FLUID THERAPY

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CREDIBILITY FACTOR

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NOW YOU KNOW ABOUT ME, WHAT ABOUT Y'ALL?

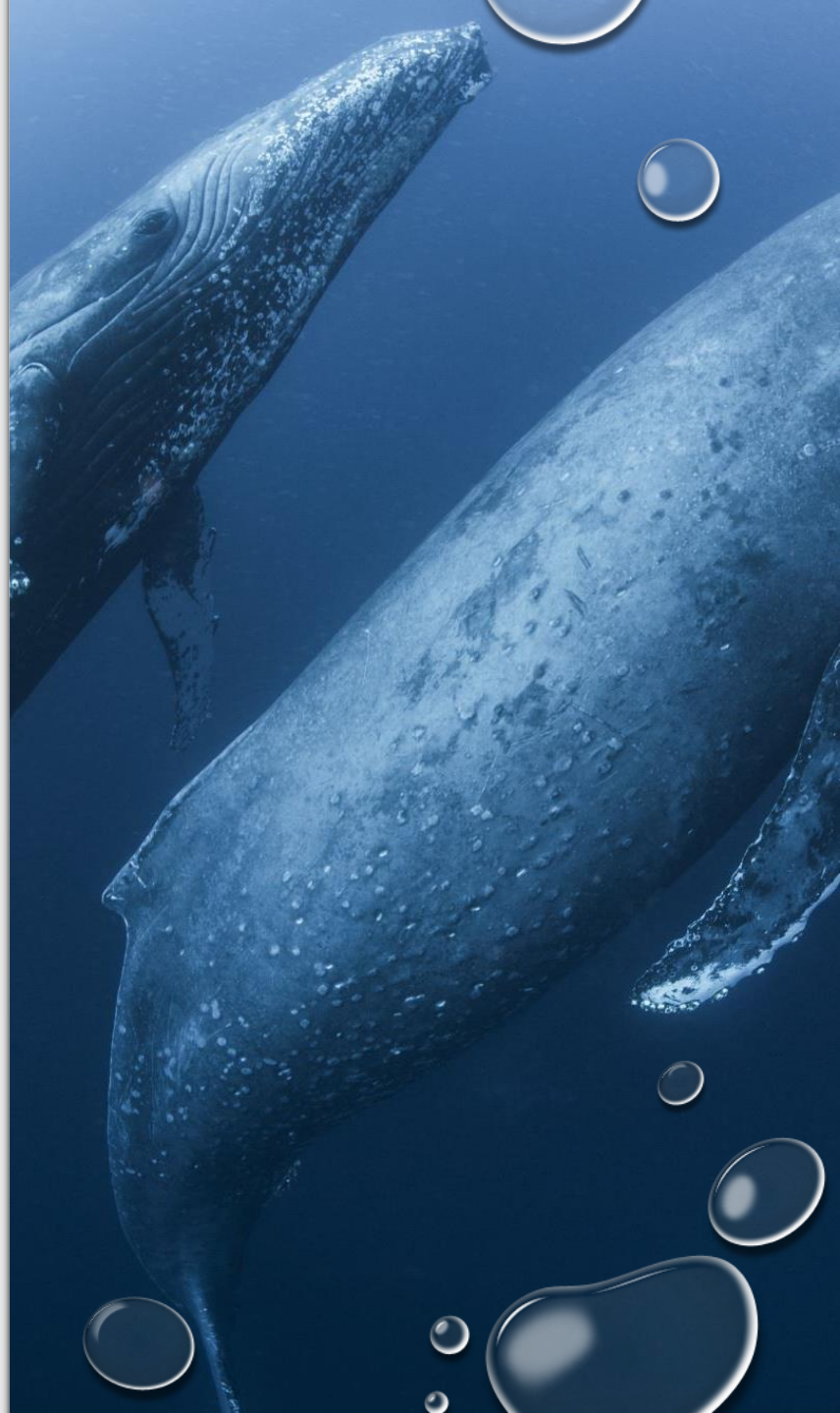
- HOW MANY OF Y'ALL ARE VETERINARIANS?
- VET TECHS?
- VETERINARY STUDENTS?
- REHABBERS?
- REHAB STUDENTS?
- UNDERGRADS?
- OTHER?

LEARNING OBJECTIVES

- WHERE DOES WATER GO IN THE BODY? UNDERSTANDING BODY WATER DISTRIBUTION
- LOST WATER – ASSESSING LEVELS OF DEHYDRATION
- HOW MUCH IS ENOUGH? CALCULATING FLUID DOSAGES AND KNOWING HOW MUCH TO GIVE
- SO WHAT DOES THIS DO? MONITORING THE AFFECTS OF FLUID THERAPY
- LET’S GET HYDRATED! ADMINISTERING FLUID THERAPY

WHERE DOES WATER GO IN THE BODY? UNDERSTANDING BODY WATER DISTRIBUTION

- HOW MUCH OF THE BODY WEIGHT OF AN ANIMAL IS WATER?
  - 2/3 OF THE LEAN BODY WEIGHT OF A MAMMAL*
- INTRACELLULAR WATER – WATER WITHIN THE CELLS
- EXTRACELLULAR WATER – WATER NOT WITHIN THE CELLS
  - INTRAVASCULAR WATER – WATER WITHIN THE VASCULATURE (BLOOD VESSELS)
  - INTERSTITIAL WATER – WATER IN THE BODY BETWEEN THE BLOOD VESSELS AND CELLS



WHERE DOES WATER GO IN THE BODY? UNDERSTANDING BODY WATER DISTRIBUTION

Total Body Water (TBW) approximately 2/3 of BW (60%)
Example: 20 kg coyote has 12 L of water (20 kg x .6 = 12 L)

Intracellular water
40% of BW and 2/3 of TBW

Example: A 20 kg coyote has 8 L of intracellular water
(20 kg x .4 = 8 L)

Intravascular Water
5% of BW and ¼ of extracellular fluid
Ex: a 20 kg coyote has 1 L of plasma
(20 kg x .05 = 1L)

Interstitial Water
15% of BW and ¾ of extracellular fluid

Example: A 20 kg coyote has 3 L of interstitial fluid
(20 kg x .15 = 3L)

CASE #1

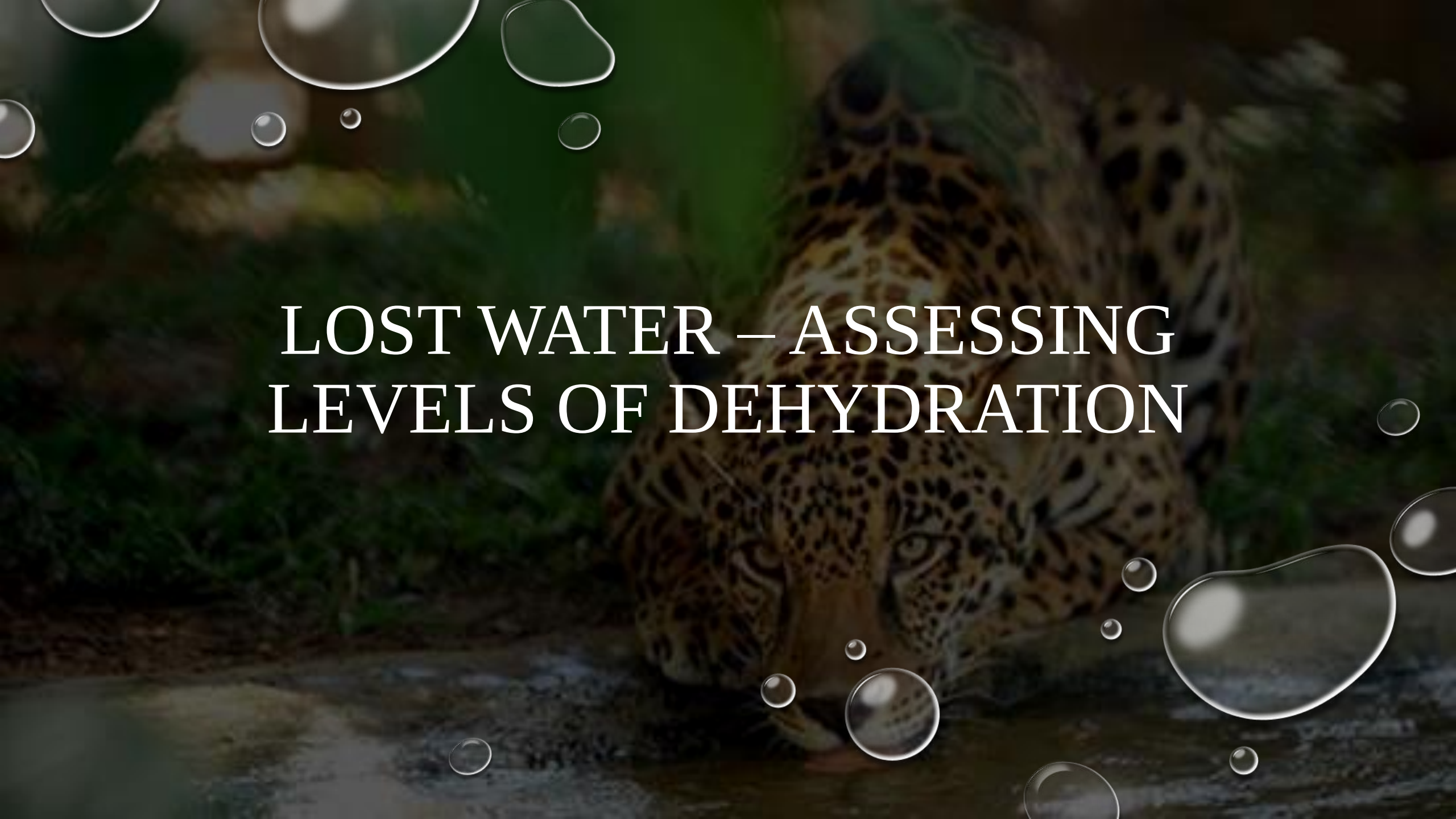
- A 10 KG FOX PRESENTS TO YOU.
- WHAT IS THE TOTAL BODY WATER OF THE FOX (IN LITERS)?
  - 6 L
- WHAT IS THE VOLUME OF INTRACELLULAR FLUID OF THE FOX?
  - 4 L
- WHAT IS THE VOLUME OF THE INTERSTITIAL FLUID OF THE FOX?
  - 1.5 L
- WHAT IS THE VOLUME OF INTRAVASCULAR FLUID OF THE FOX?
  - 0.5 L
- WHAT IS THE VOLUME OF THE EXTRACELLULAR FLUID OF THE FOX?
  - 2 L

A NOTE ABOUT REPTILES AND BIRDS

- AVIAN SPECIES
  - TBW IS APPROXIMATELY 60% OF BODY WEIGHT
  - SIMILAR TO MAMMALS
- REPTILE SPECIES
  - NOT SIMILAR TO MAMMALS
  - TBW = 75% OF BODY WEIGHT
    - EXCEPT TURTLES – THE CARAPACE MAKES A DIFFERENCE AND TBW = 66%
    - DIVIDED EQUALLY BETWEEN INTRACELLULAR AND EXTRACELLULAR WATER
      - 70% INTERSTITIAL
      - 30% INTRAVASCULAR
- IF YOU AREN’T FAMILIAR WITH A SPECIES, DON’T BE AFRAID TO ASK/LOOK IT UP

WHY DO WE GIVE FLUIDS?

- RESTORE WATER AND ELECTROLYTE BALANCE
  - WHAT THINGS ARE WE THINKING ABOUT?
  - WHY DON'T THINGS STAY NORMAL?
- MAINTAIN NORMAL DAILY BODY LOSSES
- REPLACE PATHOLOGICAL LOSSES
  - WHAT'S A PATHOLOGICAL LOSS?????



LOST WATER – ASSESSING LEVELS OF DEHYDRATION

WHO'S AT RISK FOR DEHYDRATION?

- ORPHANED YOUNG
- ANIMALS NOT DRINKING/EATING ON THEIR OWN
- ANIMALS WITH VOMITING AND DIARRHEA
- BURN VICTIMS
- TRAUMA/BLOOD LOSS

CASE #2 AND #3

- A BOX TURTLES PRESENTS TO YOU FOR BEING HIT BY A CAR. THERE IS TRAUMA TO THE SHELL ALONG WITH BLOOD LOSS. ARE YOU CONCERNED ABOUT DEHYDRATION?
- AN ORPHANED COYOTE PUP IS BROUGHT TO YOU. THE PUP IS ACTIVE, VOCALIZING, HAS ITS EYES CLOSED (DUE TO AGE). ARE YOU CONCERNED ABOUT DEHYDRATION?

ASSESSING FOR DEHYDRATION

- REMEMBER THIS CAN BE SUBJECTIVE
- ANIMAL HISTORY
- PHYSICAL EXAM
  - PULSE, MUCOUS MEMBRANES (MM), CAPILLARY REFILL TIME (CRT), SKIN TENTING
- WEIGHT LOSS
- URINE COLOR/SPECIFIC GRAVITY
- BLOODWORK (PACK CELL VOLUME/TOTAL PROTEIN)
  - EVEN FURTHER: CREATININE, BUN, NA CONCENTRATION

DEHYDRATION ESTIMATION - MAMMALS

% Dehydration	Clinical Signs
<5%	Normal on examination
5%	Slightly dry or tacky mucous membranes
6-8%	Dry/tacky mucous membranes + skin tents/wrinkles
10-12%	Same as above + sunken eyes, lethargic
>12%	Very poor prognosis – animal usually dies

Remember – SQ fluids can be used to treat mild-moderate dehydration

DEHYDRATION ESTIMATION – BIRDS AND REPTILES

% Dehydration	Clinical Signs Birds	Clinical Signs Reptile
3%	-	Increased thirst, lethargy, decreased urates
<5%	No clinical signs	-
5-10%	Tight skin (especially over keel), dry/wrinkly skin, skin tenting, eyes dull and eyelids tent, tacky mouth with mucous strands	
7%	-	Increased thirst, anorexia, dullness, dry loose wrinkled skin, dull eyes, dry, sticky mucous membranes, abnormal shedding
10%	-	Dull to comatose, dry mucous membranes, sunken eyeballs, no urates
10-15%	Inside of mouth dry, extremities cold, continuous skin tent, rapid HR, ill, listless, depressed	

CASE #4

- A RED TAIL HAWK PRESENTS TO YOUR CLINIC DURING THE SUMMER. UPON PHYSICAL EXAM, YOU FIND THE FOLLOWING:
  - DRY, WRINKLY SKIN OVER THE KEEL
  - A BCS OF 2/5
  - A TACKY MOUTH
- WHAT PERCENT DEHYDRATION DO YOU THINK THE HAWK IS?

HOW MUCH IS ENOUGH? CALCULATING FLUID DOSAGES AND KNOWING HOW MUCH TO GIVE

HOW MUCH DO YOU GIVE?

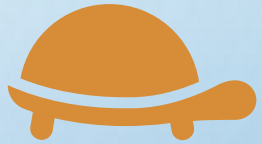
- FLUID DEFICIT: LOSS OF EXTRACELLULAR FLUID FROM THE BODY (DEHYDRATION)
- MAINTENANCE FLUID: FLUID NEEDED TO MAINTAIN NORMAL BODY WATER VOLUME, DETERMINED BY METABOLIC BODY SIZE
- THERAPEUTIC DOSE = MAINTENANCE REQUIREMENT + FLUID DEFICIT

- DO NOT GIVE MORE THAN 5% OF THE BODY WEIGHT AT ONE TIME
    - OR ELSE WHAT?

WHAT ARE THE MAINTENANCE FLUIDS?

Small mammals: 50-100 mL/kg/day (5-10% body weight)

Avian: 50-150 ml/kg/day (5% body weight)



Reptiles: 10-30 ml/kg/day (1% body weight)

PRACTICE CASE

YOU HAVE A 125G EASTERN SCREECH OWL

PRESENTS BAR BUT 5% DEHYDRATED

(AVIAN DAILY MAINTENANCE IS 50 ML/KG/DAY)

HOW MUCH DO YOU GIVE?

MAINTENANCE: 0.125 KG X 50 ML/KG/DAY = 6.25 ML/DAY

DEFICIT: 125 G X 5% = 6.25 ML (CORRECT OVER A 3 DAY PERIOD = 2.1 ML/DAY)

TREATMENT: 8.25 ML/DAY FOR 3 DAYS IN 2 TREATMENTS

CASE #5

A 1.2 KG RACCOON BABY PRESENTS TO YOU.

THE RACCOON IS BAR, BUT HAS TACKY MUCOUS MEMBRANES AND A POSITIVE SKIN TENT RESPONSE.

HOW DEHYDRATED DO YOU SUSPECT THE RACCOON TO BE?

6-8%

WHAT IS THE MAMMALIAN MAINTENANCE RATE?

50-100 ML/KG/DAY

WHAT IS THE DEFICIT IN THIS RACCOON? HOW MANY DAYS DO YOU WANT TO SPLIT THE TREATMENT OVER?

1200 G X 6-8% = 72-96 MLS

3 DAYS SO 24-32 MLS PER DAY

WHAT IS THE MAINTENANCE FLUIDS FOR THIS RACCOON?

1.2 KG X 50-100 ML/KG/DAY = 60-120 ML/DAY

WHAT IS THE TREATMENT FOR THIS RACCOON?

84-152 MLS PER DAY IN TWO-THREE TREATMENTS**

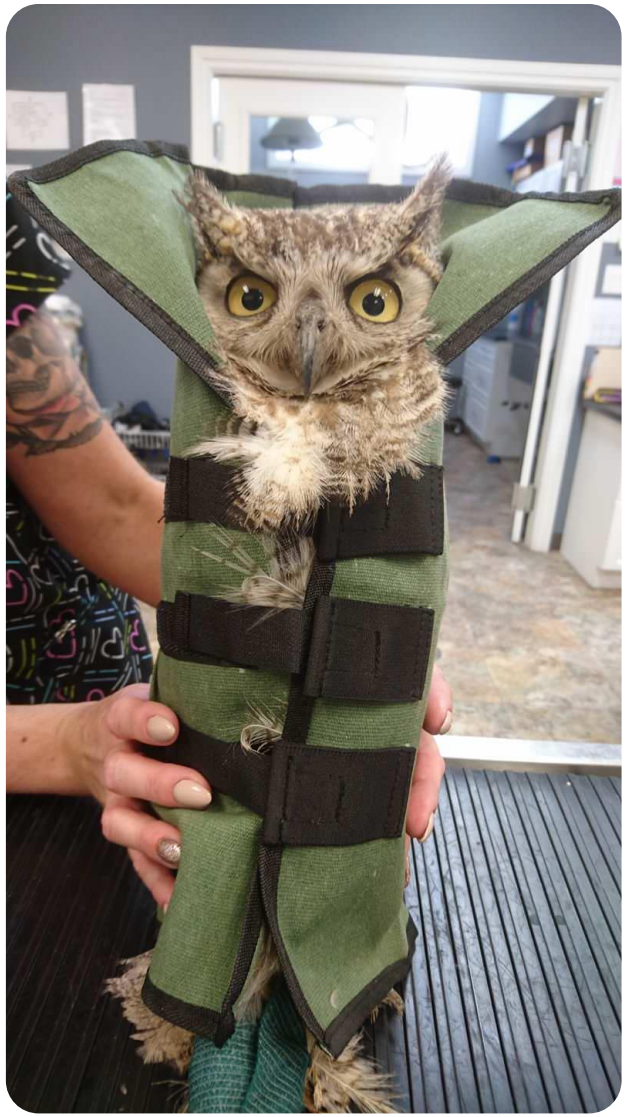
FLUID TYPES

- FLUID CONTENTS:
  - ELECTROLYTES +/- GLUCOSE
  - SODIUM, POTASSIUM, CHLORIDE, CALCIUM, MAGNESIUM, BICARBONATE
- REPLACEMENT FLUIDS: EXPAND EXTRACELLULAR SPACE
  - LACTATED RINGER'S (LRS), SALINE, NORMASOL-R
- MAINTENANCE FLUIDS: MIMIC DIETARY INTAKE
  - NORMASOL-M, PLASMALYTE-M
- OTHERS
  - HYPERTONIC SALINE = SHOCK THERAPY

SO WHAT DOES THIS DO? MONITORING THE AFFECTS OF FLUID THERAPY

- PHYSICAL EXAM – DO THE SIGNS OF DEHYDRATION RESOLVE?
- BODY WEIGHT – SHOULD BE INCREASING OR MAINTAINING, ESPECIALLY IF EATING
- GOAL: ANIMAL EATING/DRINKING ON ITS OWN

LET’S GET HYDRATED! ADMINISTERING FLUID THERAPY

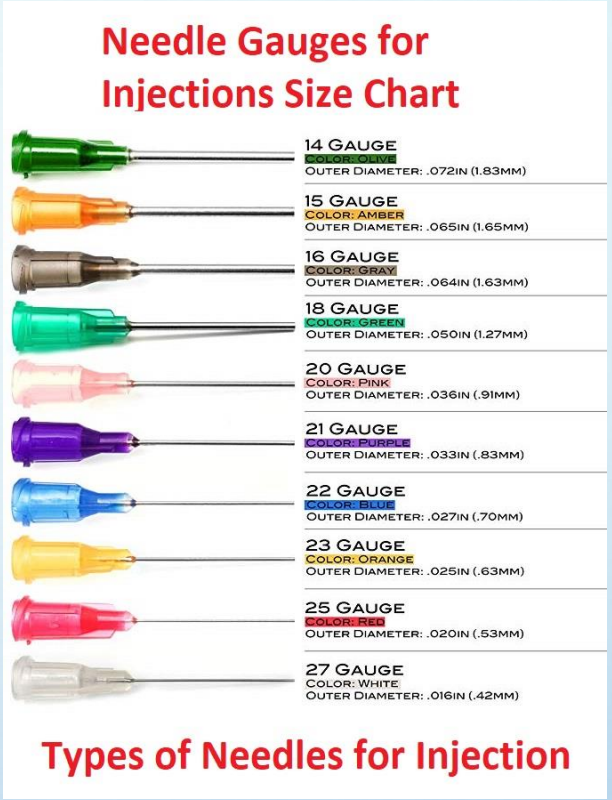


WHAT MATERIALS DO YOU NEED?

- WHAT ANIMALS ARE YOU WORKING WITH?
- ALCOHOL SWAB
- GLOVES
- WARM FLUIDS
  - WHY WARM FLUIDS? HOW DO YOU WARM THEM?
- SYRINGES/NEEDLES
- FLUID LINE

THE KEY TO NEEDLES

- RANGE IN SIZE DEPENDING ON NEED
- MUST BE STERILE
- ONE-TIME USE
- HANDLE SAFELY AND APPROPRIATELY
  - BEVEL UP
- APPROPRIATE DISPOSAL



Species	Size	Length
Nestling Bird	27G	0.5”
Large Bird	22-25G	1”
Reptile	22-25G	0.5”-1”
Mammal	18-22G	1”-1.5”

WHAT ABOUT SYRINGES?

- HOW MUCH ARE YOU GIVING?
- HOW MUCH DO YOU WANT TO STRUGGLE?
  - LARGER SYRINGES ARE MORE DIFFICULT TO HANDLE
  - THINK ABOUT YOUR FRACTIOUS ANIMALS
    - BUTTERFLY NEEDLE?
- ALWAYS ASPIRATE!

CASE #6, #7, AND #8

You are presented with a fractious raccoon that needs fluids. What do you need in order to administer fluids to this animal?

You are presented with an eastern box turtle that is dehydrated. What materials do you need in order to administer fluids to this animal?

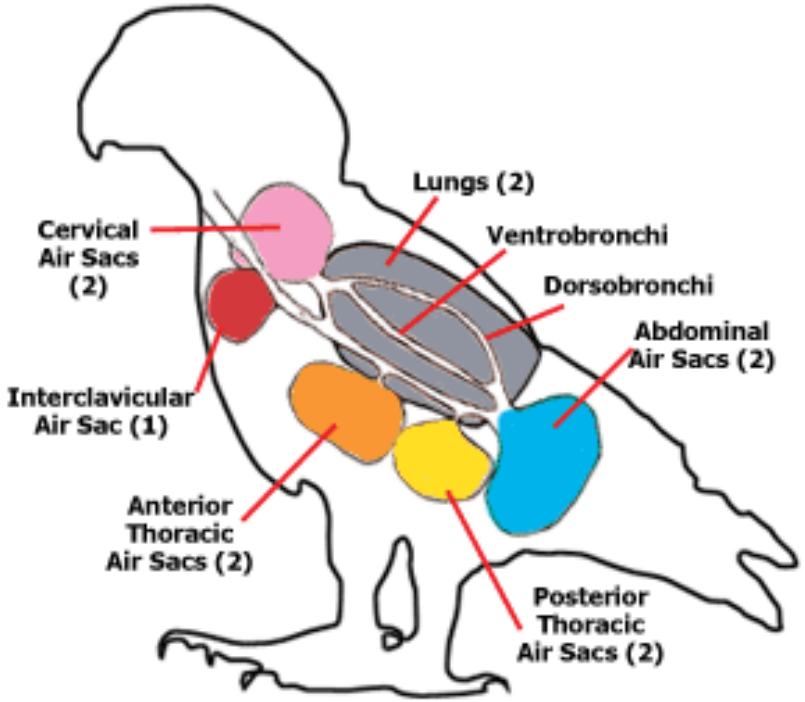
You are presented with a blue jay. What materials do you need to administer fluids to this animal.

MAMMAL HANDLING CONSIDERATIONS

- TEETH
- INFECTIOUS DISEASE
  - RABIES
  - NEEDLE DISPOSAL
- TENT SKIN AND POKE THROUGH SHOULDER OR BACK, KEEP NEEDLE PARALLEL TO SKIN
- ASPIRATE!!!!
- FILL UNTIL BUBBLE IS FIRM
- MAY BLEED SLIGHTLY – APPLY PRESSURE
  - IT’S A LOT OF BLOOD, AH WHAT HAPPENED?

AVIAN HANDLING CONSIDERATIONS

- Beak, talons
- Air sacs
  - Wing webs, intrascapular, breast, inguinal region
- Apply in groin or back
- Part feathers and limit alcohol
- Should be able to see your needle and fluid bubble clearly
- Stay parallel to skin



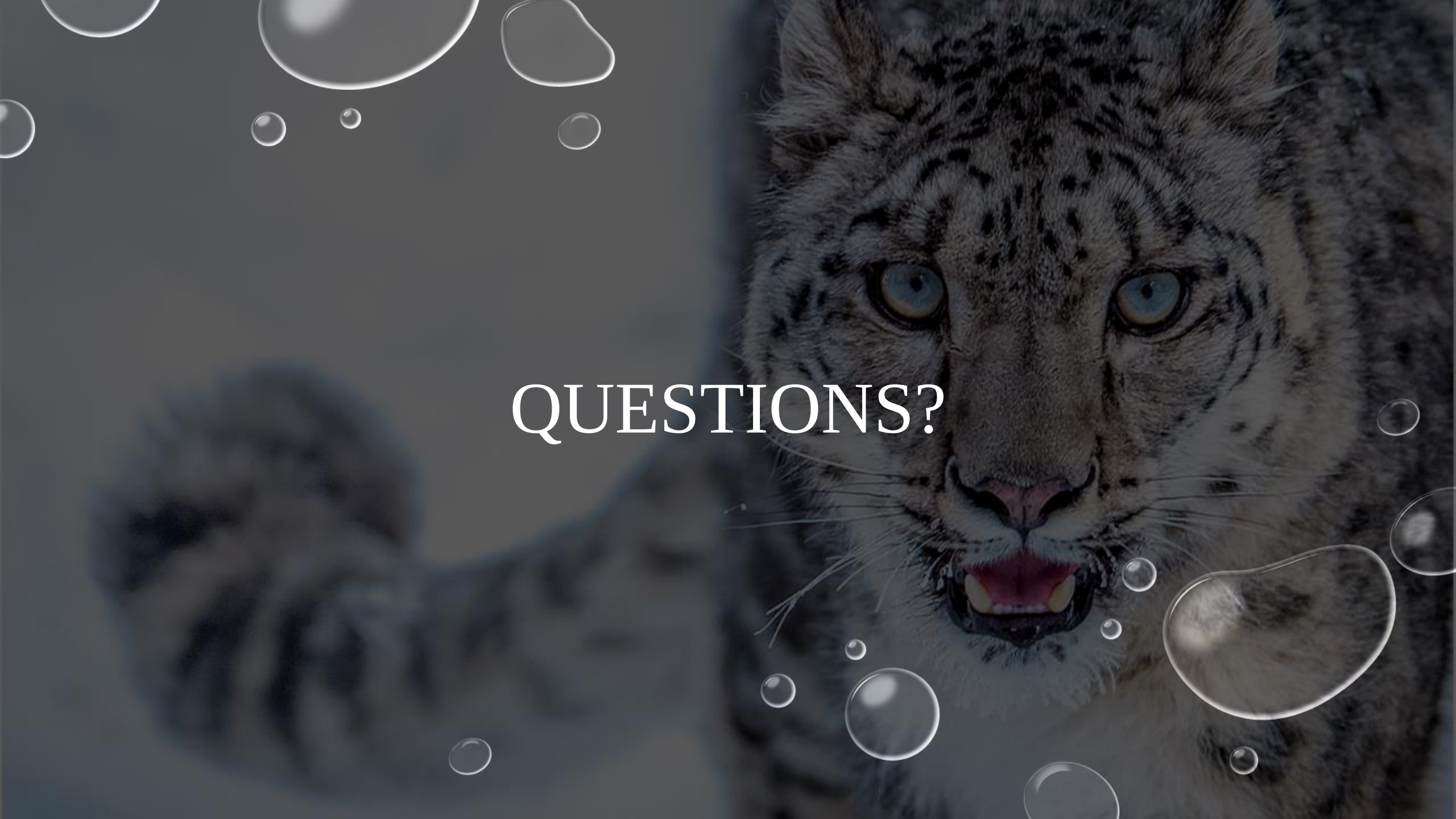
ALWAYS ASPIRATE!!!

REPTILE HANDLING CONSIDERATIONS

- ACCESS TO SKIN
- SLOWER METABOLISM
- LOOSE SKIN NEAR NECK OR INGUINAL AREA
- LOWER BACK BETWEEN SCALES

THINGS TO REMEMBER

- GIVE SLOWLY
- SOME FLUID MAY LEAK
- USE YOUR BEST JUDGEMENT
- YOU CAN GIVE TOO MUCH
- SAFETY


QUESTIONS?

REFERENCES

- Rebekah Weiss, Fluid Therapy for Wildlife
- Bernie Hansen 2019 VMC 942 Fluid Therapy
- Susie Jones NCSU CVM class of 2021
- Nicole Himebaugh NCSU CVM class of 2020
- Kelsey Stover NCSU CVM class of 2017