the soil and leaf litter. In colder climates, a similar den can be erected, ensuring that it is housed in an inside room of the house so that the weather extremes outside are not a factor.

TEMPERATURE:
As these little creatures at this stage of their development are now left in a den under the earth, the temperature should be at a constant 23°-25°. A thermometer probe can be placed under the soil so that a quick glance can establish the temperature in the make-shift burrow. Once puggles are left in the burrow, they only have contact with the mother when she returns to feed it, which can be anywhere between 5 to 10 days, therefore these animals are not nurtured as the marsupial joeys are. We should take note of this factor, and only handle the animal at feed time.

FEEDING:
After about three weeks of tube feeding, (7 feeds) the puggle should be willing to 'slurp' or lick up formula from the palm of the hand and once this occurs, it is usually easy sailing thereafter, although it does depend on the individual puggle.
If however, the puggle still will not accept milk from the palm of the hand, tube feeding will have to be continued.

Once the puggle is fully spined it may require a larger tube for feeding as the smaller 5 gauge can turn around on itself if too flexible and small in circumference. Purchase a larger tube, 6 or 7 gauge in readiness to change over.

IF A PUGGLE STOPS SLURPING MILK, CONSIDER THE NEED FOR FLUID AND OFFER WATER IN THE PALM OF YOUR HAND. A JUST-SPINED PUGGLE WILL LAP APPPROX 25% OF ITS BODYWEIGHT IN WATER. ONLY THEN WILL IT RECOMMENCE TAKING FORMULA. WOMBAROO IS FOOD, FLUID NEEDS TO BE OFFERED!

After a couple of months feeding from your hand, you can start offering the formula in a shallow dish, until the puggle will accept this method. Always have a bowl of water available at all times.

ECHIDNA GROWTH ESTIMATES

Milk	Age in days	Body length mm
Transition from <30 to >30	31 to 35	12ml <30 + 3ml >30
	36 to 40	9ml <30 + 6ml >30
	41 to 45	6ml <30 + 9ml >30
	46 to 49	3ml <30 + 12ml >30
Out of pouch	50	170
	60	200
	70	225
	80	255
	90	285
	100	310
	110	340
	120	370
>30	130	395
	140	425
	150	450
	160	480
	170	510
	180	540
	190	570
	200	600
	220	630

Don't be alarmed at the feeding habit of an echidna, when it slurps its milk from a shallow bowl/plate. It is quite normal for an echidna to insert its beak into and under the milk formula, blowing bubbles from its nostrils to rid the milk, as it slurps the milk with its long tongue.

Of the several puggles I have been involved with rearing, their individuality was obvious. One slurped from the hand after 3 weeks in care, one did not feed from the hand until she was fully spined and outside full time, another would slurp only 10-15% from my hand and would have to be tube fed the remainder, another slurped from my hand after 8 weeks in care. Some slurped from the hand immediately.

5 month old Bubbles eating his carnivore mix

SUPPLEMENT MIX:
At around five months of age, it is a good idea to offer solid food, in the form of a slurry made up of termite mound dirt and Wombaroo small carnivore mix. Mix the ingredients with a little tepid water to a medium paste, and offer in a small dish. Echidnas usually slurp up this food with relish.
When feeding on soft bodied invertebrates, there are few tell tale parts left in the scat to provide clues to the extra food sources.

ENCLOSURES:
At about 5 1/2 months, the echidna should be introduced to an enclosure outside. If you wish to keep an echidna through the rearing period, an enclosure will have to be constructed in readiness for the animal to forage outside. For those who aren't aware, echidnas can climb. In fact I have seen a fully grown echidna with a sore leg climb a six foot chain fence,
So a lot of thought must go into the enclosure. Being very adept diggers, the best way to prevent the puggle from climbing and digging out, is to erect an enclosed area by using corrugated iron.

Right: 'Eckles' at 7 months, devouring termites in a rotting palm log.

METHOD:
A good sized enclosure should be situated in the shade in a hot climate and measure approximately 6 X 6 m (20' X 20').
It is beneficial to have shrubs in the enclosure as the leaves under shrubs promotes the likelihood of invertebrates living under the soil.
Dig a trench about 90 cms (2') deep, and place the iron lengthways along the trench. Another sheet of iron can be riveted to the lower sheet, providing 4 foot high sides. The corrugation will prevent the echidna from digging under or climbing out, but there must not be any object up against the iron, or the puggle will use it to pin itself between the two objects, and slowly edge itself up and over.

Place old rotting logs, a compost heap of grass, leaf matter (preferable decayed), and large boulders so that the echidna can dig around and under them. Spread a good covering of dead leaves all over the compound. Having a thick layer of foliage on the ground will attract many invertebrates. I have always ensured a fresh termite nest is placed in the enclosure whenever it is obvious that the echidna has foraged through the majority of the nest. A large termite nest may last a couple of weeks. Although there are many types of termites, I have had success with the typical bush termite mounds that are usually up to 1m (3') high. I chop the top off the mound so that the remaining termites can repair it and continue to survive.
Always ensure there is water available. Dig a shallow dentation into the soil to accommodate a large bowl of water, this is so that the echidna does not tip it over.
Place the echidna's dirt-filled container in which it was raised, on its side in the enclosure, so that the puggle can stay in the dirt or return to it whenever not investigating the new environment.

WEANING:
At about six months of age, you would expect the echidna to weigh approximately 2 to 2 1/2 kilos. By now, the animal should be foraging outside day and night, investigating its surroundings, and coming home to be fed once a week. At this stage, the animal will lose about 200 grams in between feeds, which is the energy that it uses for foraging during the week. If using Wombaroo echidna formula, They should wean from their milk between 7 and 8 months of age.

Bubbles lapping his formula.

Right: 'Bubbles' came home every Saturday and lapped 500 ml of Wombaroo >30 Formula.

RELEASE:
If the area where a puggle is found is not disclosed to the person rearing it, the problem of where to release will arise. In this situation it is better for the baby puggle to be reared by a person who lives on a property with 'echidna friendly' native bush in the local environment. Being able to release directly from the place of rearing, gives a carer the opportunity to assess how the animal is faring, and also allows the echidna to come and go, and eventually wean itself. This cannot be done if the animal has to be taken away for release.

Another factor to keep in mind is:
As so little is known about the stress levels of echidnas, if change of environment is kept to a minimum, there is less chance that the animal will stress. There have been a few stories conveyed of carers rearing unspined puggles to the 5 months old stage, then moving house, and the echidnas have ultimately died. One has to wonder whether the change in environment had a serious affect on their stress levels.

COMPLICATIONS/AILMENTS:
If an echidna ceases to slurp (*once it has been slurping really well on a regular basis*) this may indicate either dehydration, a respiratory ailment or gastrointestinal problem. Offer water first and if the puggle does not take the water, consider an infection.
The most effective antibiotic we have used is Amoxycillin injectable antibiotic at a dose rate of:

Betamox Injection I.M. -*Amoxycillin trihydrate = amoxycillin 150 mg/ml* (*Norbrook Laboratories Aust P/L)*
@ 0•05 ml/kg every 24 hours for five days

Betamox Long-Acting Injection-I.M. - *Amoxycillin trihydrate = amoxycillin 150 mg/ml* (*Norbrook Laboratories Aust)*
@ 0•1 ml/kg every 48 hours for 2-3 doses.

PERSONALITY:
They are intelligent little creatures, they do have a personality and have their own way of interacting with you.
Observing them is an extremely interesting past time. They are very strong, and will try to push even ***you*** out of the way! Whilst sitting with an echidna on the grass, it will manoeuvre itself in and around you, poking its snout into any crevice it can find...very inquisitive animals!

STATUS:
The echidna is regarded as common and widespread.
They are less affected by land clearing than many other native animals as they can live anywhere there is a supply of ants and termites. However, floods may have a dire affect on their survival if they aren't able to escape. Despite their covering of spines, they do have natural predators such as eagles, (who are capable of flipping them over and pecking the soft underbelly) and Tasmanian devils, who even eat the spines. Goannas may at times be successful in devouring an echidna, however, some goannas come to an untimely end if the spines get caught in their mouths, with ultimately both animals dying.
They were a favourite food of Aboriginal people and early white settlers, although they are now wholly protected by law (*supposedly).*

SURPRISING INFORMATION:
As the female echidna uses only strong muscles to act as a pouch on her abdomen and hold the egg and puggle, it was thought that once the mother accidentally drops the puggle, she would not be able to pick the baby back up again.

This was disproved when a carer was given a mother echidna and her dislodged, unspined puggle.
To find out what would happen, I suggested she keep the mother and baby in a small enclosed area, (*with a bowl of water available*), to see if the mother would allow the puggle to suckle. If the mother did, then Anne could take the mother and baby back to the wild and leave them both in a burrow, allowing the mother to continue rearing the baby. After 3 days of watching them, Anne went to check on the fourth day and the mother had retrieved the baby! Anne was able to release the mother with her baby well secured, back to where she had come from.

This was proven a second time, when I advised another couple of wildlife cares to do the same with a mother and baby. They placed the mum and puggle in a large aviary with dirt and leaf litter, and a bowl of water.
Within a couple of days I went to their residence to check, and sure enough the mum already had the puggle back in her folds of tummy skin. She was also released with the baby intact.

CASE HISTORY: BUBBLES

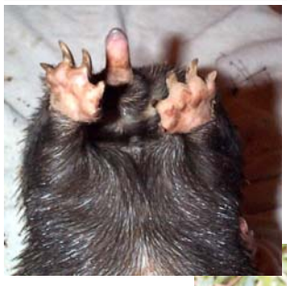
Bubbles at 85 days of age.

My 4 acres was fenced, and Bubbles returned to the house a couple of times a week. He always came home on a Saturday, which was feed day.
He weighed 2•75 kilos at eight months of age. He resided under a pile of rocks in amongst a grove of trees and at other times could be found foraging in his favourite spots on the property. At this stage he was lapping 500 ml of formula at his weekly feed, and gained 500 gram after feeding. We allowed Bubbles to take what he wanted in formula once he began to lap from a dish. We would give him more if he wanted it and he would leave milk when he was satisfied. We feel that this method has proven successful, the result being an animal which looked as good as those we encountered in the wild. We believe that if using Wombaroo echidna formula, the animal will wean itself when its intake of solid food is sufficient to not rely on the supplement milk offered.
During the week between feeds, he lost approximately 200 grams of weight which was used in energy whilst foraging. *(Of course if the animal hasn't got a large foraging area, it could expend less energy in this time, and therefore lose less weight between feeds.)*
Bubbles made holes in the screen doors trying to get in, and it was not an uncommon event to find him in the office curled up in a corner. If a door was left open, chances were that Bubbles would invite himself in, so the golden rule around the place was to ensure that doors were not left open and if you couldn't find Bubbles in the bush, you started looking for him *indoors!*

CASE HISTORY: CACTUS

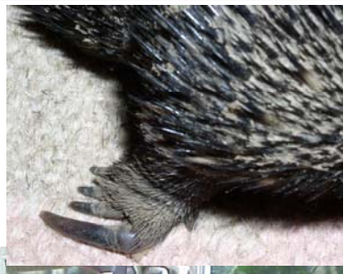
I came to the conclusion that 'Eckles', (*another echidna reared from spineless*), was a female, as she was lapping exactly half the amount of milk that Bubbles did at the same weight. Once per week, she lapped 250 mls and she weighed 2 kg. She was not as friendly as Bubbles and did not follow me around the property, so I would take her out foraging every afternoon late until dark, and ensured she had at least half a termite mound in her enclosure.

When she was at the unspined stage, she never slurped enough, so I would have to tube feed her the rest. She came in at **165 gm** and was initially fed **33** ml, which was 20% of her bodyweight, every 2 days. On her sixth day she weighed **246 gm** after her formula, but she used between **12 and 16 grams** of her bodyweight in energy, each 48 hours.



Left: Front feet.

Right: The hind foot.



WEIGHT B = Weight before feeding

WEIGHT A = Weight after feeding

MILK = <30 or >30

ECHIDNA FEEDING CHART						
DATE	**WEIGHT B**	**20% MILK**	**MILK**	**WEIGHT A**	**AGE**	**COMMENTS**