“Global Worming”:

What you can do to prevent anthelminthic meltdown

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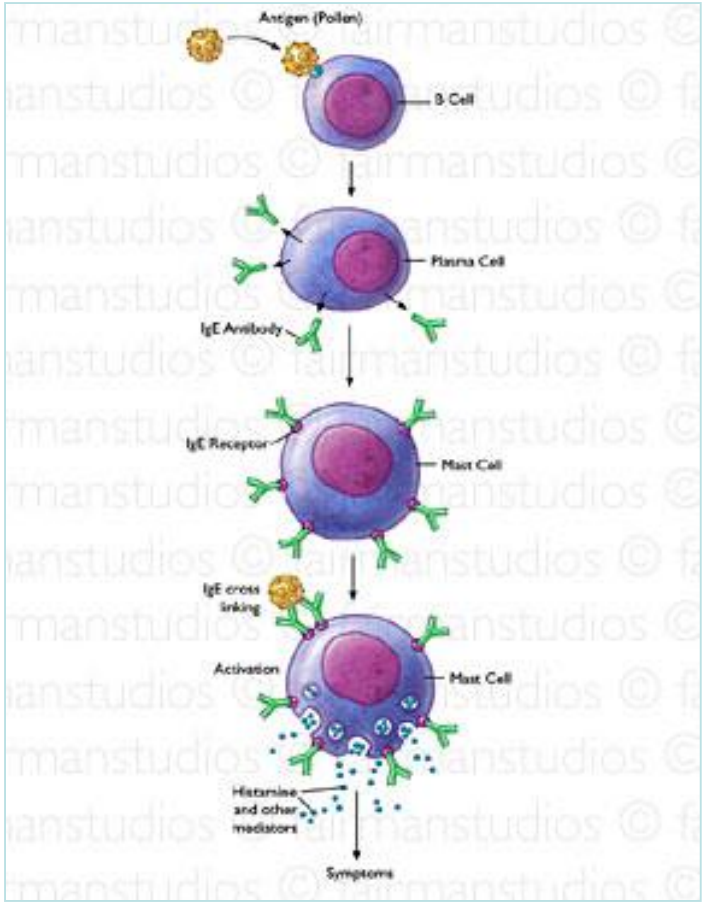
History of De-worming

- 1600's
  - Parasites treated with bloodletting
- 1950's:
  - 90% of fatal colics due to large strongyles
- 1960's:
  - Effective de-wormers debut
  - Routine de-worming begins
- 1980's:
  - Ivermectin discovered
- 1990's
  - Moxidectin discovered
  - First evidence emerges on de-wormer resistance in horses
- 2000's…

Parasite Biology

- Parasitic worms do not *amplify* their numbers within the host
  - Each generation of parasites must return to the environment to undergo essential changes
- Horses show varied, but never *absolute*, immunity to parasites
- Resistance to de-wormers is *inevitable*



Strongyle resistance: the movie

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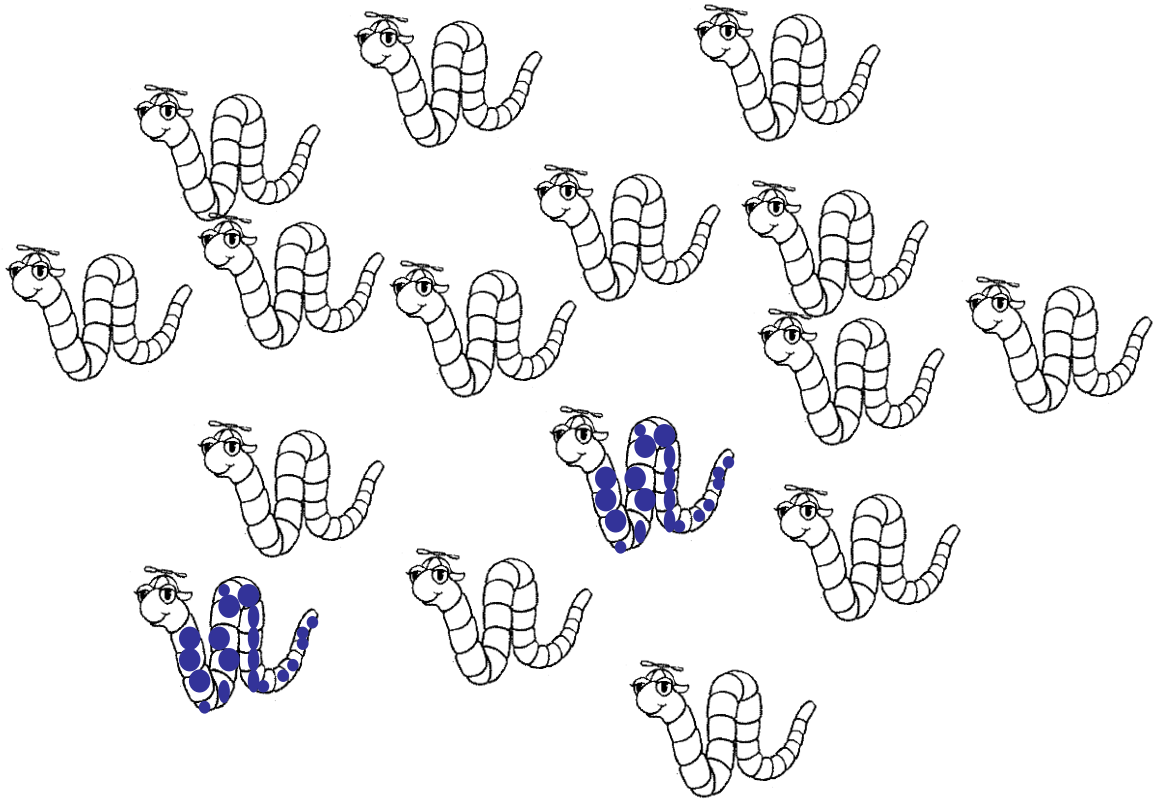

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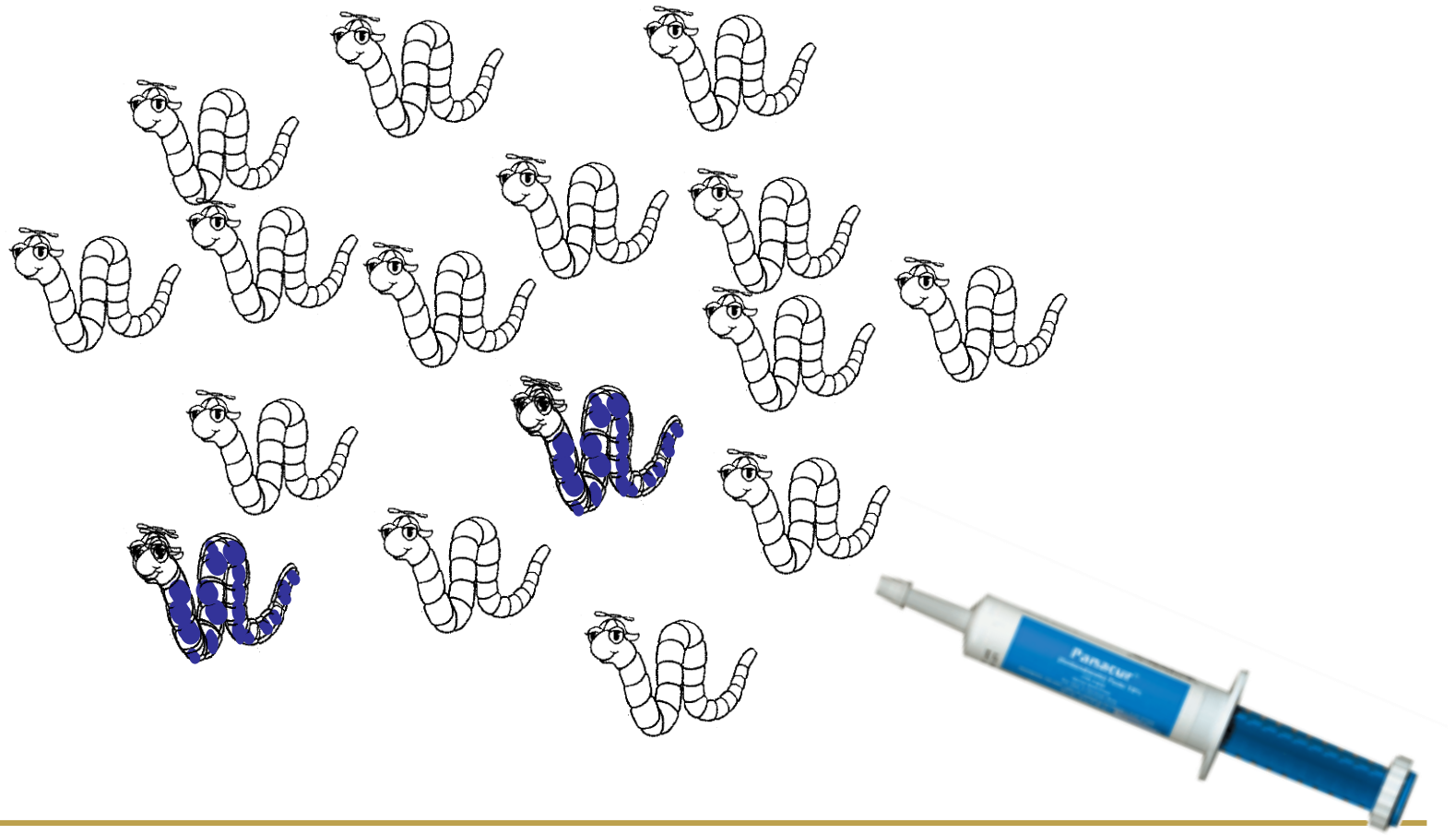

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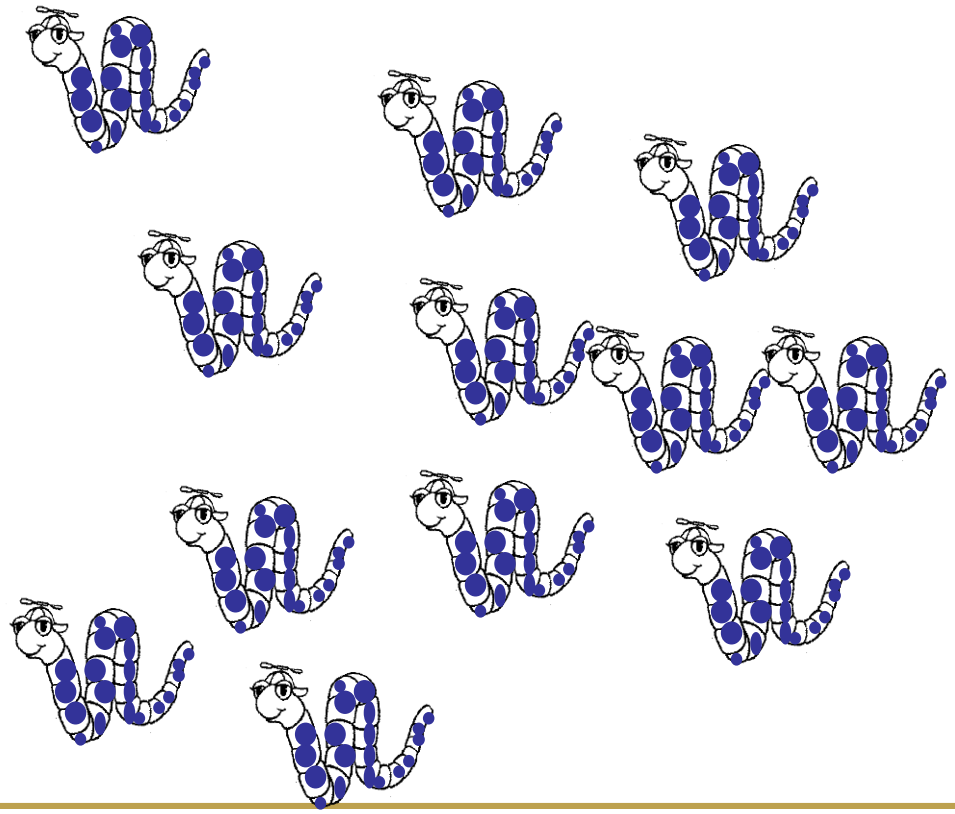

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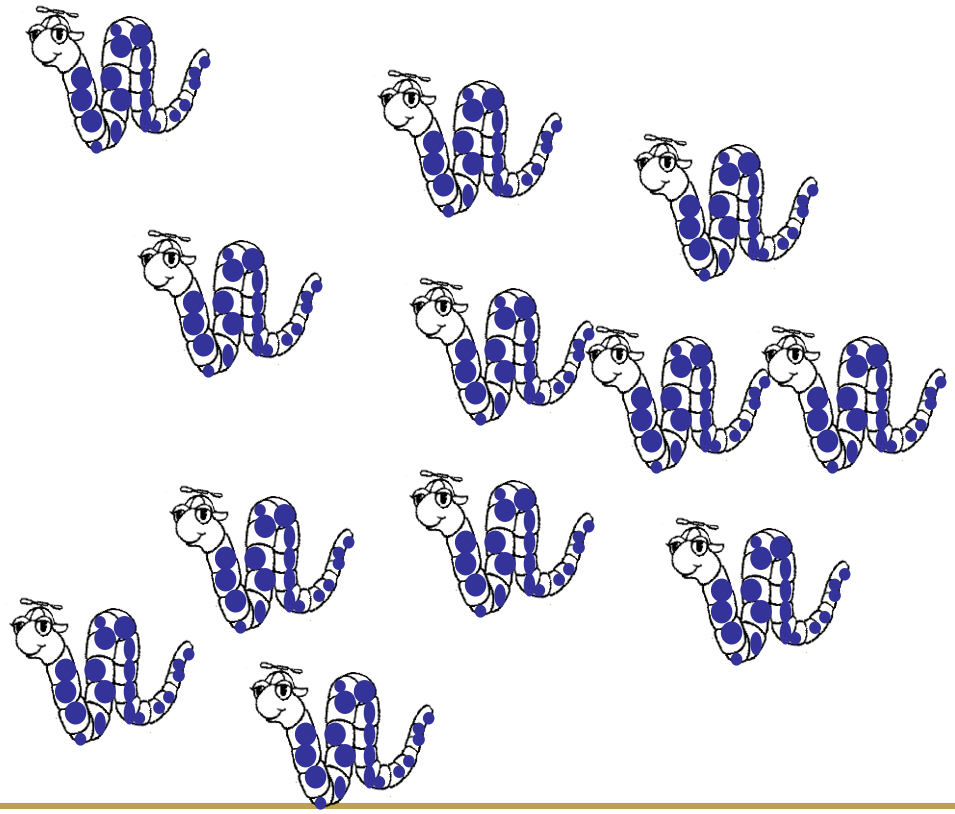

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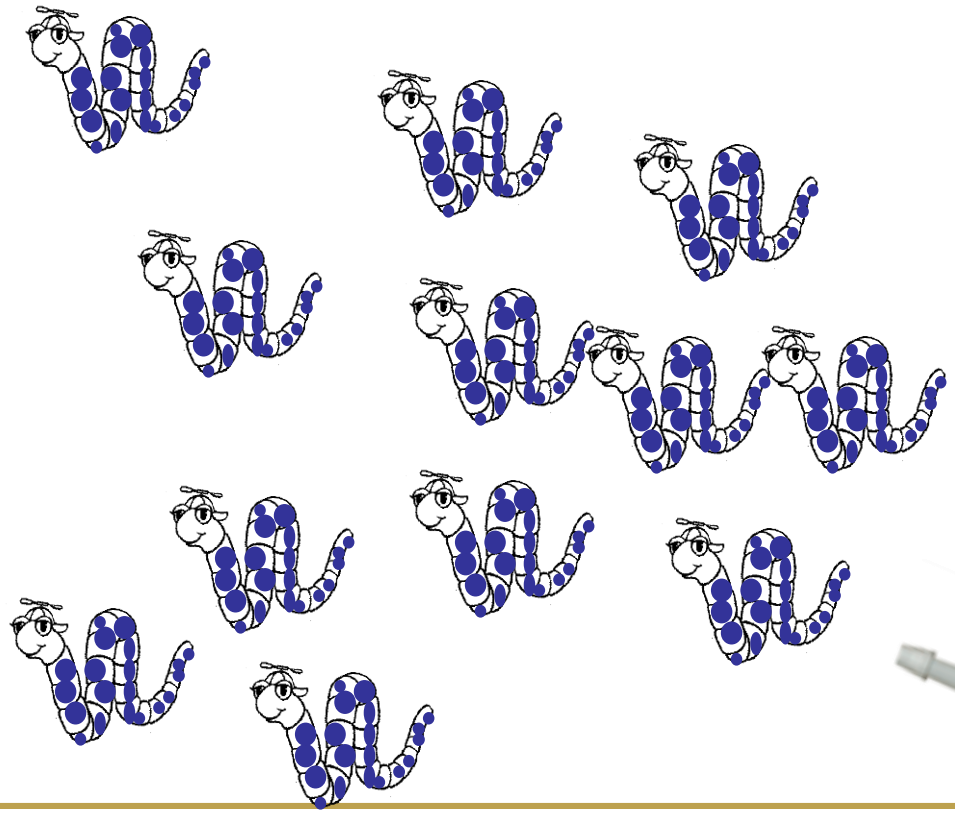

Anthelminthic Resistance: An emerging threat

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- In the past 25 years, no new classes of de-wormers have been developed for use in animals
- In goats and sheep, there are now farms where worms are resistant to 100 % of known de-wormers
- Horses?

Many de-wormers are already showing severe resistance

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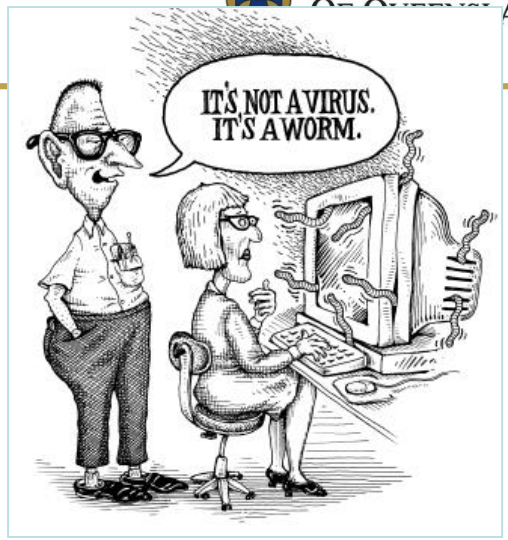
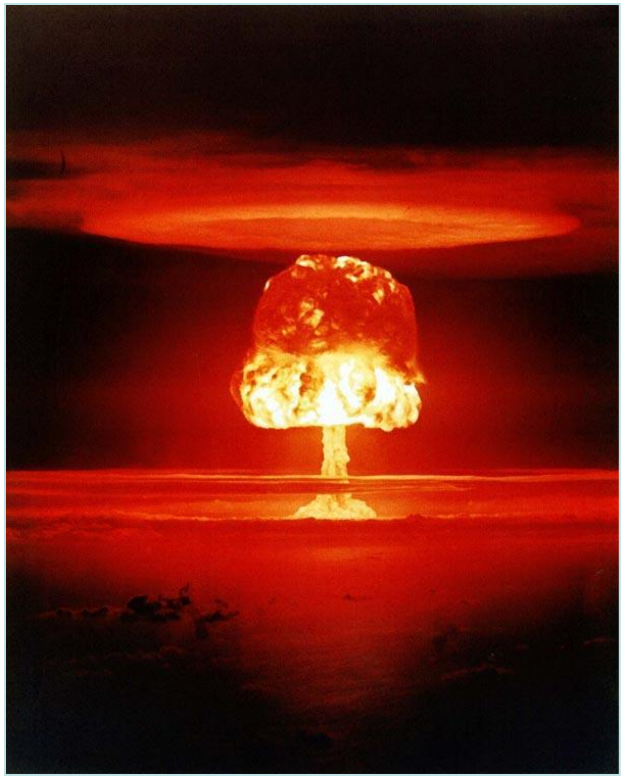
- Fenbendazole/Oxybendazole
  - As low as 0% effective against small strongyles!
- Ivermectins
  - As low as 65% effective against roundworms



10 steps

you can take to prevent de-wormer meltdown

Step #1: Acknowledge the problem



- De-wormer resistance has already happened.
- There is only one class of de-wormer that is still uniformly effective: avermectins
- Once we have avermectin resistance, we're out of drugs. Period.

Goals – Parasite control

1. Prevent and treat parasite-related disease*
2. Prevent further resistance from developing

*** Horses are never parasite-free; the goal is control, not eradication

Make the diagnosis.

Step #2: Start performing Fecal Egg Counts

- Perform a fecal egg count on a sample of horses
  - shows number of eggs per gram of manure.
- ONLY evaluates number of adults, not harmful larvae.
  - Tells you who needs to be de-wormed
  - Tells you if your de-wormer worked

Make the diagnosis.

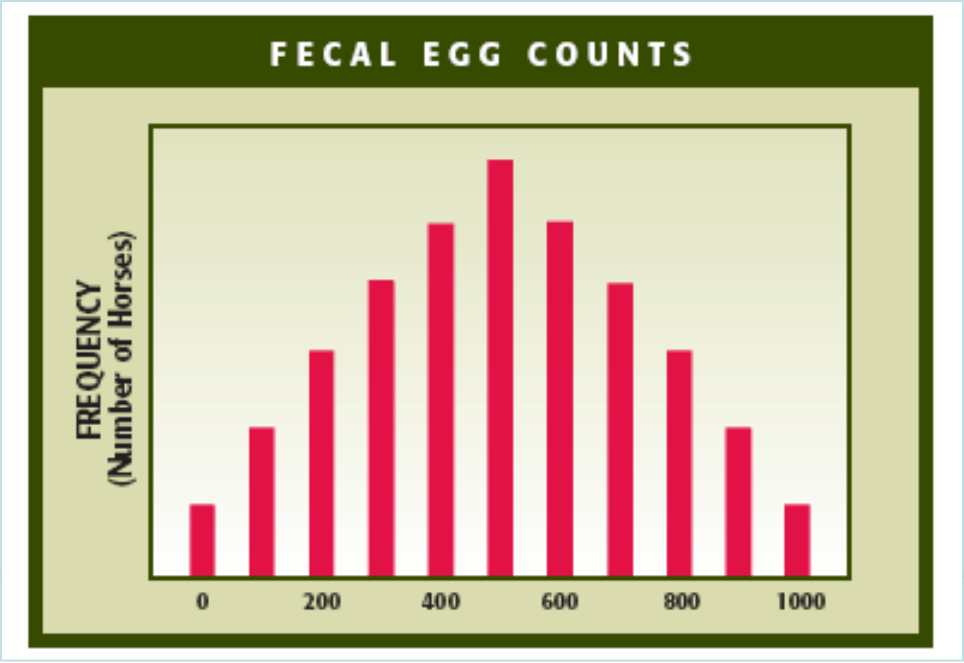
Step #2: Fecal Egg Count Reduction Test

- Perform a FEC
- Choose a dewormer to test
  - Administer appropriate dose
- Repeat FEC in 2 weeks
- Fully effective drug
  - Will cause a 95-100% decrease in # of eggs

De-worm smart, not hard:

Step #3: **Understand Natural Immunity**

- Some horses have very good natural immunity against worms, will never get fecal eggs counts above 150 epg



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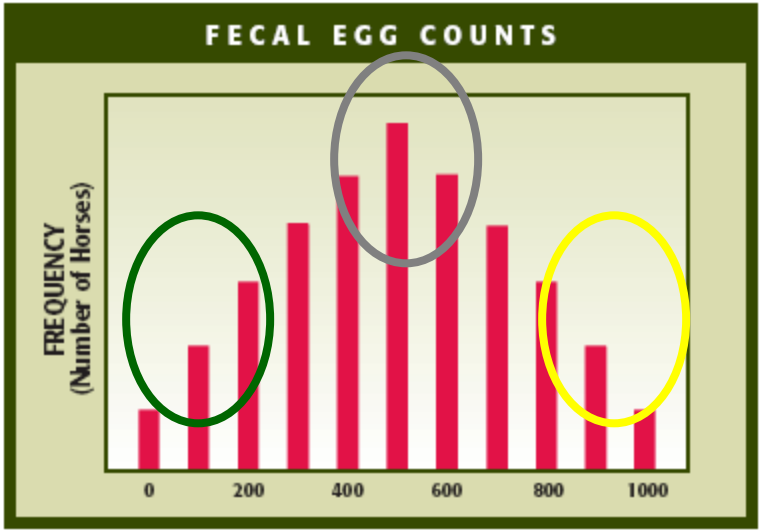
Strongyle Contaminative Potential

- FEC ~2 months after de-worming:
  - Low contaminators: less than 150 epg
  - Moderate contaminators: 150-500 epg
  - High contaminators: over 500 epg

20% of horses produce 80% of the eggs



"Resistance is futile!"

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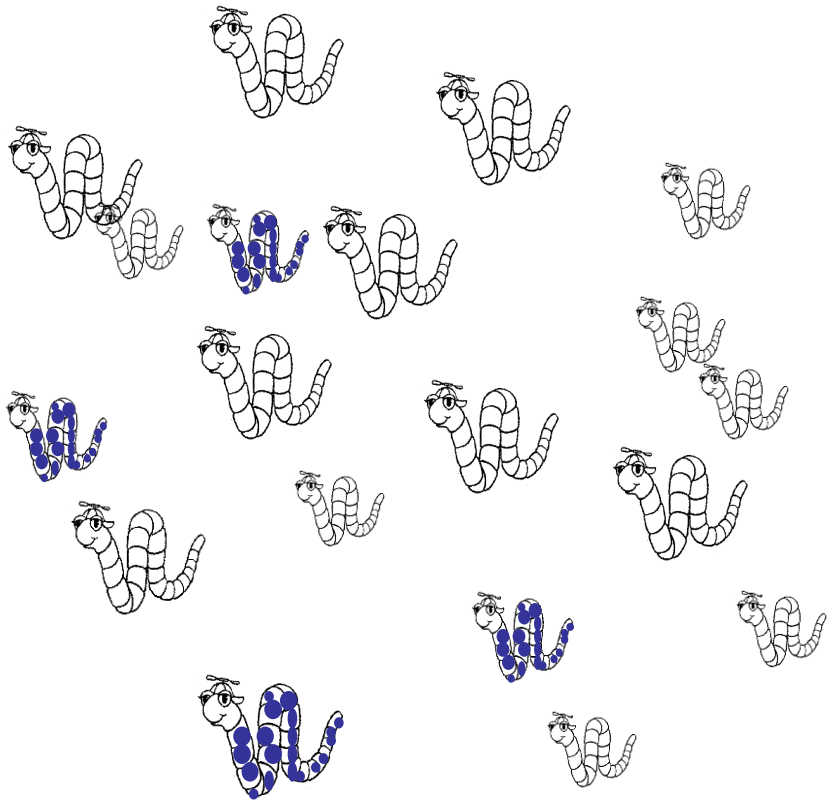
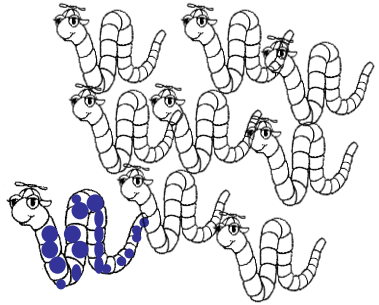
Step #3: Save the refugia!

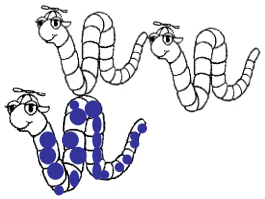
- **Refugia:** parasite populations that are "hiding" from anthelminthic selection pressure
  - Refugia saves genetic variability that maintains drug sensitivity
- "Where do I find this refugia of which you speak?"
  - By only deworming the **high shedders**
  - By not removing all the encysted larvae

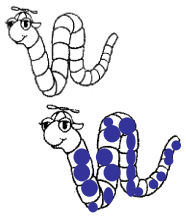


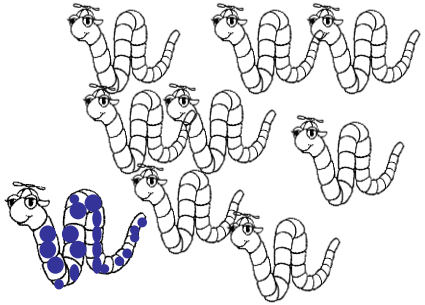


EACH WORM =

100 EPG








Panacur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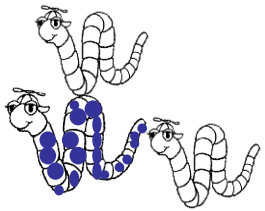


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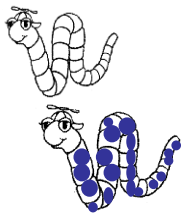


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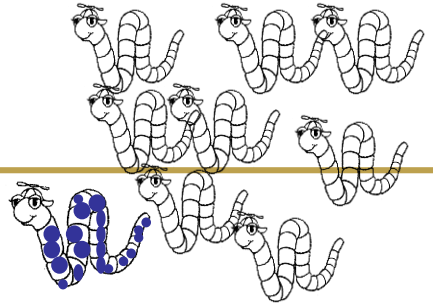

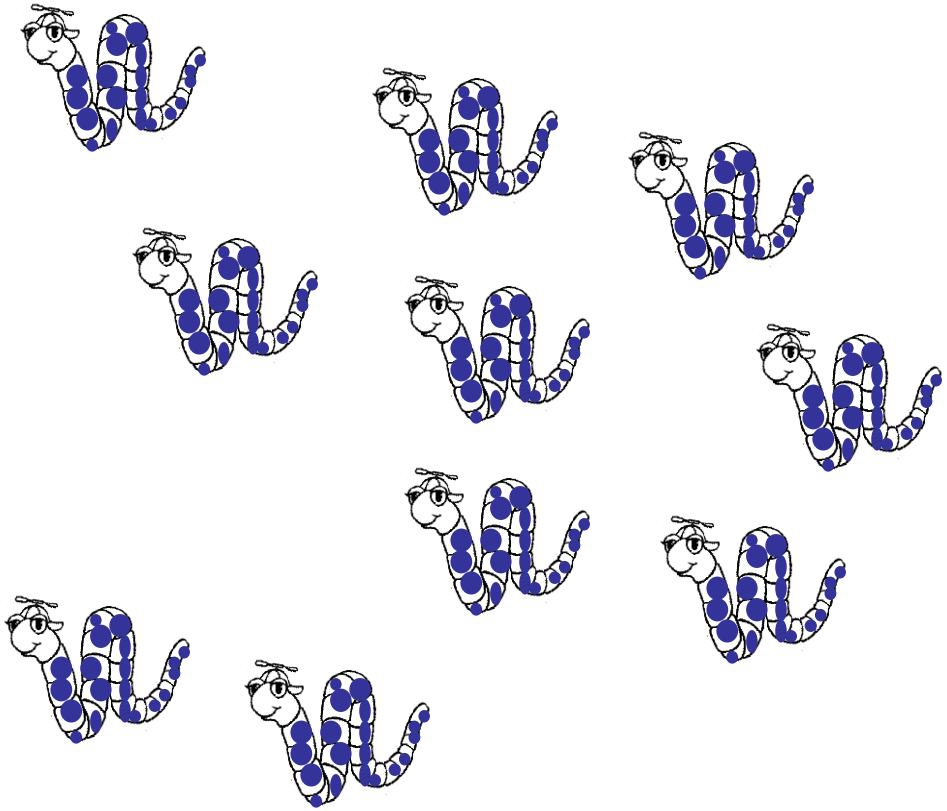

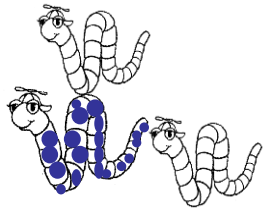

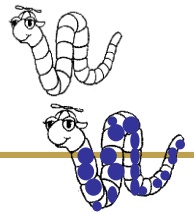

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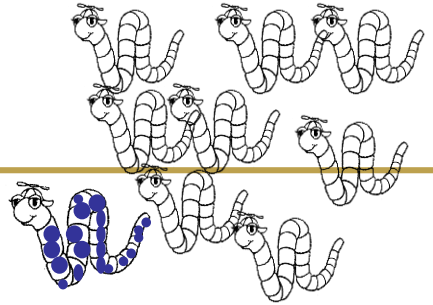

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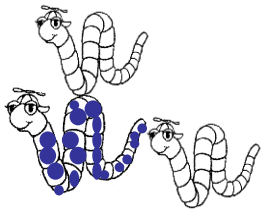

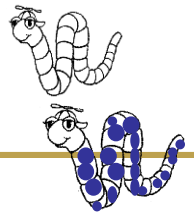

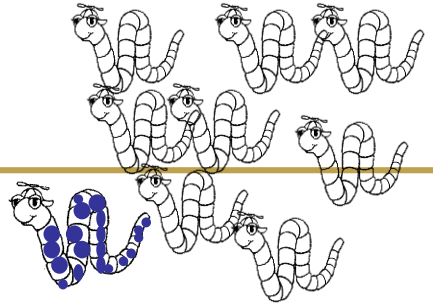

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refugia

De-worm smart, not hard:

Step #5: **Pick the right drug**

- Use products that are effective in your area against the parasites of concern
- Fenbendazole, oxibendazole, pyrantal pamoate only kill the harmless adults. Ivermectin gets some un-encysted larvae
- Why give them? To prevent egg contamination of your pasture
  - #1 goal of a good de-worming program

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Step # 6: **Use the correct dosing interval**

- De-worming every eight weeks?
  - De-wormers suppress egg production for different amounts of time:
  - Quest (moxidectin): 12 weeks ???
  - Zimectrin (ivermectin): 4-8 weeks
  - Anthelcide (oxibendazole): 4 weeks
  - Panacur (fenbendazole): 4 weeks
  - Strongid (pyrantel pamoate): 4 weeks

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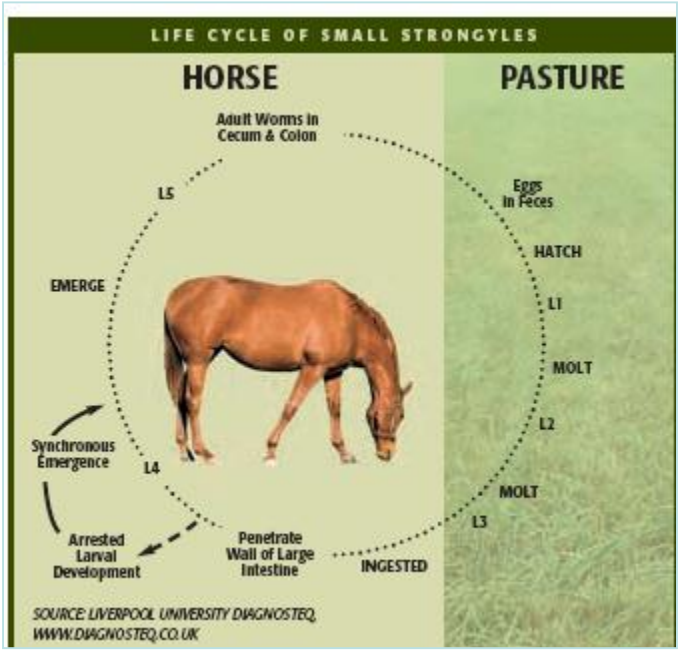
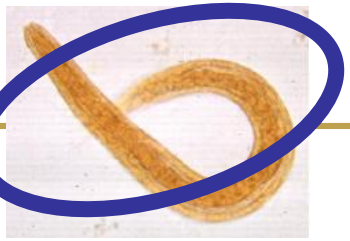
Step # 7: **Consider life stage of each patient**

- Parascaris in foals is a major concern
  - Poor growth and ill thrift
  - Ascarid impactions carry a very poor prognosis
  - Known resistance throughout Australia and New Zealand
- Treatment protocol
  - First @ 10-12 weeks
    - Any earlier does not prevent disease
  - Second @ 5-6 months
  - Third @ 91-12 months
  - Combination product
    - Ivermectin
    - Praziquantel
    - Pyrantel

De-worm smart, not hard:

Step # 8: **Use seasonal de-worming**





De-worm smart, not hard:

Step # 9: **Reduce larval numbers**

- Remember, it takes 3 days from egg to L3
  - Pick up manure every 3-5 days
  - Do not drag fields that are occupied

De-worm smart, not hard:

Step # 10: **Educate your friends!**

- The *bad* old days
  - No good de-wormers
  - A lot of fatal colics
- The *good* old days
  - New effective drugs, great control
  - "Recipe"/calendar approach very effective
- The present time
  - Emerging resistance, no new drugs
  - New threats necessitate better diagnostics, more individualized programs

Ideal Adult Management

- Perform FEC 2-3 times a year
- Only deworm those who need it
  - High shedders
  - Horse with clinical signs
- Use products that are seasonably logical
- Use products that you can easily administer

Cost?

- Treating horses 6 times a year was similar in cost to doing FECs and treating only when needed.
- An additional bonus: horses have better parasite control, and resistance is minimized.

*Fenbendazole can be used as a treatment for encysted cyathostomes in horses under veterinary supervision.[1]

*Equimax Liquid worm drench to be administered by vet to control tapeworms.

1 Steinbach T. (2006) Small Strongyle Infection: Consequences of larvicidal treatment of horses with fenbendazole and moxidectin Vet. Parasitol., 139:115-131