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PRESERVE the delicate balance of the ecosystem
MANAGE the development of resistance to preserve efficacy for generations to come
DELIVER increased efficacy against specific vector species
CREATE SOLUTIONS FOR DIVERSE SITUATIONS
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PROVIDE residual control

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MINIMIZE the limitations of each AI
MAXIMIZE the strengths of each AI
DELIVER precise amounts of each AI

TARGET THE RIGHT SPECIES
The art of developing effective biorational solutions begins and ends with target specificity.

PRESERVE the delicate balance of the ecosystem
AVOID harm to predator and pollinator populations

CUSTOMIZE SOLUTIONS
Distinct needs in the field drive development of customized solutions.

DELIVER pre-hatch control
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MAINTAIN residual control after multiple flood/dry-down cycles
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About the Cover: Aedes cinereus, a fierce biter in certain seasons, often prefers to bite unprotected ankles. Photo by Sean McCann, entomologist and blogger at www.ibycter.com.
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For anyone involved in vector management, or any aspect of pest management, it is virtually impossible to be unaware of current concerns regarding pollinator health and claims made by some that insecticides are the culprit in this problem. These allegations can be found on the Internet and in the popular press, even including an appearance on the cover of *Time* magazine.

Of all the insects considered beneficial, perhaps none is more favorably viewed by the public than the western honey bee, *Apis mellifera*; see Figure 1. We have learned to embrace these insects, inspired by appealing images that help sell cereal, feed a hungry Winnie the Pooh, and have even been voiced by Jerry Seinfeld in the popular 2007 animated film, "Bee Movie."

Honey bees are responsible for pollinating many fruits and vegetables necessary for a healthy diet and are an important contributor to the rich diversity of flowering plants around homes and gardens. As the world’s population grows, so does the pressure to produce more food. Honey bees provide an important benefit to agriculture through pollination of many food crops – a task only bees and a select few other insects can achieve.

In 2006, some beekeepers began to report unusual colony losses throughout the United States. Along with higher than expected overwintering mortality, beekeepers reported that in some hives, adult worker bees abandoned their colonies within a short period of time, leaving the colony to die.

This specific ‘condition’ was termed Colony Collapse Disorder (CCD) and has been used frequently – and incorrectly – by the media as the descriptive term to define the broad problems associated with honey bee health. Although it has been useful to increase public awareness of the legitimate issues facing honey bees, CCD is not a disease. There is no single malady affecting all honey bee colonies. In a national survey conducted in the US, 5500 beekeepers listed the factors they believed were contributing to the decline/losses of their colonies (Spleen et al 2013):

- Weak colonies in the fall 34%
- Queen failure 32%
- Starvation 31%
- *Varroa* mites 17%
- Poor wintering conditions 10%
- CCD 9%
- Pesticides 7%
- *Nosema* (disease) 6%
- Small hive beetles (pest) 4%

The survey was self-reported and there was no consistent understanding of symptoms. These numbers add up to more than 100 as some beekeepers attributed losses to multiple causes.

Unfortunately, some activist groups have used the reports of honey bee health problems to promote their anti-pesticide agenda by blaming the ‘threat’ to bees strictly on insecticides, particularly on one class of chemistry, the neonicotinoids.

---

**Figure 1:** The western honey bee, *Apis mellifera*. Photo by Charles J Sharp
The issue of honey bee health is complex and is being manipulated by anti-pesticide activists to affect public opinion by appealing to their natural sympathy toward these beneficial insects. After all, who would not want to protect honey bees?

For these groups, it is easy to connect bee health problems with an easy scapegoat – insecticides. The activists and some in the media readily refer to scientific articles that imply neonicotinoids are a major factor affecting bees. Bayer scientists found one study (Lu et al 2014) seriously flawed, because bees were fed a tenfold amount of neonicotinoids normally encountered, an amount determined to be both unrealistic and deceptive, representing a disservice to scientific investigation into honey bee health (Keller 2014). Unfortunately, the general public has neither the expertise nor the patience to discern the difference between good and bad science.

Scientists and regulatory authorities agree bee health is a complex issue and researchers are continuing to seek answers for honey bee colony decline. Peer-reviewed science has discovered and published that the stressors contributing to reduced health of honey bees are complex and accumulative. These stressors include: genetic weakness (decades of inbreeding replacement bee stock); nutrition (exposure to monoculture croplands and lack of wild foraging variety); disease (bacteria, viruses and fungi); parasites (Varroa and tracheal mites); beekeeping practices and yes, pesticides; see Figure 2.

A 2013 Report on the National Stakeholders Conference on Honey Bee Health, organized by the US Department of Agriculture (USDA) and the US Environmental Protection Agency (EPA) to investigate the causes of CCD, clearly states that pesticides are a concern, but not the leading contributor to poor colony health; see http://www.usda.gov/documents/ReportHoneyBeeHealth.pdf.

Perhaps the most significant contributor to poor colony health is the parasitic mite, Varroa destructor,
which was introduced to the US in the late 1980s; see Figure 3. This mite attaches to adult and immature honey bees, feeding on their hemolymph, just as a tick would feed on you or your dog. As with ticks, *V destructor* can carry a number of serious pathogens that infect the host bee and later the entire colony. In a 2013 report, the USDA acknowledged that *Varroa* “remains the single most detrimental pest of honey bees, and is closely associated with overwintering colony declines.”

Contrary to claims made by some anti-pesticide groups, extensive studies in Europe and North America have shown that poor bee health is strongly correlated with the presence of *Varroa*, not exposure to neonicotinoids. Neonicotinoid products have been used in Australia since the 1990s, yet in a recent report, Australian authorities noted these uses have “led to an overall reduction in the risks” associated with agricultural and horticultural application of insecticides. The report continued, noting that honey bee populations “are not in decline, despite the increased use of this group of insecticides.” The big difference between the US and Australia is that the *Varroa* mite does not occur in that country.

Unfortunately the activists and some beekeepers are ignoring these facts and continue to fuel public sentiment against these important pest management tools. Just as unfortunate, a small number of bee-loss incidents have been given special media attention that has raised public anxiety and concern. A real danger is that such concern is often the stimulus for political action that may adversely impact mosquito abatement operations, even though no further need of restriction or regulation may be necessary.

Incidents in Oregon and Minnesota have led to local prohibitive regulations, as well as in Washington, Maine, Vermont and Ontario, Canada. Even though some of these incidents were the result of avoidable misapplication, and despite scientific evidence supporting continued use of neonicotinoids, many politicians feel the need to act.

It is important for all parties to understand that honey bees are susceptible to many insecticides. After all, honey bees are insects. Neonicotinoids, pyrethroids, pyroles, organophosphates, carbamates, and organic pyrethrums will kill honey bees when exposed to a toxic dose. Boric acid – all the EPA 25(b) exempt active ingredients (many of these formulations are actually labeled to control “bees”) and even soap (there are registered insecticidal soaps) – will kill bees based on the level of exposure, not just the inherent toxicity of the active ingredient.

The North American Bee Care Center, which opened in 2014, was designed to unite Bayer’s extensive bee health experience and knowledge under one coordinated platform; see Figure 4.
The Center’s initiatives include:

- Fostering discussion and sharing of new ideas with beekeepers, farmers and others interested in engaging in the conversation on bee health.

- Building on Bayer’s more than 25 years of providing products to combat bee diseases with an increased focus on research and development.

- Working with partners to develop new technologies to support product stewardship and sustainable agriculture.

- Collaborating with universities and researchers to jointly develop sustainable solutions for bee health.

For mosquito control professionals it may seem an ‘easy’ solution to simply respond to this issue by replying to the public that our districts do not use products that contain active ingredients that are being highlighted by the activists and the media. However, remember the true goal of the anti-pesticide groups is not restricted to one class of insecticides. Prohibiting the use of any insecticide product or class would be a major setback that likely would expand to products beyond the neonicotinoids.

The label changes mandated for neonicotinoids are not the first pollinator hazard label requirement to appear on products we use. Such hazard statements currently appear on pyrethroids registered for outdoor use. EPA has made it clear to registrants that ANY product registered in a manner that may result in exposure to honey bees will be evaluated for pollinator hazards as they come up in the current re-registration queue.

Fortunately, our industry understands the importance of sound product stewardship to protect people, wildlife and our environment. Given that the pipeline of new insecticides is not guaranteed to produce ever-increasing options, we must be good stewards of all of our chemistries, or face further restrictions that will take effective products away from us.

So what is a mosquito abatement district to do? We suggest the following:

- Train all personnel on how to communicate with their constituents on the real issues affecting bee health.

- Prepare a ‘Fact Sheet’ on your program’s activities, including risk mitigation regarding pollinator health.

- Establish a relationship with your local apiary specialist, typically employed through your state’s department of agriculture or university extension service.

- Communicate with your local beekeepers and beekeeping associations.

- Develop a honey bee colony location list, noting that these may be transient within a given season. Make refinement and updating the list an ‘evergreen’ project and avoid treating areas with bees if practical.

- Notify beekeepers of your spray routes and treatment schedule.

- Recommend that hives be placed in these areas to help reduce exposure: 1) 300 feet away from truck spray routes; 2) in protected areas, if possible – under tree canopies, opposite side of bushes, shrubs, and fences from the spray vehicle; and 3) upwind from established spray routes, as prevailing winds are often predictable.

- Identify a beekeeper willing to rescue bee swarms, if reported.

- Remember to time adulticide applications when honey bees are not active, both by site (blooming crops/trees/plants) and time (after dusk and before dawn), whenever practical.

A respectful relationship between mosquito abatement programs and beekeepers will go a long way toward preventing incidents and generating unnecessary public concern.

REFERENCES CITED


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Skeeter Life: Exemplifying the Professional Commitment of Mosquito Control Employees
by Aaron Lloyd and Roxanne Connelly

INTRODUCTION

The Florida Mosquito Control Association’s (FMCA) annual Dodd Short Courses (DSC) have offered world class training to public health personnel in the State of Florida and beyond for the past 31 years. Every year, without hesitation, a group of instructors from various mosquito control programs, federal and state agencies, universities and colleges come together to teach a wide range of courses to provide education for both novice and seasoned public health professionals. The week-long DSC has an intense agenda that operates seamlessly because of the multi-year dedication of employees of the vector control industry, volunteering as organizers, instructors and facilitators.

Dedication to our industry does not begin or stop with the DSC, nor is it limited to a 40-hour workweek. Most mosquito control personnel work well beyond their paid time because of outstanding work ethic and desire to constantly improve their knowledge and ability to protect the public’s health. Whether you volunteer your time as a committee member or course instructor, or simply check every water source you see during your off time for mosquito larvae, the extra effort volunteered by numerous mosquito control personnel is the catalyst that ensures mission accomplishment.

The DSC committee, responsible for programming and organizing this annual training event, recognized this dedication and realized that the work life of most mosquito control personnel quickly spills over into their personal life, becoming a way of life — Skeeter Life.

DESIGN PROCESS

Many have seen the countless window decals and bumper stickers – Salt Life, Swamp Life, Hunt Life, Mud Life, etc – designed to promote the activities that people are dedicated to, in their work, hobby or lifestyle. Members of the DSC committee were working to create a logo for the 2014 program and the idea of Skeeter Life was introduced as a possibility. The committee did not want to use it for the 2014 Dodd Short Courses program because they liked the idea enough to make it a permanent DSC symbol, rather than using it once as an annual logo and then mark it as history. The DSC committee worked together during meetings and by e-mail exchanging ideas until a logo design determination was made.

Figure 1: The FMCA’s Skeeter Life logo was designed by biologist Hana Nardi.
There are several details implemented into the *Skeeter Life* logo that represent the mosquito control industry; see Figure 1. Look closely and you will see a pupa used for an “e” in Skeeter; a larva replaced the “i” in Life; two dippers were used to centralize the design; and finally a skeletonized mosquito head to accentuate a tribal look. Hana Nardi, a talented artist from Lee County, FL, with a degree in environmental studies, was hired to translate the logo from crude sketches and committee member ideas into a high quality artistic design.

**SKEETER LIFE PRODUCT ROLLOUT**

The first introduction to *Skeeter Life* products occurred during the DSC 30th anniversary in early winter 2014. Several items were offered, including hats, pens, shirts, water bottles and car decals; see Figure 2.

Response from the DSC attendees were promising, and that encouraged the DSC committee to continue offering *Skeeter Life* products at mosquito control meetings. *Skeeter Life* products were subsequently made available at the chikungunya/dengue vector control workshop hosted at the Florida Medical Entomology Laboratory in Vero Beach, FL, June 2014, and the 86th FMCA Annual Fall Meeting in Weston, FL, November 2014; see Figure 3.

The FMCA will be exhibiting at the 81st American Mosquito Control Association Annual Meeting in spring 2015 at the Hilton New Orleans Riverside Hotel, New Orleans, LA. Located in the exhibit hall, the booth will offer information on FMCA, the Aerial Short Course, and Dodd Short Courses, copies of *Wing Beats* magazine, and *Skeeter Life* products for sale.

For those unable to attend meetings, all of the products are available to view and purchase at [www.skeeterlife.org](http://www.skeeterlife.org). At this time, all profits made...
from the sale of *Skeeter Life* products are donated to the Haiti Mosquito Control Association, supporting mosquito control education initiatives and establishment of formal mosquito control programs in Haiti (Jules 2014).

*Skeeter Life* was designed to represent those mosquito control personnel who enjoy their work and are proud to be a vital part of such an outstanding group. The DSC committee appreciates the time and effort of all involved in the management and distribution of the products as well as the support shown by mosquito control personnel with the continued purchase of *Skeeter Life* products.

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The development of this product is an example of the old proverb, “Necessity is the mother of invention.” Our case in point: the IsoLair 4500-206 Broadcaster® and 4500-500 Broadcaster® granular applicators. These systems use a slide gate to regulate material flow from the hopper and are adjusted with a micrometer. The opening of this gate is rather small because of the low application rates of larval mosquito control products, making calibration difficult and not reliably reproducible, even though the settings are made with the micrometer. Because it is a gravity fed system, the load weight affects the flow, resulting in flow changes as the hopper empties.

We at Lee County Mosquito District (LCMCD) as well as others have pondered how to improve this system. We came to the realization that any improvement would need to be a positive displacement design to overcome the issues of a gravity feed system, and decided upon an impeller driven design. However, questions arose as to whether this would crush granular formulations or if jamming would be an issue. During development, two other issues were identified and required resolution. First, the IsoLair system incorporates a ventri between the blade gate and the exit fins, creating a vacuum below the hopper. In the impeller delivery system the vacuum would draw the granules past the unloaded blades of the impeller when it was not rotating. The second issue was preventing granules from flowing past the impeller by gravity when it was not moving.

A flexible impeller was chosen over a rigid one. Factoring in cost, availability and design, our proof-of-concept prototype and final design were
based on an outboard motorboat engine water pump impeller; see Figure 1. In order to maintain the external dimensions of the equipment, the rotary gate was designed to fit into the blade gate housing section of the IsoLair located just below the hopper; see Figure 2. To maximize the impeller size and accommodate the space, prototype II moves material left to right as well as top to bottom; see Figure 3.

To prevent material from flowing through the gate when it was not moving, an extension of the case surrounding the impeller was incorporated. This requires the impeller to push material upward before it exits the gate. The clearance between the impeller and its case is 0.125 inch. The flexible impeller prevents the granules from jamming while the selected clearance prevents binding at the top of the gate where the impeller closes against the case as well as between the impeller and the case. The combination of flexible impeller and relative large clearance creates little drag, allowing the use of a small motor which experiences a load of only 0.8 amp; see Figure 4. Granules are prevented from being sucked out of the hopper through the clearance gap along the unloaded side of the impeller by long bristled velveteen material (paint pad material) which blocks the gap; see Figure 5.

Using this positive displacement design, calibration is based on revolutions per minute (rpm), providing a high level of precision and ability to easily change calibrations in the field for different materials and/or application rates. When GPS mediated larviciding is used in conjunction with the rotary metering gate, flow rate can be adjusted based on actual ground speed. LCMCD is working with Ag-Nav to develop the control system for the rotary metering gate. They will offer a rotary metering gate conversion for the IsoLair Broadcaster systems with system controls.
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built into the Guia, which will include calibration, storage of settings for calibrated materials and flow control to provide accurate application rate based on ground speed.

LCMCD used this system during the 2013 mosquito season without any failures associated with the new design; see Figure 6. Calibrations were easily reproducible by resetting the impeller rpm to the prescribed setting. Unbalanced hoppers due to changes in calibrations no longer occurred and the hoppers were empty when they were expected to be empty.

ACKNOWLEDGMENTS

The development of this product was assisted by the knowledge, skill, ingenuity and patience of LCMCD colleagues, Cesar Bacares, machinist and Paul Woodside, avionics.

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INTRODUCTION

In addition to the annoying itch resulting from biting insects, arthropod-borne diseases including Lyme disease, encephalitis, Rocky Mountain spotted fever and West Nile virus are a cause of concern for many individuals who wish to enjoy the outdoor environment during the warmer months of the year. Additional concerns regarding the Heartland and dengue viruses have raised the demand for effective repellents to a new level. Over the years, military personnel of various nations experienced these same concerns and conducted many field studies in order to develop repellents to protect their soldiers. While some armies used oils of citronella, camphor and paraffin as repellents, they were found to be effective for only limited periods of time. As a result, the search for more effective repellents continued, leading to the discovery of N,N-diethyl-m-toluamide (DEET). DEET “was developed and patented by the US Army in 1946 for use by military personnel in insect-infested areas... and was registered for use by the general public in the US in 1957” (EPA 1980).

Over the years, as cases of arbovirus infections continued to be reported in the news, so did the use of DEET. However, with the increased use of DEET, reports of adverse reactions associated with its use began to surface (Corbel et al 1999). Increased awareness of these reactions led to the discovery and marketing of non-DEET alternatives, such as Merck KGaA, Darmstadt, Germany/EMD Performance Materials Corp’s active ingredient, IR3535®. World War I led to the expropriation of property and Merck & Co was established as an independent, separate American company that currently holds the rights to the name only in North America. As a result, Merck KGaA, Darmstadt, Germany operates as EMD Performance Materials Corp in North America. An international consumer information webpage, www.ir3535.com, was created in 2013 to provide expert knowledge and awareness about this active ingredient, while informing the public about the safe and suitable use of skin repellent products.

ALTERNATIVES TO DEET

Over the past few years, non-DEET alternatives have been giving consumers a number of alternate choices on the retailer shelf. Consumer awareness has grown and buyers pay more attention to the health effects of products available in the marketplace. They are constantly looking for other active ingredients that are considered the safest for the family. Though DEET is generally cheaper than non-DEET products, the health and safety concerns that sometimes arise with DEET materials lead the consumer to look for other non-DEET alternatives like IR3535.

How does IR3535 compare with other non-DEET products in the market? With regards to natural oils and ingredients derived from nature, IR3535 has been shown to have a longer staying power. Naturally derived repellents show a high rate of evaporation and offer less staying times on the skin. As for other non-DEET products, IR3535 has been shown to have comparable efficacy but it also has added advantages in its toxicological profile and its “Biopesticide” classification by the EPA; see Figure 1.

COMPANY HISTORY

Merck KGaA, Darmstadt, Germany is the oldest pharmaceutical and chemical company in the world. Established in 1668 by the Merck family, the company will be reaching its 350th milestone anniversary in 2018. The firm currently holds the rights to the Merck name in every part of the world except for North America.
INSECT REPELLENT STUDIES

In order to supply some additional information on general comparisons to DEET, studies were conducted on a number of insects in order to determine the effectiveness of IR3535 over time. The following studies show that IR3535 has an “equal to” or “better than” staying power than DEET in some instances; also see http://www.ir3535.com/en/scientific_publications/scientific_publications.html.

Repellent efficacy of IR3535 at concentrations of 10.0%, 20.0%, 25.0% and 30.0% was compared to the positive control DEET at comparable levels. Three different formulations were evaluated in various studies: an ethanolic solution, a cream and a pump spray. Arm-in-cage and field tests were conducted in diverse regions of the world. Ability to repel mosquitoes was tested against Aedes aegypti, Ae albopictus, Culex species and Anopheles species. In addition to the mosquito studies, repellent efficacy was conducted using black flies, Simulium species; stable flies, Stomoxys calcitrans; the deer tick, Ixodes scapularis; and the cat flea, Ctenocephalides felis.

The yellow fever mosquito, Aedes aegypti, is widely used for cage testing of repellents. A very high biting pressure and relatively brief repellent protection times are characteristic for this day biting species. For these reasons, most laboratory repellency tests of IR3535 have been performed with Aedes aegypti. Arm-in-cage studies resulted in equivalent repellency protection for Ae aegypti for IR3535 and DEET. The mean protection time varied from 2.0 to 9.8 hours; see Figure 2. The formulation used was found to be as important as the concentration of repellent in the study.

The Asian tiger mosquito, Aedes albopictus, an aggressive human-biting species that feeds by day, is a vector of dengue and chikungunya. An invasive species, displacing other mosquitoes, it was once limited to Asia, but now present on all continents. For Ae albopictus, repellency protection for field tests ranged from 4.0 to 8.0 hours. The efficacy of IR3535 is comparable to DEET in this study; see Figure 3.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>IR3535</th>
<th>DEET</th>
<th>PICARIDIN</th>
<th>OLE/PMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>Least known</td>
<td>Most known</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>Bio-pesticide</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Damage of synthetic material &amp; plastic</td>
<td>May impact plastics</td>
<td>Does</td>
<td>Does not</td>
<td>Does not</td>
</tr>
<tr>
<td>Dual/Combo product</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Mosquitoes, deer ticks, body lice and biting flies</td>
<td>Broad spectrum; effective for many varieties of insects</td>
<td>Biting flies, mosquitoes, chiggers, ticks and fleas</td>
<td>Mosquitoes [30% PMD as effective as 20% DEET]</td>
</tr>
<tr>
<td>Light &amp; non-sticky</td>
<td>Comparable to DEET: 7.5 - 20% loading = 8 hours protection</td>
<td>Longest: 7.5 - 34.4% loading = 2 to 12 protection</td>
<td>Comparable to DEET: 7.5 - 20% loading = 4 to 12 hours protection</td>
<td>Shortest: 7.5 - 30% loading = 2 to 6 hours protection</td>
</tr>
<tr>
<td>Long lasting</td>
<td>2 months or older</td>
<td>2 months or older</td>
<td>2 months or older</td>
<td>3 years or older</td>
</tr>
<tr>
<td>Restriction on children</td>
<td>Highly effective</td>
<td>Unfavorable</td>
<td>Suitable</td>
<td>Highly effective</td>
</tr>
<tr>
<td>Sensitive skin</td>
<td>Less likely</td>
<td>Dermatitis and low incidence of neurotoxicity</td>
<td>Less likely</td>
<td>Eye irritation</td>
</tr>
<tr>
<td>Side effects</td>
<td>Odorless</td>
<td>Unpleasant / offensive</td>
<td>Odorless</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Toxicological profile</td>
<td>Toxic Category IV: acute oral, dermal irritation, acute inhalation</td>
<td>Toxic Category III: slightly toxic by the eye, dermal and oral routes</td>
<td>Toxic Category IV: acute oral and dermal irritation, and eye irritation</td>
<td>Toxic Category IV: acute oral, dermal irritation</td>
</tr>
<tr>
<td>Widely researched and recommended</td>
<td>Least</td>
<td>Yes</td>
<td>Somewhat</td>
<td>Somewhat</td>
</tr>
</tbody>
</table>

Figure 1: General comparison of IR3535 to other alternative insect repellents.
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The mosquito genus *Culex* is important in that several species serve as vectors of such human diseases as West Nile virus, filariasis, Japanese encephalitis and St Louis encephalitis. Figure 4 shows comparable protection of IR3535 and DEET against several *Culex* species.

For various species of *Anopheles*, field testing using an ethanol-based lotion at 15.0% ai and 25.0% ai resulted in mean protection times ranging from 5.0 to 6.0 hours. Mean protection times for cage studies varied depending upon the species of *Anopheles*. IR3535 and DEET protection times were found to be comparable, except in the study using *An maculatus*, an ethanolic formulation at 25.0% ai that resulted in DEET providing better repellency protection for the first hour of the study. At the second hour of the study, both DEET and IR3535 provided comparable protection.

All ticks are blood feeders and certain species are known for carrying and transmitting many different pathogenic microorganisms. Human diseases transmitted by ticks include Lyme disease, tick-born encephalitis and human anaplasmosis. *Ixodes ricinus* and *I scapularis* are among the important vectors of tick-borne diseases. A study using the deer tick, comparing a lotion with 10% ai, a pump spray formula with 20% ai, and an aerosol with 20% ai, resulted in protection times of 9, 12 and 11 hours, respectively; see Figures 5 & 6.

Another study using sand flies, *Lutzomyia longipalpis*, compared 15.0% and 30.0% DEET to 15.0% and 30.0% IR3535, found IR3535 to be significantly better (95% confidence) at protecting rabbits from fly bites during the two hour study.

**REFERENCES CITED**

Carroll, SP. 2008. Prolonged efficacy of IR3535 repellents against mosquitoes and blacklegged ticks in North
Figure 5: Tests on human hands with the deer tick, Ixodes scapularis.

Figure 6: Protection time in hours against Ixodes scapularis.


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Rui-De Xue, Director of Anastasia Mosquito Control District (AMCD) realized critical training and education needs of local mosquito control workers were not being met. To address this issue, a 2003 meeting was held with former AMCD Director Robert Betts and Daniel L Kline from the United States Department of Agriculture, Agricultural Research Service, Center for Medical, Agricultural and Veterinary Entomology (CMAVE) to discuss developing a regional workshop. Since 2004, AMCD and CMAVE have partnered

<table>
<thead>
<tr>
<th>Workshop Dates</th>
<th>Name of Speaker</th>
<th>Organization</th>
<th>Title of presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 23-25, 2004</td>
<td>Daniel L Kline</td>
<td>USDA - ARS - CMAVE</td>
<td>Mosquito population surveillance techniques</td>
</tr>
<tr>
<td></td>
<td>Research Entomologist</td>
<td>Gainesville, FL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Center for Vector-borne Diseases, University of California, Davis, CA</td>
<td>Where is mosquito control headed?</td>
</tr>
<tr>
<td></td>
<td>John D Edman</td>
<td>Center for Economic Entomology, University of Illinois Urbana-Champaign, IL</td>
<td>Integrated mosquito management</td>
</tr>
<tr>
<td></td>
<td>Professor &amp; Center Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 22-24, 2006</td>
<td>Robert Novak</td>
<td>Center for Economic Entomology, University of Illinois Urbana-Champaign, IL</td>
<td>Mosquito-borne arbovirus diseases in USA</td>
</tr>
<tr>
<td></td>
<td>Professor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 22-24, 2006</td>
<td>John D Edman</td>
<td>University of California</td>
<td>Current status of mosquito-borne virus in North America</td>
</tr>
<tr>
<td></td>
<td>Emeritus Professor</td>
<td>Davis, CA</td>
<td></td>
</tr>
<tr>
<td>March 27-29, 2007</td>
<td>Dave Brown</td>
<td>Sacramento-Yolo Vector Control District</td>
<td>WNV control in Sacramento and Yolo Counties, CA</td>
</tr>
<tr>
<td></td>
<td>Director</td>
<td>Sacramento, CA</td>
<td></td>
</tr>
<tr>
<td>March 31-April 1, 2009</td>
<td>Lyle Petersen</td>
<td>CDC - Division of Vector-borne Infectious Disease</td>
<td>Mosquito-borne arbovirus diseases in USA</td>
</tr>
<tr>
<td></td>
<td>Director</td>
<td>Ft Collins, CO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Center Director</td>
<td>Gainesville, FL</td>
<td></td>
</tr>
<tr>
<td>March 29-31, 2011</td>
<td>Daniel Strickman</td>
<td>USDA - ARS - CMAVE</td>
<td>The national needs and future direction for control of mosquito-borne diseases</td>
</tr>
<tr>
<td></td>
<td>National Program Leader</td>
<td>Beltsville, MD</td>
<td></td>
</tr>
<tr>
<td>March 27-29, 2012</td>
<td>Robert Wirtz</td>
<td>CDC</td>
<td>The research program of the CDC’s entomological branch</td>
</tr>
<tr>
<td></td>
<td>Branch Chief</td>
<td>Atlanta, GA</td>
<td></td>
</tr>
<tr>
<td>March 27-29, 2012</td>
<td>Roger Nasci</td>
<td>CDC - DVBID</td>
<td>Update of WNV and other mosquito-borne viruses in the USA</td>
</tr>
<tr>
<td></td>
<td>Branch Chief</td>
<td>Ft Collins, CO</td>
<td></td>
</tr>
<tr>
<td>March 25-27, 2014</td>
<td>Thomas Unnasch</td>
<td>University of South Florida Department of Global Health</td>
<td>New insights into the ecology of EEE virus transmission in</td>
</tr>
<tr>
<td></td>
<td>Professor &amp; Director</td>
<td>Tampa, FL</td>
<td>the Southeastern USA</td>
</tr>
</tbody>
</table>

Table 1: Keynote speakers and presentation titles at Workshops at AMCD, 2004 - 2014.
to coordinate and host the annual Arbovirus Surveillance and Mosquito Control Workshop at AMCD in the last week of March.

The goal of the workshop is to provide current information and expertise to educate our northeast Florida employees, professional staff, and staff from other regions in the field of mosquito control. We strive to share research information about the biology and control of mosquitoes, including new discoveries and technology; to advance technology transfer from research institutes and universities to local mosquito control organizations; and to provide annual information updates on new insecticides and equipment for arbovirus surveillance and mosquito control.

Workshop presentations have been expanded from arbovirus surveillance and mosquito control topics to include other vector and pest control information, based on requests and needs of some participants. Workshop programs and selected papers have been published in the Technical Bulletin of the Florida Mosquito Control Association in 2006, 2008 and 2013, Volumes 7, 8 and 9, respectively (www.floridamosquito.org/Products/TechnicalBulletins.aspx). Interest in the workshop has greatly increased from 50 people representing 16 Florida and Georgia organizations in 2004, to more than 160 participants from 50 organizations and 24 states in 2013 & 2014. International participation has also increased dramatically from 1 country, Canada, in 2004, to more than 20, with representatives from Brazil, Ecuador, Haiti, Israel, China, India, German, Hong Kong, Taiwan, Thailand, Mali, Cameroon, UK, Malaysia, Australia, Saudi Arabia, Egypt, Puerto Rico, Korea, Mexico, Italy, Austria, and Nigeria in attendance in subsequent years.

A keynote speaker is invited each year to address a specific arbovirus topic. Daniel Kline provided the inaugural keynote address and John D Edman has given the keynote presentation twice. Ten arbovirus and mosquito control experts have given the keynote address; see Table 1.

Each year we have also invited one or more guest speakers who are respected experts in their fields, most of them from international locations. A total of 40 experts have given this designated guest presentation. The total number of presentations has increased from 20 originally to nearly 80 currently. Mara Clark, Daniel Kline, and Ulrich Bernier have the distinction of having given presentations each of the last 10 years. In addition, since 2006, a lecture and dinner have been added to the workshop program, and representative administrators of relevant governmental agencies and local scientific organizations have been invited to give an overview of regulatory issues and other pertinent topics.

During the past 11 workshops, AMCD and regional mosquito control agency and industry staff has received significant benefits, including education on the latest mosquito control and surveillance techniques, along with the opportunity to network with those conducting research in their field. These workshops have provided more than 220 continuing education unit (CEU) credits for mosquito control agency staff in Florida. We have received positive feedback every year, highlighting the significant knowledge gained on arbovirus surveillance and mosquito control technology. Additionally, the workshops have enhanced AMCD’s reputation in the field of mosquito control nationally, and even internationally.

The 12th annual Arbovirus Surveillance and Mosquito Control Workshop at AMCD is scheduled to be held March 24 - 26, 2015. For more information, please visit AMCD’s website at www.amcdsjc.org.
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2015 MEETING ANNOUNCEMENTS

10 - 11 March 2015
The annual meeting of the Tennessee Mosquito & Vector Control Association will be held at the Ellington Agriculture Center, Ed Jones Auditorium (The Barn) in Nashville, TN. For more information, e-mail info@tennmosquito.org, visit our website at www.tennmosquito.org or call 615-262-6456.

24 - 25 March 2015
The 12th annual Arbovirus Surveillance and Mosquito Control Workshop will be held at Anastasia Mosquito Control District, St Augustine, FL. For more information, visit AMCD’s website at www.amcdsjc.org.

29 March - 2 April 2015
The 81st Annual Meeting of the American Mosquito Control Association will be held at the Hilton New Orleans Riverside, New Orleans, LA. For more information, visit www.mosquito.org/annual-meeting.

25 - 29 May 2015
The 4th International Forum for Surveillance and Control of Mosquitoes and Mosquito-borne Diseases will be held in Guangzhou, Guangdong, China. For details, visit www.mosquitoforum.net or www.asiansvemc.org.

15 - 18 November 2015
The 87th Annual Meeting of the Florida Mosquito Control Association will be held at the Renaissance World Golf Village in St Augustine, FL. Details will be made available at www.floridamosquito.org.
Ahhh! The New Jersey light trap. That space ship-like contraption that attracts moths, gnats, dragonflies, house flies, black flies, bees, wasps, hornets, little tiny frogs, spiders, ticks, ants, and the occasional mosquito. Yes, the New Jersey light trap attracts all these and more. Mosquito control inspectors are also attracted to these celestial contraptions, attracted not by choice and through no fault of our own, in most cases. The job of the light trap collector is usually presented as an option to employees: Whoever is not at work on selection day usually gets the job.

Once you have assembled your arsenal of light traps, the next problem is deployment. The best location for a light trap is where there are lots of mosquitoes. On the edge of a swamp or wetland, close to woodland pools, or tire piles. Unfortunately, NJ light traps need electricity like female mosquitoes need blood. Therefore, we must rely on the kindness of strangers. In exchange for a few dollars a year from the County – we call it bribery – we will bring six burly mosquito control inspectors to your back yard, pound fence posts in newly laid sod, attach a light trap to it, and drag yellow extension cords through the gladiolus and tomato plants to the nearest outdoor electric socket. Once plugged in, it will continue to glow and whirl like a beacon in the night for the next six months.

Now that we have lit up your back yard like a summer carnival, the fun has only just begun. Ideally, we would work out something with the post office where the mailman would pick up the samples, drop them into an envelope and mail them to our office. Well, at least that’s an idea that I’ve been suggesting weekly for nearly twenty years now. The response has been less than enthusiastic. Neither rain, nor sleet, nor snow, nor dead of night... nor automatic lawn sprinklers, dogs that think you are a fire hydrant, rabid woodland creatures, or lonely housewives with a donut in one hand and a Diet Coke in the other, will keep the dedicated inspector from collecting samples in person.

My light trap route is close to one-hundred miles a day so it’s a good thing I like to drive. For several years my assigned vehicle was a nice size Jeep Liberty. It had plenty of room for my sample jars, a small cooler with dry ice to keep the samples cold and kill off any insects that managed to survive the suicide mission that is the trip from the top of the trap, through the fan, past the funnel shaped screening and head first into the Mason jar at the bottom of the trap. There was also plenty of room for my hat, lunch and newspapers. Newspapers, by the way, are frowned upon by my supervisor, who thinks we should always be working and, hence, they must be secreted into and out of the building and only read during “personal” breaks or lunches. He believes that an uninform work force is less prone to revolution. His theory has worked so far. We only hire people who we feel are adequately uninformed.

One day it was decided I was much too content with my little Jeep Liberty. Contentment is another thing that is frowned upon around here. Off balance and apprehensive is acceptable; contentment is not! Suddenly my jeep was verboten. I was assigned an ocean liner on wheels, stripped, of course, of the usual ocean liner amenities: swimming pool, tennis courts, deck chairs. This truck could carry Hannibal, his troops, and the elephants over the mountains in one trip. There’s a sign on the back that says “Caution this vehicle makes wide turns.” The back-up signal was conducted by the Philadelphia Orchestra. Anyway, after loading my little cooler and box of vials on the passenger side with the forklift, I lower the rope ladder on the driver’s side and climb aboard. I must admit there is a certain feeling of power sitting high above the roadway, behind the wheel of a machine that turns cross-country truck drivers green with envy. The feeling that you may well be the complete master of the internal combustible engine fades, somewhat, when you realize Mercer County Mosquito Control is printed in large letters, and several languages, all over your weapon of mass destruction. Our mosquito control Czar – err, supervisor – thinks we should be easily identifiable, even to those whose first language is Farsi. I do believe it is a bit of overkill to send out fleets of trucks that could have invaded Normandy to do battle with this little insect you can smooch between two fingers.

Some of you may believe that light trap collection is a bit of a walk in the park, but it is not for the faint of heart. Did you know that the wasp and hornet populations look at the New Jersey...
light trap as a housing opportunity? Apparently nothing says “home” like free electricity and a fan to the wasps and hornets. At first they pose no problem. One or two wasps hovering about, waiting patiently for me to make my collection are really not a problem. But after a couple of weeks when friends and family have moved in, they become a bit more concerned about the sanctity of the homestead. At this point drastic measures must be employed. These measures come in the form of wasp and hornet spray. When spraying your light trap with wasp and hornet spray, it’s a good idea to park your truck as close to the trap as possible. I learned the hard way. If conditions are ideal, the best way to use the wasp and hornet spray is the drive-by method. With the truck window open just enough to get your arm and the spray can outside, get the truck up to about fifty-five miles per hour and start spraying until you are well past the trap. It may not be the most efficient way to rid the trap of wasps and hornets, but it sure beats racing them back to the truck on foot. If the drive-by method doesn’t kill all the wasps, enough of them will be incapacitated from laughing that you should be able to resume collection in a couple of days anyway.

Another problem is bugs that just won’t die. Despite being drawn through wire mesh, past a moving fan and slammed into a Dixie cup, many bugs end up surviving the journey. Some appear to thrive on it. For those who do make it alive into the Dixie cup a portion of a No-Pest Strip, laden with pesticides, lies in the bottom of the Mason jar and is supposed to finish the job. The problem is the No-Pest Strips don’t always work. I am convinced that the bugs that are dead, died from trauma or shock or suicide or anything other than the No-Pest Strips.

One final tip: It’s always a good idea to continuously lobby for new light traps. For some reason they are rather expensive, although I think they could be assembled by a third grade science class. Light traps are usually not high on the list of “must have” equipment. Coffee makers, toaster ovens and microwaves are – but light traps are not. We still have a couple of traps in the garage that came equipped with a kite and a key and only work during thunderstorms.

But despite all the drawbacks to New Jersey light trap collecting, things could be worse. I could be working on the midnight garbage run through the Bronx. Or being dressed up as Darth Wader and put in the middle of a swamp while our crew makes a thermal fog application around me just for a photo opportunity. Or my supervisor could read this and take away my newspapers.
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From Where I Sit: Notes from the AMCA Technical Advisor
by Joe Conlon

From where I sit... I’ve published articles in Wing Beats regarding presentation tips in both 2006 and 2010—so I’m about due for another. We would do well to review presentation basics to optimize our communication efforts. After all, the work you put into the subject of a presentation deserves to be accurately and effectively communicated to your audience. Alas, far too many speakers compromise the value of their talks through poor preparation or a failure to recognize that the first order of business is to communicate. That is the sole purpose of being at the podium.

Some of what I’m about to say has been covered in my previous articles but I’m repeating them for emphasis—they’re that important!

You are up at the podium to communicate...period! Your manner of speaking, the content of your slides and your interaction with the audience should all be carefully chosen and exercised based on getting specific message points across. At its core, presenting is marketing your topic.

Time-wasters are your greatest enemy. Provide a compact, informative, easily comprehended talk by eliminating unnecessary verbiage and slides.

TIME IS OF THE ESSENCE

Timers are used for a reason—don't ignore them. Going overtime places the session moderator in the unenviable position of either embarrassing you by using the proverbial shepherd's crook or shortchanging the other presenters on THEIR time allowance—which won't make you many friends. Both problems can be avoided if presenters are vigilant regarding time in developing and practicing their presentations. Frankly, it’s just plain rude to continue your talk when you’ve been informed you’re over your time limit. If you’ve not timed your presentation through practice beforehand—that’s your problem. The moderator is not obligated to let you finish and compromise everyone else’s presentation because of your lack of preparation.

Here’s a list of common time-wasters:

IRRELEVANT SLIDES/DATA

I make it a habit of continually reviewing my slides in the weeks and months before a meeting and make a concerted effort to cull irrelevant data while optimizing communication. Review your slides from the perspective of the audience and you’ll be surprised at how much slide information is not actually material to your discussion.

PRESENTATION OUTLINES

Do not spend any time during a 20-minute presentation providing your audience an outline of what you’re going to present. This is a classic time-waster and serves no actual purpose, when you think about it. Just get on with it!

OVERLY-DETAILED MATERIALS AND METHODS

Unfortunately, in all too many cases, overly-detailed descriptions of materials and methods seem to constitute the majority of information given in scientific presentations. While the esoteric statistical methods you employed to determine that flies will alight upon manure may be of marginal interest to some in the audience, the preponderance are generally more interested in your results and a discussion of their implications. Include particulars of protocols and statistical analyses only to the extent they have a demonstrable bearing on results. Frankly, most scientific presenters use statistics the way a drunkard uses a lamp-post—for support rather than illumination. Those in attendance truly wanting to get down into the weeds about your materials and methods can do so out in the hallway after your talk.

SPOKEN ACKNOWLEDGMENTS

A slide acknowledging those who contributed to the study is entirely appropriate. However, it’s almost always at the end of the presentation when time is of the essence—or you’re already beyond your allotted time. Thus, the slide should be shown as you thank the audience for their attention. The audience will be reading the slide once it appears on the screen, so there’s no need to comment further. Similarly, an acknowledgment slide can be presented without comment at the beginning while introducing the topic.

DETAILED INTRODUCTIONS

Additionally, take into account the time needed for your introduction by the moderator and your own opening remarks. These can take anywhere from 2-5 minutes.

VERBAL TICS OR FILLERS

Eliminate the “ums” and “uhs” attendant to nervousness by practicing your talk in front of friends or coworkers. Sure, it may be uncomfortable at first, but it’s better to work out your unease in front of a potentially sympathetic audience rather than at a conference—where reputations are often made or unmade.
UNFAMILIARITY WITH SLIDE REMOTES AND LASER POINTERS
Speakers should arrive prior to the symposium/session in order to familiarize themselves with slide remotes and laser pointer function! Fumbling around with these devices needlessly uses up an inordinate amount of presentation time that would be obviated by arriving a few minutes early to test out the devices.

INCOMPATIBLE VIDEO FORMATS
Another common mistake is taking for granted that a movie that works on your home computer will work similarly on the system being used to project your talk at a conference. Bad assumption. Murphy’s Laws are always operative when employing videos in a presentation, so have a Plan B ready should Murphy make an appearance. Make sure your visuals are compatible with the computer system that will be used to project them onto the screen – particularly if these visuals form an integral part of your presentation. When possible, view the presentation in the preview room. Do NOT wait until your presentation begins to review logistics, for you’ll invariably use up valuable time that could have been better spent on conveying your message.

AVOID “BELLS AND WHISTLES”
Please....PLEASE...PUHLEEEEASE – withstand the temptation to employ the schmaltzy sounds and animations available in PowerPoint. These are the province of rank amateurs and will be viewed as such when employed in front of any respectable group of professionals – you know, the kinds who usually make...hiring decisions. These theatrics seldom contribute significantly to your message and probably, in fact, detract from and compromise any actual point you’re trying to make.

Take-home message? Do NOT make the medium the message.

USE LARGE, EASILY READABLE FONTS
Take particular care to use highly contrasting colors. We’ve all seen presentations that look wonderful on a computer screen, but whose color scheme fails to faithfully translate when projected. Avoid busy backgrounds that may compromise effective font contrast. Complicated and fancy fonts may seem hip and trendy, but seldom allow audiences to absorb the message while they’re attempting to translate the alphabet into understandable words. Always ask yourself if the font you’re contemplating using helps makes your message more easily understood by your audience. If not, choose another. You may think a strange font is cool – your audience may not.

USE VOICE MODULATION
No one enjoys a monotone presentation, particularly when in the throes of post-prandial narcosis after lunch. If you are to engage the audience and truly communicate, you need to grab and maintain their interest. A monotone delivery shows little passion for your own work. Expect your audience to show the same level of interest that you display.

KEEP YOUR SLIDES SIMPLE
Avoid “busy” slides. Presenters will often say, “I know this slide is a bit busy, but...” Then why are you using it? Revise the slide to reflect exactly what you’re trying to communicate and eliminate “noise.” We are all often tempted to place 30 years worth of...
work onto a single slide, particularly when it can be cut and pasted from a published table or figure. DON’T DO IT! Complicated tables can be viewed at length and absorbed when in a journal – but not during a timed presentation.

Use no more than three bullets and no more than 7-9 words per bullet if you want to be understood. Excess verbiage and information that doesn’t have significant bearing on your message (probably more than you’re willing to admit) should be eliminated.

Always keep in mind the amount of information your audience is capable of absorbing in the short time they view a slide – usually about 30 - 45 seconds.

**USE YOUR SLIDES ONLY AS A REFERENCE**

Don’t describe your slides, e.g. “This slide shows...” Properly constructed slides should be self-explanatory and flow logically without need of clarification. A brief topic outline alone on each slide should produce a cascade of information from each bullet if you know your subject. Use your slides only as a reference – and use your slide bullets as topic headings upon which you can expand for the audience.

Finally, never stare at your slides or read your slides... your audience can see what's on the slide. They certainly don’t need you to read it for them. Besides, they can read a lot faster than you can speak.

**AVOID HOLDING THE LASER POINTER ON THE SLIDE FOR EXTENDED PERIODS**

Briefly point to the object that you intend to discuss. The pointer will invariably begin to tremble on the screen after a while and you’ll begin making rapid circles around the object about which you’re speaking. This is very distracting to the audience. In addition, while pointing the laser at the slides you usually have your face away from the audience.

Effective speakers keep their eyes scanning the audience while they are speaking as much as possible. This is EXTREMELY important – but often overlooked – and there’s no excuse for it!

**BE AWARE OF THE POSITION OF THE MICROPHONE**

If you’re speaking from a podium, be aware of your position in relation to the microphone pickup. This is another good reason to use your slides as an outline only, for then you can maximize your time facing the audience. The more you are forced to view the slides from the podium, the more likely you will be turned away (at least partially) from the microphone.

**SPEAKERS SHOULD DRESS PROPERLY**

Your manner of dress and comportment while at the podium are more important than you might think. Effective communication requires some measure of theatrical presence to ensure that your message remains long after your presentation. Studies have shown that up to 90% of your message transmittal depends upon how you look and sound when you speak. As a result you cannot count on the manifest worth of your research alone to make the imprint on the audience that you desire.

Thus, speakers should dress in attire appropriate for public speaking at a scientific conference. A professional conference should be approached in a professional manner. The manner of dress is a direct reflection of the level of esteem in which the speaker holds his/her audience. A sport coat and tie are a minimum.

You’ll probably now agree that the extraordinary amount of work that often goes into producing scientific research makes it a profound shame when the sharing of this new knowledge becomes compromised by inept presentation – so keep these three commandments in mind throughout the planning and delivery of your presentation.

**COMMANDMENT #1**

Continually review your presentation dynamics and remove time-wasters such as marginally relevant slides, long intros, overly detailed testing protocols, lengthy acknowledgements, slide remote operation instructions and others you can identify.

**COMMANDMENT #2**

Keep your slides easy to understand by ALL members of your audience – not just niche scientists.

**COMMANDMENT #3**

Above all, make COMMUNICATION your PRIMARY goal.

**REFERENCES CITED**


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