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JDIP News is published periodically to enhance intramural communications and ensure that JDIP participants and stakeholders are updated on news of relevance to our community.

Please direct any comments, contributions and suggestions via email to: Vivek Kapur, JDIP Program Director, at vkapur@psu.edu



National Institute of Food and Agriculture



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JDIP Funding Update

By: Tiffany Cunningham, J.D.

In July, JDIP submitted a renewal grant application to USDA National Institute of Food and Agriculture (NIFA) for its final year of funding under the CAP Initiative. The application was received by USDA-NIFA and is in the process of being reviewed. The results should be announced sometime this fall. As there was limited space in the renewal grant application, JDIP has provided supplemental information, relative to JDIP's management plan, for the review panel and those who may have an interest in learning more about JDIP's operational structure. Please visit our website at www.jdip.org and click on the hot link in the upper right hand corner entitled, "Renewal Grant Application Supplemental Information" for further information.

JDIP 2010 Joint Annual Meeting with the JAM Update

By: Kenneth Olson, Ph.D.



The JDIP annual conference was held in conjunction with the 2010 Joint Annual Meeting (JAM) of the American Dairy Science Association (ADSA), Poultry Science Association (PSA), Asociación Mexicana de Producción Animal (AMPA), Canadian Society of Animal Science (CSAS) and American Society of Animal Science (ASAS), July 11 – 15 in Denver, CO. JDIP members had the option of a special one-day registration that included JDIP's Sunday meeting and the scientific sessions on Monday or registering for the entire JAM conference. This venue provided opportunities to network with other scientists as well as industry representatives, while allowing these professionals to learn more about the innovative work being done in the Johne's disease area. Sunday's session focused on work in JDIP Core and Project areas, including updates on the vaccine and diagnostics projects. On Monday, 39 abstracts were presented in oral and poster sessions of the JAM. A meeting highlight was the attendance of Dr. Roger Beachy, Director of USDA-NIFA, in two of the Johne's/JDIP sessions and his subsequent highlighting of the work being done through JDIP in comments for all JAM attendees.



JDIP trade show booth (pictured, Kenneth Olson)

Regarding the JDIP participation in the meeting, JDIP had 28 one-day registrations. Of these one-day registrations, 9 registrants were not JDIP members but still all have ties to Johne's disease. 13 JDIP members registered for the entire JAM conference. In addition, 10 individuals, who were not on our current JDIP Membership list, had oral or poster presentations in the JDIP sessions. This would indicate a total of 52 active participants in the sessions, plus an undetermined number who attended some or all of the presentations on either Sunday or Monday. Past JAM registration records showed that in 2009 there were 7 current JDIP members in attendance, 5 members in 2008 and 10 members in 2007. As such JDIP had a greater presence at the JAM conference than in the past.

A substantial benefit of meeting at the JAM was the fact that Dr. Beachy and other NIFA staff members were present and took in presentations in both the morning and afternoon sessions. Our participation also resulted in increased awareness of JDIP among dairy and animal scientists through the scientific presentations and our booth in the trade show where we distributed proceedings from our meeting and additional information related to JDIP. We also received a few membership applications. One additional benefit has been increased coverage of our work by several of the major farm publications.

In thinking about the future, JDIP would appreciate any feedback or suggestions that you might be able to provide as we begin planning next year's annual meeting. Thank you to everyone who participated in this year's annual meeting. We look forward to seeing you at next year's annual meeting!



American Association of Bovine Practitioners (AABP) Annual Meeting

By: Kenneth Olson, Ph.D

The American Association of Bovine Practitioners (AABP) 2010 Annual Meeting was held in Albuquerque, New Mexico from August 19th to 21st. While JDIP did not get adequate pre-registration to proceed with the "New Horizons in Johne's Disease Control" workshop that was planned, we did have a booth in the trade show. This helped create increased awareness of JDIP in the veterinary community and provided an opportunity to visit with many people about the work.

Almost all of JDIP's remaining proceedings booklets from the 2010 annual meeting at the JAM were distributed from the trade show booth. Ken Olson compiled a CD, which included the 2010 JDIP annual conference proceedings with the Sunday presentations, the proceedings from the 2009 New Horizons workshop and the current national Johne's Strategic plan. Even though all of the copies of the CD went on the first day of the AABP meeting, the information is available on our website (www.jdip.org). JDIP also received three membership applications and anticipates receiving more from contacts that were made at AABP. A survey was developed and distributed to veterinarians to assess their participation in the Johne's program and get input on future direction for the program. Response has been limited to date, but it will be used as we identify additional information needs.

Travel Awards to Attend the JDIP 2010 Joint Annual Meeting

By: Tiffany Cunningham, J.D.

The JDIP would like to once again congratulate the recipients of the JDIP travel award to assist in attending the 2010 Joint Annual Meeting. This award recognizes the outstanding research of graduate students and post-doctoral appointees from all over the world. This year, JDIP received a total of twenty abstracts for its annual travel award.

The submitted scholarship applications were reviewed in a three round process by the Executive Committee of the JDIP. As usual, any Executive Committee member that had a conflict of interest with an application was excluded from the discussions. Overall, the JDIP was able to award eleven scholarships spanning five institutions and two countries.

Based on a review of the applications, the following graduate students and post-doctoral appointees were selected for support (listed alphabetically by last name):

- Abdellrazeq, Gaber (Alexandria University - Egypt)
- Espejo, Luis A. (University of Minnesota - USA)
- Kugadas, Abirami (University of Minnesota- USA)
- Kuo, Chih-Jung (Cornell University - USA)
- Lamont, Elise A. (University of Minnesota - USA)
- Lima, João Ribeiro (University of Minnesota - USA)
- Park, Kun Taek (Washington State University - USA)
- Pradhan, Abani (Cornell University - USA)
- Smith, Rebecca (Cornell University - USA)
- Wadhwa, Ashutosh (University of Tennessee, Knoxville - USA)
- Wu, Chia-wei (University of Wisconsin - USA)



Travel Awardees (pictured from left to right: Ashutosh Wadhwa, Gaber Abdellrazeq, Abirami Kugadas, Dr. Vivek Kapur, Chih-Jung Kuo, João Ribeiro Lima, Kun Taek Park, Rebecca Smith, and Abani Pradhan)

Congratulations again to our awardees!

JDIP Year 7 Request for Applications (RFA)

By: Tiffany Cunningham, J.D. and Vivek Kapur, BVSc, Ph.D.

JDIP would like to announce its Year 7 Request for Applications ("RFA"). While some information is provided below, please visit www.jdip.org and click on the "Funding Opportunities" link in the left-hand column for more information on the application process. Please contact the project leader for your program area if you have any questions relating to the science. If you have needs for assistance with study design, please contact the JDIP biostatistical consulting core.

Finally, for programmatic questions please send an email to help@jdip.org or call the JDIP Project Assistant, Tiffany Cunningham, at 814-867-0261, and we will be happy to help. Good luck with your proposal preparations and the submission process (in case you are submitting).



Dates: Applications must be received by 5:00 PM EST on Wednesday, December 1, 2010

Funding Description: JDIP intends to issue competitive awards for research, education and extension on Johne's disease, contingent upon funding becoming available for the fourth year of the JDIP Phase II program from the USDA-NIFA-CAP initiative.

Total Amount to be Awarded: It is expected that a total of approximately \$1,300,000 will be available for this annual funding cycle. Of this, approximately \$500,000 has been allocated to support the ongoing JDIP Vaccine Project and approximately \$400,000 has been allocated to support the JDIP Diagnostics Project. Approximately \$400,000 will be available to support meritorious projects from investigators. It is anticipated that funds will only be available for one year during this funding cycle.

Range of Awards: \$0.00 to \$100,000.00. We anticipate that between 5 and 10 awards will be made during this funding cycle.

Eligibility: All applicants must be a current JDIP Investigator/Member, or request membership prior to receiving an award. To learn more about JDIP including our current list of Investigators/ Members, please visit www.jdip.org. New member inquiries and requests should be directed to either the JDIP Administrator (help@jdip.org) or Vivek Kapur (vkapur@psu.edu). Outstanding applications from international investigators will be considered, and applicants are encouraged to actively solicit feedback from project leaders at JDIP regarding their proposals. For applicants from non-US institutions, demonstration of leveraging of funds through matching support and/or establishing collaborations with JDIP based investigators will be preferred, but is not required.

Application and Submission Process: Please visit the "Funding Opportunities" link at www.jdip.org for further information on the application and submission process.

Funding for JDIP is provided through competitive award number 2008-55620-18710 from USDA-National Institute of Food and Agriculture

JDIP / APHIS Vaccine Project Update

By: Murray Hines II, Ph.D. and Vivek Kapur, BVSc, Ph.D.

As many of you know, there is only one vaccine currently available for *Mycobacterium avium* subsp. *paratuberculosis*. This vaccine has limitations and is not approved for use in all states. Accordingly, there is interest among many veterinarians and producers alike in the application of vaccination as a tool in Johne's programs. As such, JDIP scientists are working closely with USDA-APHIS-VS in an effort to identify viable vaccine candidates and evaluate those with the greatest potential for commercial development. This consists of a three-phase vaccine efficacy project to assess and compare the efficacy of approximately 20 experimental candidate vaccines in a series of coordinated laboratory and animal studies.

Phase I, the in vitro phase was carried out on blinded samples in the laboratories of Professor Adel Talaat at the University of Wisconsin and Professor Srinand Sreevatsan at the University of Minnesota. In Phase I, the survival of the candidate vaccines in bovine macrophages was assessed. These trials are in the final stages, in which the data will be sent to Professor Yrjo Grohn at Cornell University, and the blind will be opened after completion of the statistical analyses. In Phase II, the top candidates (perhaps up to a total of 10) will then be rigorously tested in mouse models of infection for the ability to reduce tissue colonization and elicit a protective immune response. Professors Luiz Bermudez (Oregon State University), Yung-Fu Chang (Cornell University), Judy Stabel (USDA-ARS NADC) and Adel Talaat are working on the final experimental plans. The studies are anticipated to be initiated in a blinded manner at multiple sites shortly after the top candidates from the Phase I studies are identified.

Phase III will evaluate the performance of the top 4-5 candidate vaccines from Phase II in a goat challenge model, which has been developed by Professor Murray Hines II (University of Georgia). This will also enable the validation of the previously proposed AMSC goat challenge model for JD (see Hines et. al., 2007b). These are longer term studies, as we propose to follow challenged animals to the point of at or near clinical disease. In goats, this should take approximately 9-12 months post challenge with the majority of animals developing subclinical disease and only some animals progressing to mild clinical disease. The proposed study will entail the use of 80 goat kids (divided into 8 groups with 10 kids each). Five groups will receive experimental vaccines and 3 groups will serve as controls. The project will be performed at the University of Georgia, Tifton Veterinary Diagnostic and Investigational Laboratory in Tifton, Georgia under the direction of Professors Murray Hines II and Sreekumari Rajeev. The proposed project is anticipated to start in October of 2010 with testing of breeding animals at the source farm. Samples (blood, feces) will be collected and evaluated by culture, PCR and serologic tests (ELISA, AGID) from vaccinated and challenged kids on a monthly basis for up to 12 months post challenge necropsied, evaluated for lesions, given a lesion score as previously described (Hines et. al., 2007a&b) and multiple tissues will be cultured to determine MAP CFU/gram of tissue. A limited number of blood, fecal and tissue samples will also be collected to be banked at the JDIP sample repository and/or for use by other investigators in other projects. If anyone would like to obtain blood, fecal or tissue samples for additional research projects from the highly characterized animals used in this study please contact Murray Hines II (mhinesii@uga.edu).

References:

Hines II, Murray E., Stiver, Shane, Giri, Dipak, Whittington, Lisa, Watson, Cindy, Johnson, Jill, Pence, Mel, Baldwin, Charles and Aly, Sharif. 2007a. Efficacy of spheroplastic and cell wall competent vaccines for *Mycobacterium avium* subsp.

paratuberculosis in experimentally-challenged baby goats. *Vet. Microbiol.* 120:261-283.

Hines II, Murray E., Stabel, Judy, Sweeney, Ray, Griffin, Frank, Talaat, Adel, Bakker, Douwe, Benedictus, Davis, Bill, de Lisle, Geoff, Gardner, Ian A., Juste, Ramon, Kapur, Vivek, Koets, Ad, McNair, Jim, Pruitt, Greg, and Whitlock, Robert. 2007b. Experimental Challenge Models for Johne's Disease: A Review and Proposed International Guidelines. *Vet. Microbiol.* 122:197-222.

The Cornell Workshops: "Tools for Infectious-Disease Epidemiology"

By Yrjo T. Grohn, DVM, PhD

In addition to offering statistical and epidemiological consulting services and developing new statistical and mathematical methodology, the Epidemiology and Biostatistics Core offers training workshops to the members of the JDIP community. To support the training mission, the summer course in epidemiological methods was offered at Cornell University on August 2-4, 2010 (Part I) and August 4-6, 2010 (Part II).

Our original course covered three major topics, diagnostic test evaluation, infectious disease models and risk assessment. This year we modified the workshop to make each module independent so it can be taken either separately or both modules jointly. The course contents were distributed this year among two modules: 1) risk assessment (2 ½ days) and 2) infectious-disease models (2 ½ days).

Nine participants attended both modules. Drs. Hussni Mohammed and Daryl Nydam taught risk analysis (Part I) and Yrjo Grohn and Cristina Lanzas taught infectious disease modeling (Part II).

Earlier in the year Drs. Yrjo Grohn and Ynte Schukken gave a three day infectious disease module workshop in Helsinki, Finland, January 7-9 and in Oslo, Norway, January 11-13, 2010. The plan was to repeat the course in Copenhagen in May but volcanic ash did not cooperate and all flights were cancelled at the time of the course. Fifteen people attended the Helsinki workshop and twelve the Oslo workshop.

Teaching methods in all modules included mini lectures and case studies with hands on computer exercises. Case study examples were chosen to be relevant to veterinary medicine, such as paratuberculosis, salmonella and cryptosporidium.

Based on teaching evaluations, all three workshops were well received. Students particularly appreciated the hands on exercises. The format of the course, three independent modules that can be taken independently or jointly - gave the flexibility to offer the courses according to the attendees' needs. Three day workshops in Europe that were dedicated fully to infectious disease modeling gave more time to work with and understand how infectious disease modeling works.

The partial funding by JDIP to support JDIP members attending this course was greatly appreciated.

Pooled Testing for Bovine Paratuberculosis: Details Matter

By: Locksley Messam, Ph.D. and Ian Gardner, Ph.D.

Pooling of fecal samples with subsequent testing for *Mycobacterium avium subspecies paratuberculosis* (MAP) by culture or real-time PCR is used for 3 main purposes: herd or group classification, prevalence estimation and as a low-cost initial screening for identification of animals infected with MAP. Though pooling is touted to reduce costs for the latter purpose when prevalence is low, some important considerations have been overlooked. First, there is no consensus as to which pool size is optimal for a given within-herd prevalence. Second, rarely are negative pools retested. Although the choice to not retest might be reasonable if the objective is to find animals shedding moderate to high numbers of MAP (i.e. the most infectious animals), it may be sub-optimal if the goal is to detect all infected animals. Some infected pools will invariably test negative because culture and PCR are only about 50 to 60 % sensitive based on a single sample. Third, more sophisticated pooling protocols (for example those requiring re-creation of pools of half or quarter the original size) might offer cost-saving advantages. Reticence about application of the latter two testing modifications is understandable since pooling is not supposed to increase laboratory work-load.

To address these issues, we recently compared the cost of detecting all MAP infected cows in herds of different sizes (300, 1000 and 3,000) for varying prevalences (0.01 to 0.1), pool sizes (5, 10, 20 and 50) and test sensitivities (0.5 to 0.9) using simulated data. We compared costs using two protocols differing only in the use of a halving procedure; samples from pools testing positive were re-grouped into pools half the size and re-tested. In both protocols, pools initially testing negative were retested once before final classification. Full details of the methods, including the equations used are published in *Preventive Veterinary Medicine* 2010; 94: 202 – 212.

For the range of prevalences investigated, we found that pool sizes of 10 and 20 were most economical if no loss of sensitivity was assumed with increasing pool size, while a pool size of 50 was most economical when a loss in sensitivity was anticipated. Second, we found that the protocol employing the halving procedure performed consistently and substantially better than the one without and third, notwithstanding the fact that pools testing negative initially were retested, the probability of still achieving savings of at least a half the cost of individual testing was substantial while guaranteeing negative predictive values of at least 0.9 for test sensitivities as low as 0.5.

As is true for all results from simulation studies, our results require validation under field conditions. For instance, a herd participating in the US Johne's Disease Demonstration Herd Project for which the prevalence is known with a high degree of certainty could be used for such a project, assuming that there was sufficient interest in such a study.



Johne's Program – Education and Outreach Impacts

By: Kenneth Olson, Ph.D.

The Voluntary Bovine Johne's Disease Control Program (VBJDCP) became operational at the national level in 2002. Federal funding, distributed through cooperative agreements with states, has been used to reduce testing costs for producers and encourage the use of Risk Assessments and implementation of Management Plans (RAMP's) in participant herds. As a part of the VBJDCP, veterinarians have been trained and certified relative to Johne's disease (JD) and the use of RAMP's, demonstration herds have been put in place providing data used to assess the effectiveness of recommended control practices, producer educational material has been developed, and producer meetings have been held. All of these activities have increased producer awareness of the JD and spawned other public and private efforts to assist producer efforts to address the disease.

The primary metrics used with the program have been the number of herds enrolled in the VBJDCP and the number of samples run in "approved" laboratories. It was recognized that other aspects of the program benefit producers as well. In 2008, the first national survey was conducted to assess impacts of the program not reflected in the existing metrics. State Designated Johne's Coordinators (DJC's), extension specialists, and dairy and beef producer organizations were contacted and asked to respond to surveys designed to capture information relative to other JD related activities taking place in the field. A second survey of these groups was conducted in early 2010 to assess the current status of the program and changes that occurred during the past year.

Challenges due to significant reductions in funding for state cooperative agreements have significantly impacted the program in the field. In some states, the program has almost "shut-down," while others are searching for new ways of doing business. Virtually all states reported:

- Fewer individual animal tests.
- Fewer Risk Assessments conducted and Management Plans developed.
- Fewer new and renewal certification opportunities have been provided for veterinarians.
- Fewer Johne's certified veterinarians are available to work with producers.
- Fewer meetings and educational opportunities.

While these are negatives, positive signs were also reported. There are still 1,434 certified veterinarians available to work with producers, educational materials are being developed and distributed, and face-to-face meetings are occurring. States recognize the value in the program, as half of the DJCs, who responded, indicated that some state funds were being directed to the program. This is occurring in a time of very tight budgets for most states, so it is significant.

Producers have had challenging economic times during the past year, but recognize JD as a significant disease that must be addressed at the farm. Pro-active steps to do this include:

- Expanding the availability and use of the milk ELISA test by DHIA. There was a 10% increase in sample volume compared to last year.
- Providing producer funding for university research.
- Milk Cooperative programs with members to encourage and support the use of risk assessments, management plans and testing.
- Educational information delivery to members, including national delivery through a major trade media outlet.

While these are positive signs, there is still a great need to expand contact between producer organizations and the program. DJC and industry survey responses both

showed limited contact relative to program operation with limited funding or expanded industry roles as identified in the strategic plan. Federal funding is likely to be quite limited in coming years, so it will be critical to assess how to best use the infrastructure that has been developed and the resources that are still available in helping producers address this issue.

A second part of this year's project was the development and beta testing of an instrument to assess actual implementation of recommended JD control practices in the field. The National Animal Health Monitoring System (NAHMS) dairy studies have been useful for this in the past, but given the reduction that has occurred in program funding and the overall budget deficit, development and testing of another system that could gather accurate information was seen as desirable. Desired characteristics of the instrument included:

- Adequate scope to cover all practices deemed critical by professionals in the area.
- Brief enough so that producers will answer it (maximum of 4 pages, less than 30 minutes).
- Quantifiable responses to facilitate evaluation of responses.
- Adequate herd demographic information to allow needed analysis.
- Clarity in questions to assure consistent responses from producers.
- Provide opportunities for respondents to provide clarification of their situation or greater detail in the response if they desire.
- Structures, so that it can be completed either as a written or electronic document.

An initial draft, based on the VBJDCP Risk Assessment, was developed and reviewed by an expert panel. A modified version was then distributed to approximately 70 producers across the nation for Beta testing. These producers were asked to complete the survey instrument and provide comments relative to clarity, ease of use or any other suggested improvements. Approximately half of the producers returned their surveys. They had minimal difficulty in completing it, but did provide useful suggestions for potential use nationally. Previously, we had developed a system for obtaining a statistically valid national dairy producer survey, so with this instrument, we now have a system that would be capable of assessing the implementation of recommended practices in the field.

Summary

The VBJDCP has increased producer awareness of JD and recommended control practices. It has also aided in the development of infrastructure components needed to address the disease. However, funding cuts mean that new methods must to be developed to assist producer efforts to address JD. Increased collaborative planning between the public and private sector needs to occur, if we are to maintain and effectively utilize the infrastructure that has been developed in the past decade.

(The full report is available in the "News" section of www.idip.org)

Johne's at United States Animal Health Association (USAHA)

By: Kenneth Olson, Ph.D.

The 114th Annual Meeting of the U.S. Animal Health Association (USAHA) will be held November 11-17, 2010 at the Hilton Minneapolis in Minneapolis, Minnesota. Two major Johne's meetings will be held as a part of the conference. The National Johne's Working Group (NJWG) will meet from 8:00am until 11:30am on Sunday, November 14th in the Marquette Room. The primary focus of the meeting will be on current industry initiatives that focus on or include Johne's disease as a major component of the effort. These programs will be critical to the future of Johne's control efforts. The session will also include discussion of actions that the NJWG can take to help maintain progress in the Johne's program.

The USAHA Johne's Disease Committee will meet later that day from 12:30pm until 5:30pm in the Duluth Room. This meeting will include reports of responses to last year's committee recommendations, as well as updates on education and demonstration herd activities from the past year, an overview of the new Program Standards and a report on the NJWG discussion. Special presentations are scheduled on "Diagnostic Testing" by Dr. Michael Collins and "Current Findings relative to MAP's Role in Crohn's Disease" by Dr. Don Zink. Resolutions or recommendations for the coming year relative to these or other issues may also move forward from the committee to USAHA. For further information please visit <http://www.usaha.org/meetings/2010/index.shtml>.

JDIP will be visible and active during the meeting with presentations at both meetings and a booth in the USAHA display area. Stop by the booth to visit if you are at the meeting.

Upcoming Meetings and Events

September 28 - October 2, 2010

World Dairy Expo at the Alliant Energy Center of Dane County in
Madison, Wisconsin. USA

<http://www.worlddairyexpo.com/gen.home.cfm>

October 26 - 28, 2010

NMPF/NDB/UDIA Annual Meeting at the Grand Sierra Resort,
Reno, Nevada. USA

http://www.nmpf.org/annual_meeting

November 11 - 17, 2010

USAHA/AAVLD 114th Annual Meeting at the Minneapolis Hilton Hotel in
Minneapolis, Minnesota. USA

<http://www.usaha.org/meetings/>

November 14, 2010

National Johne's Working Group (NJWG) Meeting
8:00-11:30am in the Marquette Room at the Minneapolis Hilton Hotel in
Minneapolis, Minnesota. USA

<http://www.usaha.org/meetings/>

November 14, 2010

USAHA – Committee on Johne's Disease
12:30-5:30pm in the Duluth Room at the Minneapolis Hilton Hotel in
Minneapolis, Minnesota. USA

<http://www.usaha.org/meetings/>

February 2 - 5, 2011
Cattle Industry Annual Convention & NCBA Trade Show
Denver, Colorado. USA

<http://www.beefusa.org/convcattleindustryannualconventionandncbatradeshow.aspx>

May 21 - 24, 2011
111th General Meeting - American Society for Microbiology
New Orleans, LA. USA
<http://gm.asm.org/>

July 10-14, 2011
2011 JAM (Joint Annual Meeting of ADSA and ASAS)
New Orleans, LA. USA
<http://adsa.asas.org/meetings/2011/>

October 4 - 8, 2011
World Dairy Expo at the Alliant Energy Center of Dane County in
Madison, Wisconsin. USA
<http://www.worlddairyexpo.com/gen.home.cfm>

February 5 - 10, 2012
11th International Colloquium on Paratuberculosis
Sydney, Australia
www.icp2012.com.au

JD In Print – Producer Press

- **Byrum, T.** 2010. Johne's data and DHI: A powerful tool for change? Progressive Dairyman. Aug. 11. p 45.
http://www.progressivedairy.com/index.php?option=com_content&view=article&id=4890:johnes-data-and-dhi-a-powerful-tool-for-change&catid=45:herd-health&Itemid=71
- **Cooley, W.** 2010. Solutions require more than one appearance. Progressive Dairyman. Aug 11. p 1.
http://www.progressivedairy.com/index.php?option=com_content&view=article&id=4903:solutions-require-more-than-one-appearance&catid=39:editorial&Itemid=65
- Industry News. 2010. Dairy Health: Steel Troughs & Chlorine Effective Against Johne's Disease. Bovine Veterinarian. August 10.
- **Keene, J.** 2010. Johne's Disease. American Dairyman. June 2010. p. 10
- **Olson, K.E.** 2010. Johne's Disease: What can you do? American Dairyman. June 2010. p. 13
- **Schulaw, W.** 2010. Your Animals' Good Health Benefits Everyone. Bovine Veterinarian. June 16.
- **Wall, E.** 2010 Old problem, new looks: Johne's disease is major research focus. Eastern Dairy Business. August 2010.

JD In Print – Peer Review Johne's Disease Related Publications

- **Aagaard C, Govaerts M, Meikle V, Guitierrez Pabello JA, McNair J, Andersen P, Guemes FS, Pollock J, Espitia C and Cataldi A.** Detection of bovine tuberculosis in herds with different disease prevalence and influence of paratuberculosis infection on PPDB and ESAT-6/CFP10 specificity. Prev Vet Med. 2010 Jul 12.

- **Bach H, Ko HH, Raizman EA, Attarian R, Cho B, Biet F, Enns R and Bressler B.** Immunogenicity of *Mycobacterium avium* subsp. *paratuberculosis* proteins in Crohn's disease patients. *Scand J Gastroenterol.* 2010 Aug 24.
- **Bannantine JP, Stabel JR, Bayles DO and Geisbrecht BV.** Characteristics of an extensive *Mycobacterium avium* subspecies *paratuberculosis* recombinant protein set. *Protein Expr Purif.* 2010 Aug. 72(2): 223-33.
- **Bermudez LE, Petrofsky M, Sommer S and Barletta RG.** Peyer's patch-deficient mice demonstrate that *Mycobacterium avium* subsp. *paratuberculosis* translocates across the mucosal barrier via both M cells and enterocytes but has inefficient dissemination. *Infect Immun.* 2010 Aug. 78(8): 3570-7.
- **Bower KL, Begg DJ and Whittington RJ.** Culture of *Mycobacterium avium* subspecies *paratuberculosis* (MAP) from blood and extra-intestinal tissues in experimentally infected sheep. *Vet Microbiol.* 2010 Jun 19.
- **Carroll J, Draper LA, O'Connor PM, Coffey A, Hill C, Ross RP, Cotter PD and O'Mahony J.** Comparison of the activities of the lantibiotics nisin and lactacin 3147 against clinically significant mycobacteria. *Int J Antimicrob Agents.* 2010 Aug. 36(2): 132-6.
- **Cho D, Shin SJ and Collins MT.** B-CELL epitope specificity of carboxy terminus of *Mycobacterium paratuberculosis* ModD. *J Immunoassay Immunochem.* 2010 Jul. 31(3): 181-92.
- **Chui LW, King R and Sim J.** Development of an immunocapture-polymerase chain reaction assay using IgY to detect *Mycobacterium avium* subsp. *paratuberculosis*. *Can J Vet Res.* 2010 Apr. 74(2): 102-7.
- **Clark RG, Griffin JF and Mackintosh CG.** Johne's disease caused by *Mycobacterium avium* subsp. *paratuberculosis* infection in red deer (*Cervus elaphus*): an histopathological grading system, and comparison of paucibacillary and multibacillary disease. *N Z Vet J.* 2010 Apr. 58(2): 90-7.
- **Cleland PC, Lehmann DR, Phillips PH, Cousins DV, Reddacliff LA and Whittington RJ.** A survey to detect the presence of *Mycobacterium avium* subspecies *paratuberculosis* in Kangaroo Island macropods. *Vet Microbiol.* 2010 Mar 27.
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