Culture and Sensitivity Test: In Case of Infection
by Dana Krempels

If your bunny has an infection of any kind—from an upper respiratory infection, to a jaw abscess to a urinary tract infection—it's critical to know which antibiotics will be effective against the particular pathogen (i.e., disease-causing agent) causing the problem. This means that (1) the species (and strain) of bacteria (or other pathogen) must be identified and (2) the drugs most effective at killing them or inhibiting their growth must be determined. The only reliable way this can be done is with a culture and sensitivity test.

How is a Culture and Sensitivity Test Done?

Your rabbit-experienced vet will take a sample of infected tissue or discharge from the infected area (the capsule of an abscess is the best location from which to take a sample, as the internal pus often contains only dead bacteria that will not grow in culture), and send it in a special culture tube to a licensed laboratory for testing.

In the lab, technicians will spread a sample of the infective material onto a plate of nutrient substance (usually agar, a type of gel made from algae, fortified with nutrients) and allow to grow whatever species of bacteria were in the bunny's infected tissues. With a sufficient population of bacteria grown on the plate in the form of a "lawn", the technicians will perform two main operations:

1. Identification of the bacterial species.
   This is done with various techniques, including examination of lawn characteristics (color, texture, growth pattern, etc.) gram-staining, microscopic examination, metabolic requirement "footprints" and even DNA sequencing. Bacterial species commonly isolated from rabbit infections include Pasteurella multocida, Pseudomonas aeruginosa, Bordetella bronchiseptica, Staphylococcus aureus, and Enterobacter cloacae, though a variety of bacteria may turn up, depending on the location and cause of the infection.

2. Determination of bacterial sensitivity to antibiotics
   This can be done by placing small disks of filter paper or agar impregnated with various types of antibiotics onto the bacterial lawn. The bacteria are allowed to incubate for a day or two, and then the plate is examined to see whether (continued on page 2)
Culture and Sensitivity, continued from page 1

the bacterial growth is inhibited (or not) by the antibiotics on each disk.

What Will the Results of the Test Tell Us?
The results of the test usually are provided as a table listing the names of antibiotics tested, and one of three letters paired with each antibiotic: S (sensitive), R (resistant), or I (intermediate). (If a simple dot appears instead of a letter, it means that the particular antibiotic was not included in the test.) But what do these terms mean, and how are they determined?

Sensitive (S): In this case, a clear, circular "halo" (technically known as a "plaque," or zone of inhibition) will appear around the antibiotic disk, indicating an absence of bacteria. The antibiotic has inhibited their growth and/or killed them, meaning that this particular antibiotic should be effective against the infection your rabbit has.

Intermediate (I): A somewhat cloudy plaque indicates that not all the bacteria in the area around the disk have been killed. This means that there are some members of the bacterial population that are sensitive to this particular antibiotic, but others that are genetically immune to its effects. If an antibiotic to which the bacteria show "intermediate" sensitivity is used, it is possible that the sensitive members of the bacterial population will be killed, leaving the resistant ones to reproduce. This can result in the selection of a population entirely resistant to that particular antibiotic.

Resistant (R): In this case, the filter paper will have no discernable plaque around it, meaning that the bacteria are growing normally, even in the presence of the antibiotic producing no plaque is unlikely to be effective against the bacteria causing your bunny's infection.

In three to seven days, your vet will receive the results from the lab, including the species of bacteria and the range of antibiotics to which the bacteria are sensitive (S), resistant (R) and intermediate sensitive (I). "Sensitive" means that the bacteria were inhibited or killed by that particular antibiotic, and this is what you want to hear.

Choosing and Using the Appropriate Antibiotic
Not all antibiotics are safe for rabbits! A rabbit-experienced veterinarian will not prescribe oral penicillins (e.g., amoxycillin, ampicillin, penicillin) or lincosamides in general (e.g., clindamycin, lincomycin), as they can cause fatal cecal dysbiosis. These antibiotics are dangerous because they kill normal, beneficial intestinal

The Petri dish shows Pseudomonas aeruginosa (cloudy background on the plate) being strongly inhibited (S) by three different types of antibiotic, moderately inhibited (I) by three, and unaffected (R) by the six antibiotic disks with no plaque around them.
microorganisms, but not certain dangerous ones, such as *Clostridium* spp. In the absence of competition from beneficial bacteria and other microorganisms, *Clostridium* will proliferate and—in most cases—produce potentially deadly toxins that destroy the intestine and liver. For this reason, it's very important that your rabbit is treated by a veterinarian who is familiar with the special medical needs of rabbits. If you don't already have such a vet, you can find one via the list linked at the House Rabbit Society's Veterinary Referral Page: [www.rabbit.org/vets](http://www.rabbit.org/vets).

Commonly used antibiotics that are safe for rabbits include the fluoroquinolones (e.g., enrofloxacin (Brand name: Baytril), ciprofloxacin, marbofloxacin (Brand name: Zeniquin)), difloxacin (brand name Dicural); trimethoprim sulfadiazine (Brand names: Tribrissen, Septra, Bactrim, Sulfatrim), sulfadimethoxine (Brand name: Albon), chloramphenicol, aminoglycosides (e.g., gentamycin, tobramycin, amikacin--though these are not a first choice as they can be toxic to the kidneys), and injectible Penicillin G Procaine with Benzathine ("bicillin"). Some of these work synergistically (i.e., better together than either one works individually), and some may have interactions with other drugs. Thus, it's essential that the appropriate rabbit-safe antibiotic for the particular infection be prescribed and administered by a rabbit-experienced veterinarian who is familiar with the modes of action and potential interactions of these drugs. It is also important that the antibiotics be given long enough to allow the bunny's immune system to conquer the infection (with a bit of help from the antibiotics). Many rabbit-savvy vets recommend that antibiotics be continued for 10 – 14 days after symptoms of illness have subsided, to be sure that the bacterial population is truly under control.

A full course of antibiotic treatment can take several weeks. Don't delay having your bunny properly diagnosed and treated. Almost any infection can develop into a much worse problem if left to its own devices.

When your bunny is receiving antibiotics, it is extremely important to
** give the full dose
** not miss any doses
** continue the treatment for the full time period your vet prescribes, *even if symptoms of infection subside.*

If you stop treatment early, or give too low a dosage, you risk breeding resistant strains of bacteria by killing off only those most sensitive to the drug(s) you are using, and leaving only the more resistant individuals behind to be the progenitors of the next generation, and to share their genetic resistance with the sensitive members of the bacterial population in ways that only bacteria can (transformation and conjugation). Misuse of antibiotics can cause real problems; they should be used only under the supervision of a qualified medical or veterinary professional.

**Why Bother with a Culture and Sensitivity Test?**

Some veterinarians who are not as experienced with rabbits as they are with cats and dogs will take one look at a rabbit with "snuffles" or other infection and proclaim that the problem is caused by *Pasteurella multocida*. Although this bacterial species is not uncommonly carried by rabbits, please do not let anyone convince you that your rabbit's problem is caused by *Pasteurella* unless that diagnosis is confirmed via culture and sensitivity test. Not only are some strains of *Pasteurella* resistant to commonly prescribed antibiotics, but infections in rabbits also can be caused by even more resilient strains of bacteria, such as *Pseudomonas aeruginosa*, *Bordetella bronchiseptica*, *Enterobacter cloacae*, *Staphylococcus aureus*, and many others. Without a culture and sensitivity test to positively I.D. the pathogen, you not only delay your
rabbit's return to good health, but also might waste money by treating with an antibiotic that's not effective against the particular strain of bacteria causing your bunny's infection.

If the results of the culture and sensitivity test come back as "no growth" for bacteria, then it's possible that the infection is being caused by anaerobic bacteria that require special collection techniques for growth and identification. This isn't common, but is something to consider. Alternatively, no bacterial growth could mean that the problem is being caused by a fungal infection. If this is the case, antibiotics—ineffective against fungi—are likely to make the problem worse, not better. Hence, it's wise to check for fungal species if the culture and sensitivity test comes back negative for bacteria. Completely different medications (not antibiotics) are needed to control infections caused by fungi.

**Followup: Backtracking to the Cause**

Once an infection is under control, it's smart to do a bit of detective work and seek possible causes, especially if the condition is chronic. For example, runny eyes and nose may have their origin in the molar roots, which are located directly under the eyes and very close to the sinuses. Jaw abscesses and retrobulbar (i.e., behind the eye) infections can sometimes result from loose molars, or molar roots intruding farther into the skull than normal, due to the combined forces of osteoporosis and the normal chewing pressure to which molars are subject as the bunny chews.

Dental problems are more common in older rabbits, but all rabbits should routinely have their molars checked for spurs, which are not only painful, but potentially dangerous. A tear duct flush will sometimes temporarily stop runny eye problems, but ultimately it is best to do a complete check for molar problems including visual inspection for spurs and even radiographs to detect molar root infections.

Good care, healthy diet, a happy, calm environment, and your constant vigilance for problems are your bunny's best insurance for a long, healthy, infection-free life. But when even those things fail, it's good to know there are medications that can help, as long as they're used wisely, appropriately, and always under the supervision of a good, rabbit-savvy veterinarian.

**H.A.R.E. Goes to the Movies!**

It was a new venue for us, but thanks to the kindness of Manager Bob, H.A.R.E., Inc. had not one, but two successful outreach fundraisers at the Regal Stadium Theaters in Kendall. The first was for the premier of "Wallace and Gromit: Curse of the Were Rabbit", and more recently we manned a display table and education booth in the Regal lobby for the premier of "Open Season". The crowds were wonderful and receptive! They visited politely with our foster ambassador bunnies, Edgar, Blossom, and Jasmine, and were generous with donations. We even met people interested in adopting rabbits, and are hoping to work with them soon to find just the right bunny for just the right home. Thanks to our wonderful volunteers, and to Bob and the whole crew at Regal Cinemas, who were endlessly cheerful and helpful.
Miami’s Most Adoptable Rabbits

Our rescued rabbits come in just about every shape, size and temperament, and only a few of them are pictured here. We can tell you who’s with us and more about their individual personalities when you call, but they all have one thing in common: the need for a loving, permanent indoor home. Please call (305) 666-BUNN or email dana@miami.edu for more information. You can visit our web site to view our most recent adoptable bunnies at www.bio.miami.edu/hare/adoptabun.html.

Jasmine is a little Dutch street waif who spent several months eluding dogs, cats, and over-eager children in a Miami neighborhood before a concerned gentleman called us to come rescue her. She’s a beautiful slate blue and white, soft as velvet. She loves the life of security she has now, and is happy to sit and be petted for as long as you want to pet her. Jazz is curious and sociable, but probably would do best in a home without children: her early experiences on the street have made her wary of kids.

Jazz is smart, friendly, and has very tidy litterbox habits.

SnowBlossom is a sweet little white dwarf who was dropped off at Animal Control to be euthanized. She is very gentle and friendly, loves to be petted. She would make a great companion for a lonely boy bunny, or an adult who spends time at home and needs a bunny who will probably end up sitting happily at your feet while you relax or work. Her litterbox habits are excellent.

The Seven Bunnurai were found cramped into two small cages, ankle-deep in a week’s worth of their own waste without food or water. The apartment—filled with cat and dog feces and crawling with cockroaches—had been abandoned, along with the rabbits. There’s just no end to human negligence and cruelty.

Despite their rough start, these lovely rabbits are friendly and outgoing. Some are bonded, and should go as pairs. Others would make fine spouses for some lonely bunny out there. Or you could take all seven and start your own Watership Down Warren. They all get along well, and are adorable when they lie down in a big, colorful bunny clot.

From left to right: Tanya, Chuck, Alana and Koko. Not pictured are Lemony Snicket (agouti, like Tanya and Alana), Olaf and Hjalmar (both silky black). These are small, friendly bunnies who love to cuddle.

Even if the bunnies seen above have found homes by the time you read this newsletter, be sure to visit www.bio.miami.edu/hare/adoptabun.html to see more pictures of our other adoptable bunnies. There are also links to other local shelters and foster homes.
We've Been Adopted!

We're happy to share the good news when our fosters find the home of their dreams. Here are just a few of the many bunnies who found loving, permanent families through the H.A.R.E. in 2006.

**Betsy** and **Sam** found love and a wonderful new home together with **Norma Carol**, who loves them as her own children.

**Curry** and **Crystal** have a Room with a View with the **Glauberman Family**, high above Key Biscayne.

**Jambo, Trevor**, and **Higgins** are all living in wedded bliss—each to his own new girlfriend—with **Sheri Kempinski**.

**Franklin** is living in pampered splendor with **Lesperance/Lemaire Family**, where he's the center of attention and likes to watch TV with the family.

**Edgar and Benny** both went to live with the **Contreras Family**, where each boy has his own little bunny wife and lives a life of luxury and love.

These are just a few of the lovely rabbits that were adopted from H.A.R.E. in 2005 and 2006. Perhaps we'll see your name here next time!

---

New Premiums! Your purchases support the Rescue and Rehabilitation efforts of H.A.R.E., Inc.

This fine pewter pin, made in the U.K., is about 1.75" long and 1" high. It can be worn as a pin, a tie tack, or in a pair, as cufflinks. A wonderful gift for the rabbit lovers in your life! $10.00 each, plus shipping.

---

Reduce/Reuse/Recycle! Never waste another grocery bag! These indestructible totes, made from 100% recycled plastic liter soda bottles, will hold your heaviest groceries without leaking or breaking. One side says, "Rabbits: They're not disposable. They're a 10 year commitment."

The other side sports the international recycling symbol with the words, "When you throw something away, where's away?" $10.00 each, plus shipping.
JOIN Housrabbit Rescue, Adoption & Education (H.A.R.E.)

Your contribution helps defray the costs of spay/neuter, medical care and maintenance of rescued rabbits. Make checks payable to The House Rabbit Society of Miami, and save your cancelled check as a record of your tax deductible donation. Mail completed form and check or money order (no cash, please) to: House Rabbit Society of Miami, c/o Dana Krempels University of Miami Biology Department Coral Gables, FL 33124. H.A.R.E., Inc. has the ultimate authority to use contributions at the discretion of the H.A.R.E., Inc. Board of Directors for purposes consistent with the tax-exempt purposes of the corporation. For more information, please call (305) 666-BUNN or email dana@miami.edu

Name: ____________________________
Address: ____________________________
City/State/Zip: ____________________________
Email Address: ____________________________

<table>
<thead>
<tr>
<th>Donation level</th>
<th>Contribution</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiver</td>
<td>$ 5</td>
<td>A warm, fuzzy feeling</td>
</tr>
<tr>
<td>Hazel</td>
<td>$ 12</td>
<td>Warren Peace (4 issues)</td>
</tr>
<tr>
<td>BigWig</td>
<td>$ 30</td>
<td>Warren Peace &amp; HRS shopping bag</td>
</tr>
<tr>
<td>El-a-Hrair Rah</td>
<td>$ 50</td>
<td>Warren Peace, HRS shopping bag &amp; pewter HARE pin</td>
</tr>
<tr>
<td>Frith</td>
<td>$100</td>
<td>Warren Peace, HRS shopping bag, pewter HARE pin and Handcrafted rabbit notecards</td>
</tr>
</tbody>
</table>

JOIN THE NATIONAL HOUSE RABBIT SOCIETY

Membership Type
[ ] United States $18.00/year
[ ] International/Canada $25.00/year

Additional Donation $ _________

Total Enclosed $ _________

Payment Method
[ ] Personal Check (in US dollars)
[ ] International Money Order (in US dollars)
[ ] Credit Card (Visa or Master Card)
   Card Number: ____________________________
   Expiration Date: ____________________________

Member Information
Name: ____________________________
Address: ____________________________
City/State/Zip: ____________________________
Email Address: ____________________________

Mail completed form to:
House Rabbit Society, 148 Broadway Richmond, CA 94804
Your check is your receipt. All donations are tax-deductible.
WE STILL NEED BUNNY-LOVING VOLUNTEERS!

The House Rabbit Society of Miami is in desperate need of volunteers to help with our rescue efforts and organization. We're especially interested in folks who can help with:

- Fostering rescued rabbits
- Transportation of rescued rabbits
- Newsletter layout, typesetting, and mailing
- Organization of meetings and special events

We need volunteers in Dade, Broward, and Palm Beach counties, as we're dealing with rescued rabbits and trying to reach Rabbit People in all three areas. If you would like to help, or would like more information about any of the above (or other areas in which you have expertise), please email dana@miami.edu or phone our HOPLINE at (305) 666-2866.

House Rabbit Society of Miami

*Warren Peace* is published by H.A.R.E. (Houserabbit Adoption Rescue and Education), an official Chapter of the National House Rabbit Society, an all-volunteer, non-profit organization dedicated to the rescue and welfare of domestic rabbits. Visit HRS online at [www.rabbit.org](http://www.rabbit.org)

The H.A.R.E. Hotline is (305) 666-BUNN.
Visit our web site at [hare.bio.miami.edu](http://hare.bio.miami.edu)

**Newsletter Editor:** Dana Krempels
**Board of Directors:** Dana Krempels, Kevin Johnson, Marielle Gomez-Kaifer

---

H.A.R.E., Inc.
c/o University of Miami Biology Department
Coral Gables, FL 33124

Not yet a member? To continue receiving *Warren Peace*, please use the form inside this newsletter to join H.A.R.E.