UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SMAXTEC INC. and
SMAXTEC ANIMAL CARE GMBH,
Petitioners,

v.

ST REPRODUCTIVE TECHNOLOGIES, LLC,
Patent Owner.

Case No. IPR2024-00885
U.S. Patent No. 8,823,515

REPLY DECLARATION OF TAMI M. BROWN-BRANDL, Ph.D.

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I. INTRODUCTION

1. I submit this Reply Declaration in connection with the *Inter Partes* Review ("IPR") of claims 1-4 and 15-25 ("challenged claims") of U.S. Patent No. 8,823,515 ("the '515 patent"). I previously provided a declaration, dated May 2, 2024 (my "Opening Declaration"), and I incorporate by reference the contents of my Opening Declaration in their entirety. I provide this Reply Declaration in further support of this IPR.

2. I am being compensated for my time at my standard rate of $325 per hour plus actual expenses. The opinions in this Reply Declaration are my own, and my compensation is not dependent in any way upon the outcome of the IPR of the '515 patent.

II. PROFESSIONAL QUALIFICATIONS

3. I incorporate by reference the discussion of my professional qualifications (Section II) from my Opening Declaration.

III. MATERIALS CONSIDERED

4. My analysis is based on my years of education, research, experience, and background, as well as my investigation and study of relevant materials for this declaration. When developing the opinions set forth in this Reply Declaration, I was asked by counsel to assume the perspective of a person having ordinary skill in the art ("POSA"). I reviewed and considered the materials identified in the lists below.

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Petitioners' Exhibits:

Exhibit	Description
1001	U.S. Patent No. 8,213,515
1002	Prosecution History of U.S. Patent No. 8,213,515
1005	Trevarthen, *The Importance of Utilising Electronic Identification for Total Farm Management: A Case Study of Dairy Farms on the South Coast of NSW* (Oct. 24, 2005) (Bachelor Thesis, University of Wollongong) ("**Trevarthen**")
1006	U.S. Patent No. 7,059,275 to Laitinen et al. ("**Laitinen**")
1008	U.S. Patent No. 6,059,733 to Brune et al. ("**Brune**")
1009	U.S. Patent App. Pub. No. 2006/0267767 to Pohlkamp et al. ("**Pohlkamp**")
1010	International Patent Pub. No. WO 2007/089184A1 to Liao ("**Liao**")
1011	International Patent Pub. No. WO 2006/059916A2 to Buchanan et al. ("**Buchanan**")
1013	International Patent Pub. No. WO 2004/066720 to Cross et al. ("**Cross**")
1014	U.S. Patent App. Pub. No. US 2004/0233971 to Meads et al. ("**Meads**")
1015	J.M. Bewley et al., *Comparison of Reticular and Rectal Core Body Temperature in Lactating Dairy Cows*, 91 J. Dairy Sci. 4661 (2008)
1016	L.C. Hicks et al., *Comparison of Methods of Measuring Deep Body Temperatures of Dairy Cows*, Livestock Environment VI: Proceedings of the 6th International Symposium 432 (May 2001)
1017	K.T. Higgins, *Temperature Readings by Remote Control*, Food Engineering 63 (May 2003)
1018	T. Mottram et al., *Technical Note: A Wireless Telemetric Method of Monitoring Clinical Acidosis in Dairy Cows*, 64 Computers and Electronics in Agriculture 45 (November 2008)

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Exhibit	Description
1020	T.M. Brown-Brandl et al., *Telemetry System for Measuring Core Body Temperature in Livestock and Poultry*, 2001 ASAE International Meeting Sacramento, California, USA, Paper No. 01-4032 (July 30-Aug 1, 2001)
1021	D.J. Prendiville et al., *Radiotelemetry Systems for Measuring Body Temperature*, Beef Production Series No. 57 (June 2002)
1022	Amended Complaint, D.I. 25, *ST Reproductive Technologies, LLC d/b/a STinsight v. Smaxtec Inc. et al.*, No. 3:24-cv-00037 (W.D. Wis. Apr. 23, 2024)
1023	U.S. Patent No. 5,568,788 to van den Berg et al. ("**van den Berg**")
1024	U.S. Patent App. Pub. No. 2006/0185605 to Renz et al. ("**Renz**")
1025	U.S. Patent App. Pub. No. 2007/0271320 to Tsuyuzaki ("**Tsuyuzaki**").
1026	U.S. Patent App. Pub. No. 2005/0145187 to Gray ("**Gray**")
1027	R. Daly & M. Organ, *Research Online: Digital Commons as a Publishing Platform at the University of Wollongong, Australia*, 35 Serials Review 149-53 (2009).
1028	International Application No. PCT/NZ2007/000286, International Search Report (March 18, 2008)
1029	International Application No. PCT/NZ2007/000286, Written Opinion of the International Search Authority (March 18, 2008)
1032	R.M. de Mol et al., *Results of a Multivariate Approach to Automated Oestrus and Mastitis Detection*, 48 Livestock Production Science 219-227 (1997)
1033	R.M. de Mol et al., *Description of a Detection Model for Oestrus and Diseases in Dairy Cattle Based on Time Series Analysis Combined with a Kalman Filter*, 22 Computers and Electronics in Agriculture 171–185 (1999) ("**de Mol**")
1034	J.E. Hillerton, *Detecting Mastitis Cow-Side*, National Mastitis Council Annual Meeting Proceedings 48-53 (2000)
1035	G.M. Hyde, *Milk Yield as a Factor in Dairy Herd Management* (1979) (Ph.D. dissertation, University of Illinois at Urbana-Champaign)

Exhibit	Description
1036	U.S. Patent No. 5,724,316 to Brunts
1037	U.S. Patent Pub. No. 2006/0161443 to Rollins ("Rollins")
1038	U.S. Patent Pub. No. 2005/0177390 to Young et al.
1039	Prosecution History of U.S. Patent No. 9,844,515
1040	Neter et al., APPLIED LINEAR STATISTIC MODELS (4th ed. 1996)
1041	Hair et al., MULTIVARIATE DATA ANALYSIS (5th ed. 1998)
1042	D. Schlünsen et al., *Automatic Health and Oestrus Control in Dairy Husbandry through Computer Aided Systems*, J. Agric. Engng. Res. 38 (1987)
1043	U.S. Patent Appl. Publ. No. 2003/0121972A1 to Lee et al.
1044	Help Google Search know the best date for your web page, *available at* https://developers.google.com/search/blog/2019/03/help-google-search-know-best-date-for
1045	U.S. Patent No. 6,342,242 to Allen et al.
1046	U.S. Patent No. 5,069,160 to Street et al.
1047	U.S. Patent No. 3,624,218 to Regelson
1048	J.H. Britt et al., *Determinants of Estrous Behavior in Lactating Holstein Cows*, J. Dairy Sci. 69 (1986)
1049	H. Lopez et al., *Relationship Between Level of Milk Production and Multiple Ovulations in Lactating Dairy Cows*, J. Dairy Sci. 88 (2005)
1050	E.H. Shim, *Milk Loss and Treatment Costs Associated with Two Treatment Protocols for Clinical Mastitis in Dairy Cows*, J. Dairy Sci. 87 (2004)
1051	A. Jamaludin, *Economics of feeding pasteurized colostrum and pasteurized waste milk to dairy calves*, Food Animal Economics Vol. 209, No. 4 (1996)
1052	A. Oresnik, *Effect of Health and Reproductive Disorders on Milk Yield and Fertility in Dairy Cows* (Sept. 1995)
1053	J.L. Edwards et al., *Using Activity and Milk Yield as Predictors of Fresh Cow Disorders*, J. Dairy Sci. 87 (2004)
1054	U.S. Patent No. 7,905,832 to Lau et al.

Exhibit	Description
1056	Deposition Transcript of Timothy J. Bowser, Ph.D.
1057	Deposition Transcript of Meredith Knoff
1058	S. Bagley et al., *Logistic regression in the medical literature: Standards for use and reporting, with particular attention to one medical domain*, Journal of Clinical Epidemiology 54 (2001)

Patent Owner's Exhibits:

Exhibit	Description
2001	Declaration of Dr. Tim Bowser
2002	*Curriculum Vitae* of Dr. Tim Bowser
2006	DOUG BANIA, BUSINESS VALUATION RESOURCES, LLC, THE COMPREHENSIVE GUIDE TO ECONOMIC DAMAGES, VOL. 2, CH. 38 (Jimmy S. Pappas et al. eds., 7th ed. 2023), https://nevium.com/wp-content/uploads/2023/12/Bania-Chapter-38.-Using-Internet-Analytic-Tools-for-Valuation-and-Damages-Calculations-in-Internet-IP-Infringement-and-Defamation-Cases.pdf
2007	Emory University, Goizueta Business School, *Become a Google Power User: Tips and Techniques*, https://libraries.emory.edu/media/5321
2008	A.M. Bellon, *Does animal charisma influence conservation funding for vertebrate species under the US Endangered Species Act?*, Environmental Economics and Policy Studies (2019)
2009	Declaration of Dr. Timothy J. Bowser, Ph.D. in Support of Patent Owner Response
2010	Deposition Transcript of Tami M. Brown-Brandl, Ph.D. (January 29, 2025)
2011	Declaration of Meredith Knoff
2012	*Curriculum Vitae* of Meredith Knoff
2013	Dorothea Salo, *Innkeeper at the Roach Motel*, 57 Libr. Trends 98 (2008), https://dx.doi.org/10.1353/lib.0.0031

Exhibit	Description
2014	Kwame Kodua-Ntim, *University Academics' Usage of Open Access Institutional Repositories*, 30 J. Libr. Res. Sharing 101 (2021), https://doi.org/10.1080/1072303X.2022.2103227
2015	Alex Wood-Doughty et al., *Do Download Reports Reliably Measure Journal Usage? Trusting the Fox to Count Your Hens?*, 80 Coll. & Rsch. Librs. 694 (2019), https://doi.org/10.5860/crl.80.5.694
2016	*Frequently Asked Questions on Public Statistics*, Cornell Univ.: arXiv, https://info.arxiv.org/help/faq/statfaq.html
2017	*In-depth guide to how Google Search works*, Google Search Cent., https://developers.google.com/search/docs/fundamentals/how-search-works
2018	*Our new search index: Caffeine*, Google Search Cent., https://developers.google.com/search/blog/2010/06/our-new-search-index-caffeine (June 9, 2010)
2019	*Facts about Google and Competition: How Google Search Works*, Google, https://web.archive.org/web/20111104131332/https://www.google.com/competition/howgooglesearchworks.html (Mar. 19, 2016)
2020	*Grey Literature (in the Health Sciences)*, USC Librs.: Rsch. Guides, https://libguides.usc.edu/healthsciences/grey_literature
2021	Yazdan Mansourian & Nigel Ford, *Search persistence and failure on the web: a "bounded rationality" and "satisficing" analysis*, 63 J. Documentation 680 (2007), https://www.emerald.com/insight/content/doi/10.1108/00220410710827754/full/html

IPR Filings:

Paper	Description
1	Petition for IPR
6	Patent Owner's Preliminary Response
10	Petitioners' Reply in Support of Petition for IPR
13	Patent Owner's Sur-Reply

Paper	Description
16	Institution Decision
20	Patent Owner's Response

IV. OPINIONS RELATING TO PUBLIC AVAILABILITY

5. I understand that it is Patent Owner's position that Trevarthen was not publicly available prior to September 15, 2008, or September 15, 2009. Counsel for Petitioners asked me to provide some opinions regarding the public availability of Trevarthen.

A. Date-Limited Search Engine Searching

6. Patent Owner's expert Meredith Knoff opines that "this date-limiting search functionality on Google is a helpful proxy for gauging what search results Google were relevant—or not relevant—in a specific time period. In other words, a reference that populates as a search result in response to a date-limited search supports that the reference existed and was relevant (i.e., findable) during that time period, whereas a reference that does not populate as a search result supports that the reference either did not exist or was not relevant (i.e., not findable) during that time period." Ex. 2011, ¶ 33. I disagree with Ms. Knoff. Date-limited searches on Google today are not an accurate representation of what a Google search would or would not have located if performed during the actual date-limited time period.

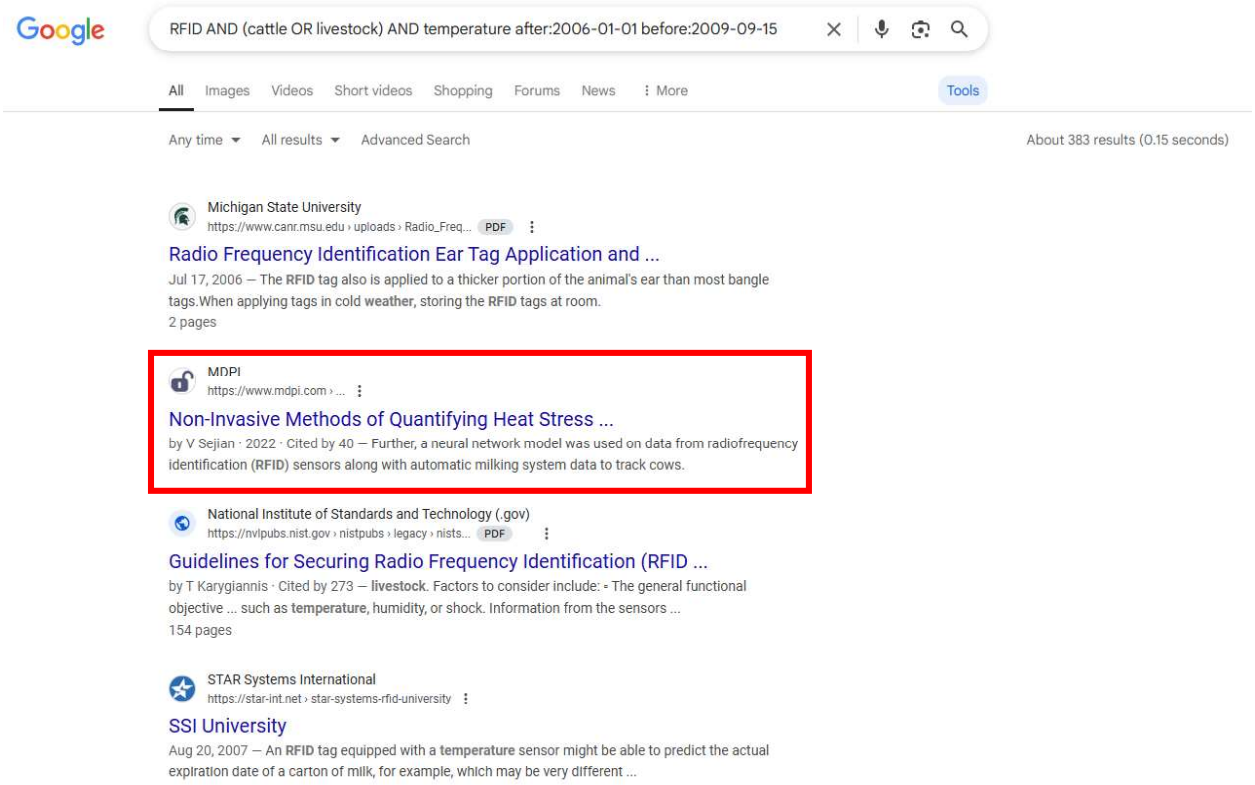
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7. As proof of the unreliability of date-limited searches on Google, I re-ran some of the same searches performed by Ms. Knoff,[1] and the search results turned up references that were clearly *not* from the date-limited time period. As shown below, papers from 2015 and later appeared in searches that were date limited to before 2009. These results tell me that date-limited time searches are *not* necessarily an accurate proxy for what a Google search would have turned up in an earlier time period.

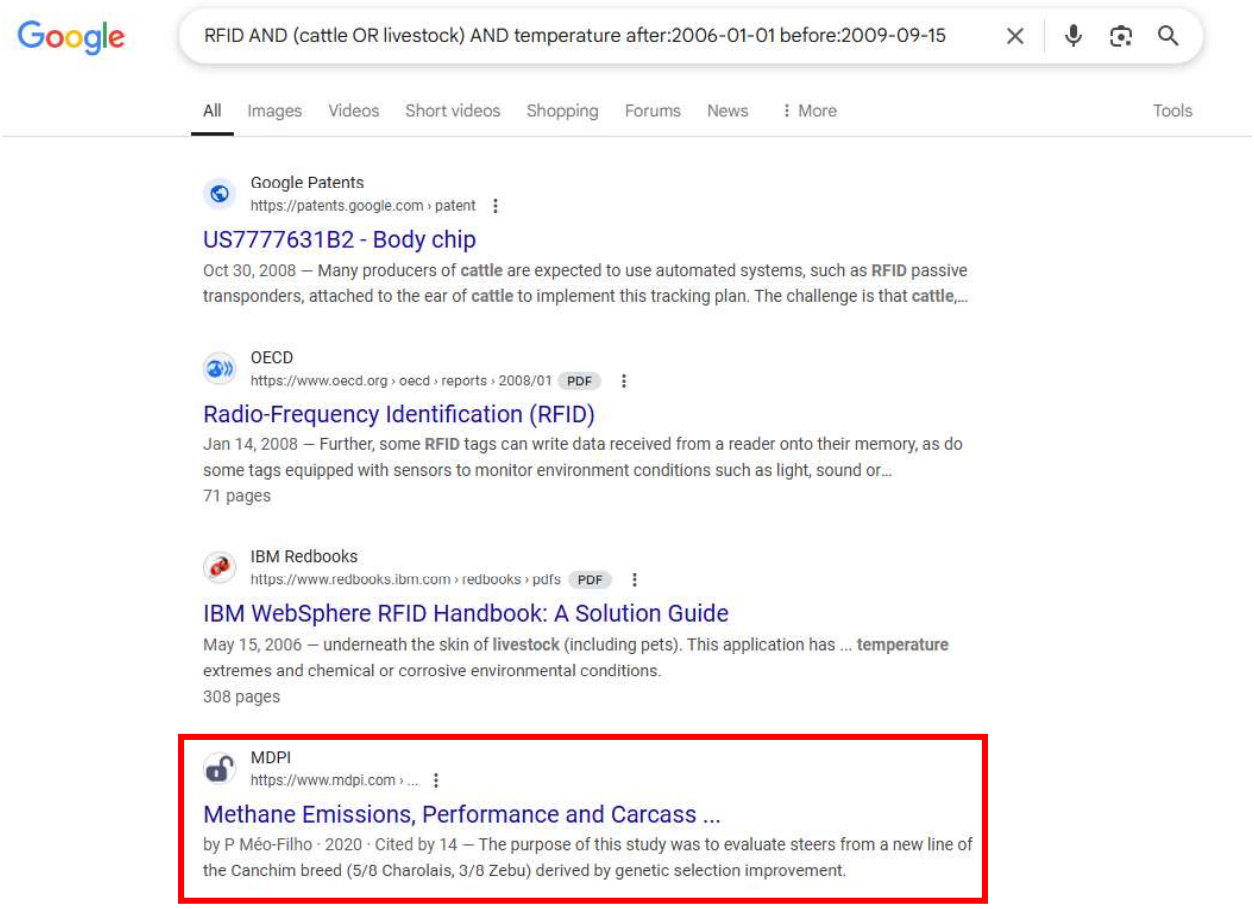
8. For example, the search string "RFID AND (cattle OR livestock) AND temperature" between January 1, 2006, and September 15, 2009, produced 383 results. The second result was a paper written in 2022—clearly not between January 1, 2006, and September 15, 2009:

[1] I turned "incognito" mode on for these searches so my prior search history would not affect the searches.

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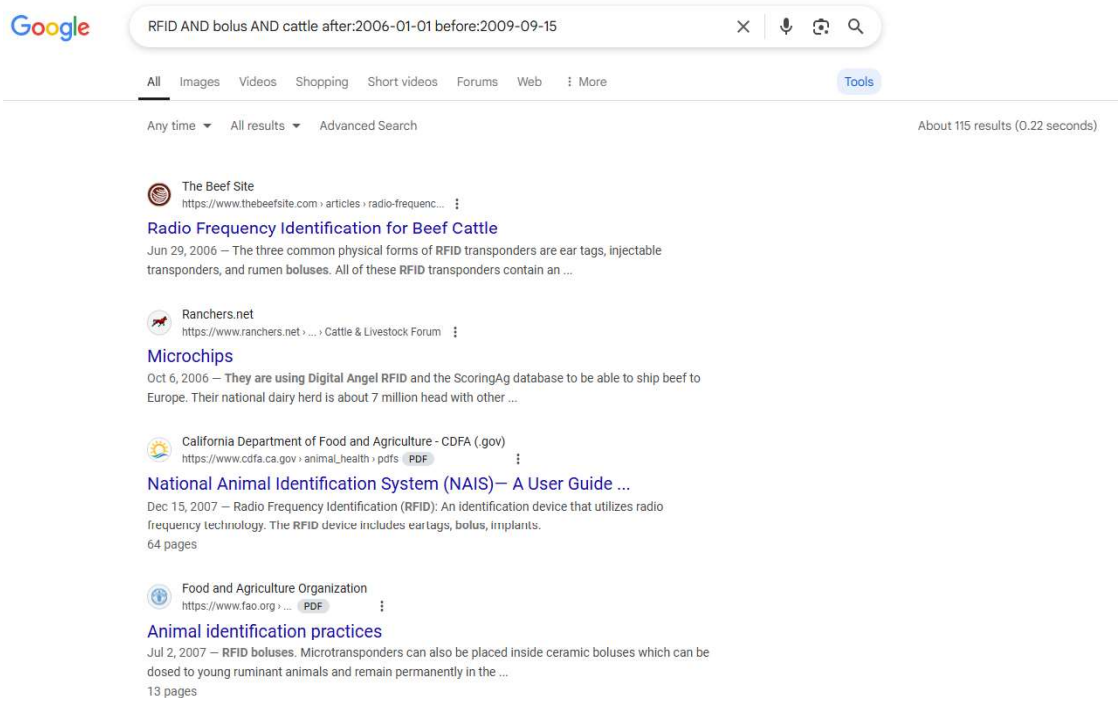


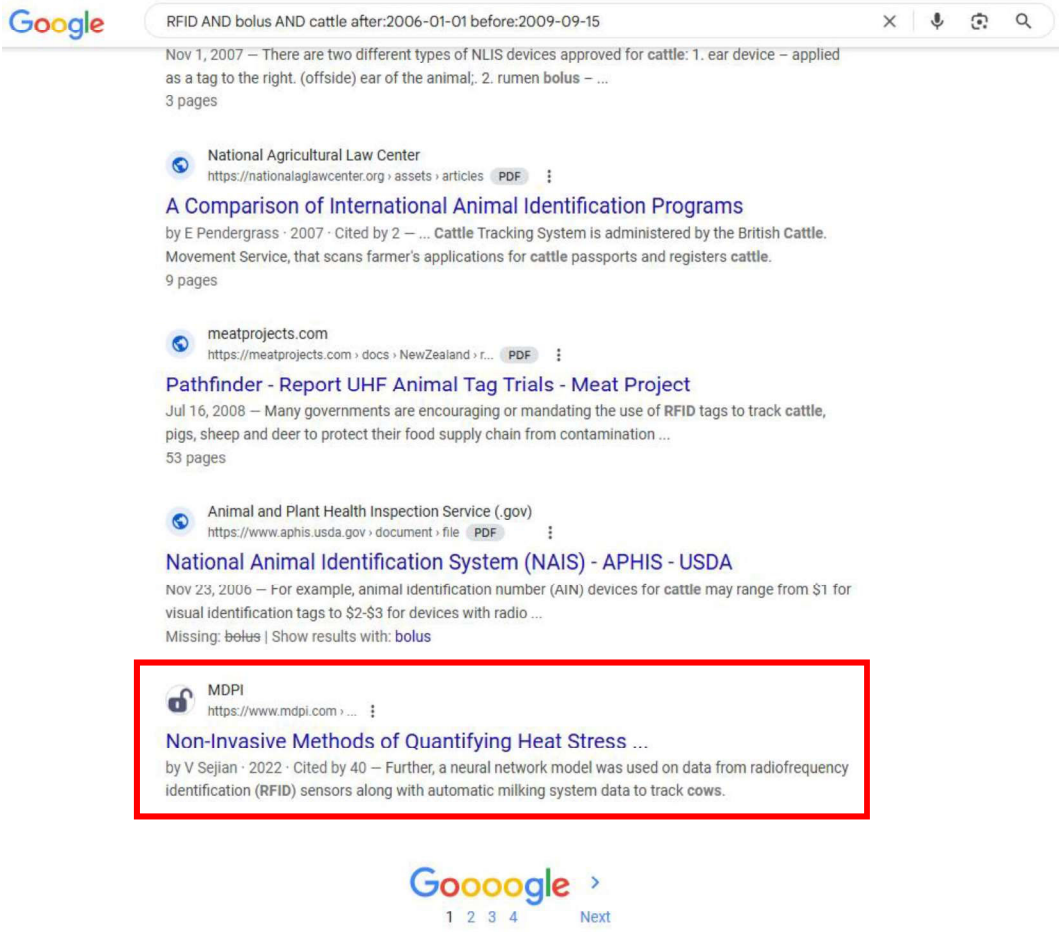
The fourth result on the third page of results was also a paper from 2020:



9. As another example, the search string "RFID AND bolus AND cattle" between January 1, 2006, and September 15, 2009, produced 115 results. The bottom result on the first page of the search results was a paper from 2020:

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10. Patent Owner may contend that this shows only that *extra* results may appear in date-limited searches, not that correct results would be omitted. I disagree. If it presents a paper from 2022 as being from between 2006 and 2009, Google could just have easily omitted relevant results from the correct time period, such as results that may not have been indexed with a correct date or a date at all.

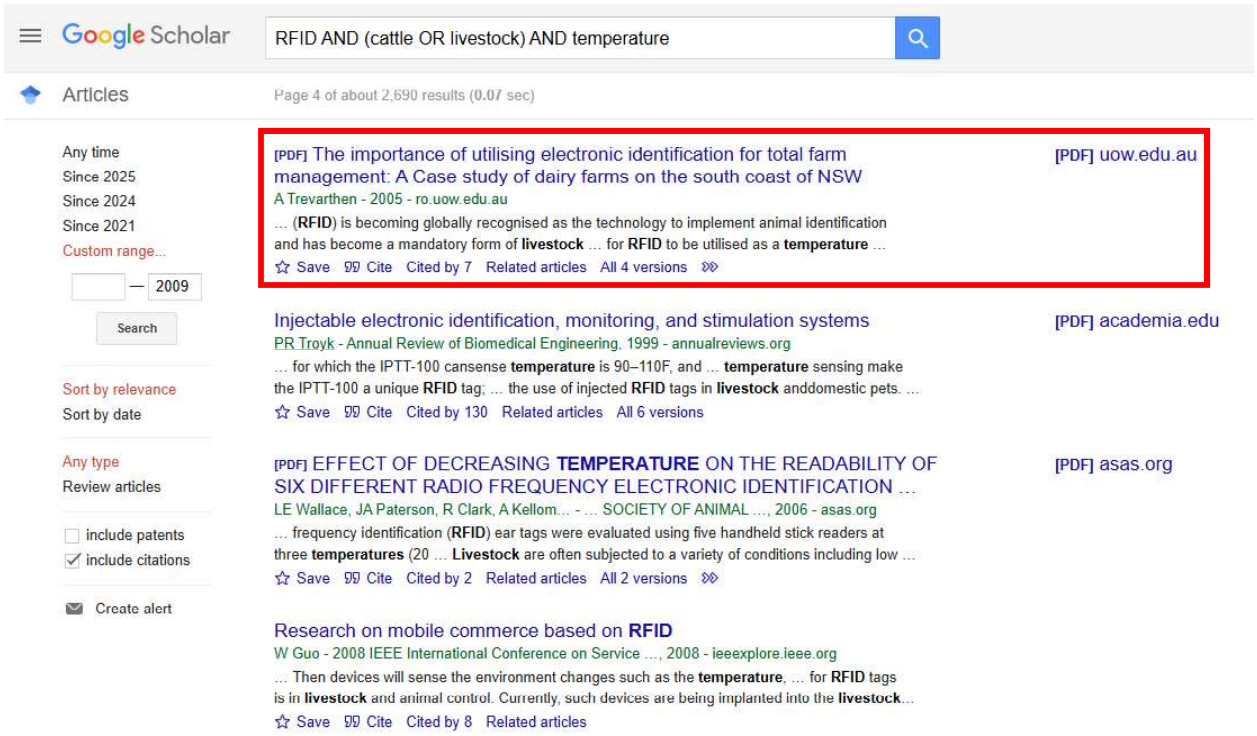
B. Locating Trevarthen on Search Engines Such as Google Scholar

11. All of the searching performed by Patent Owner's experts was done on Google. I did not see any attempt to perform searching on Google Scholar, which was an available search engine prior to 2009. I remedied this omission by performing some of my own searches on Google Scholar.

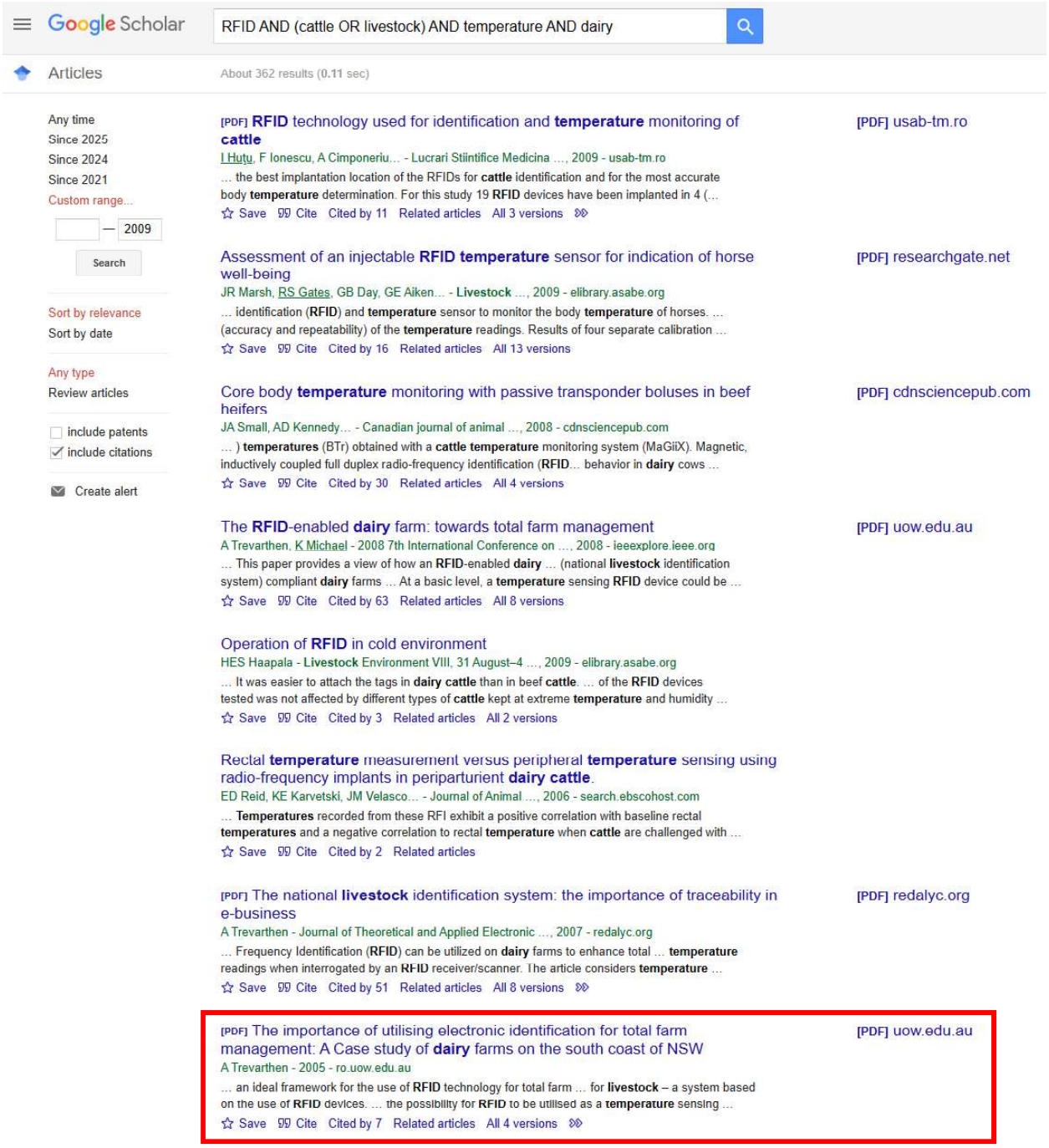
12. While I am not aware of a feature in Google Scholar to show when a particular reference was uploaded, I ran some of the search terms used by Ms. Knoff on Google Scholar, and filtered to exclude results dated *after* 2009 (to eliminate articles that would not have shown up in a search in 2009), and in each instance Trevarthen was one of the top search results. These search results, along with the fact that Trevarthen has been available on Research Online since 2006, further support my opinion that Trevarthen was indexed and locatable on a search engine between 2006 and 2009.

13. Below are images of where Trevarthen came up in each of the searches I performed:

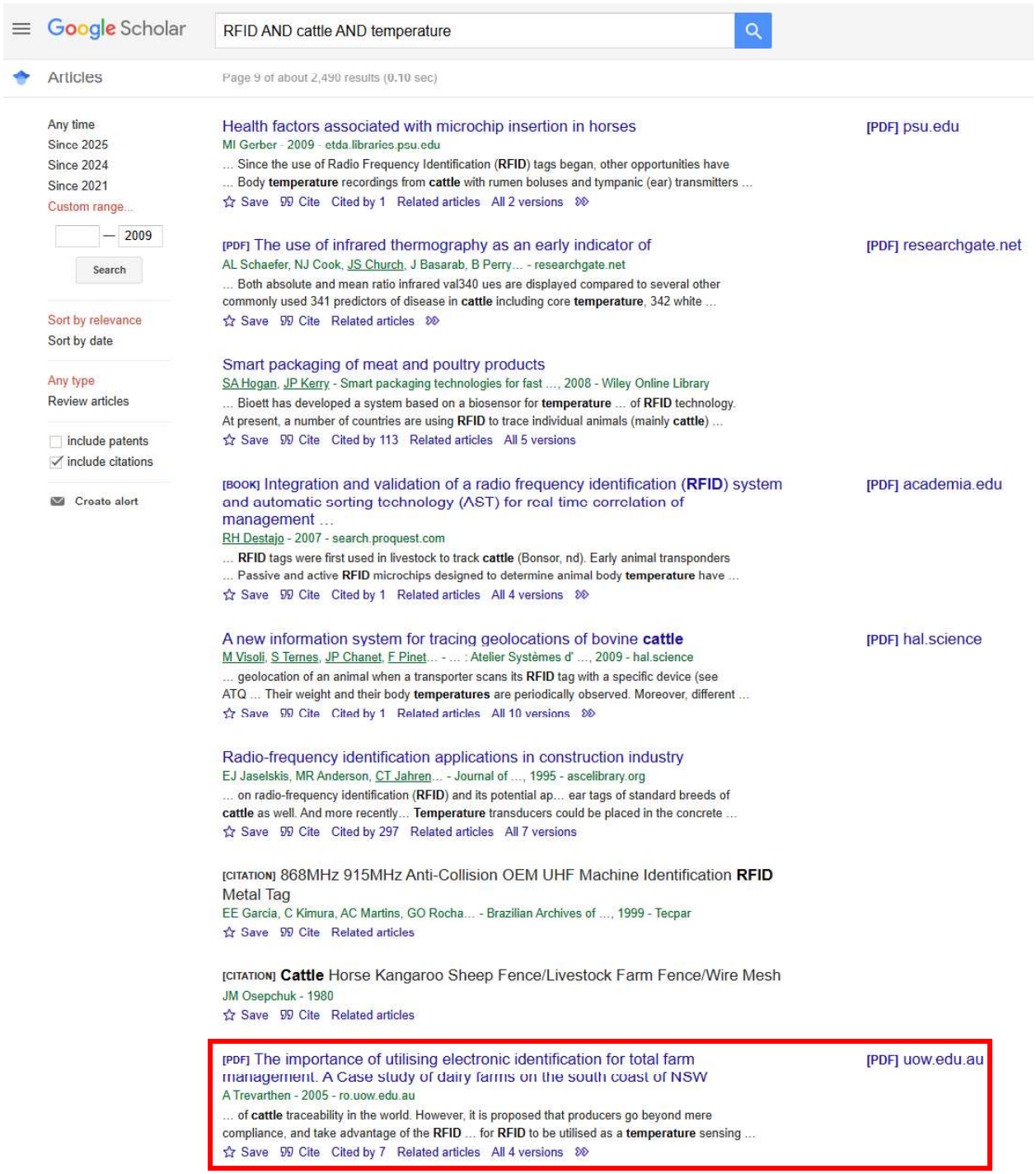
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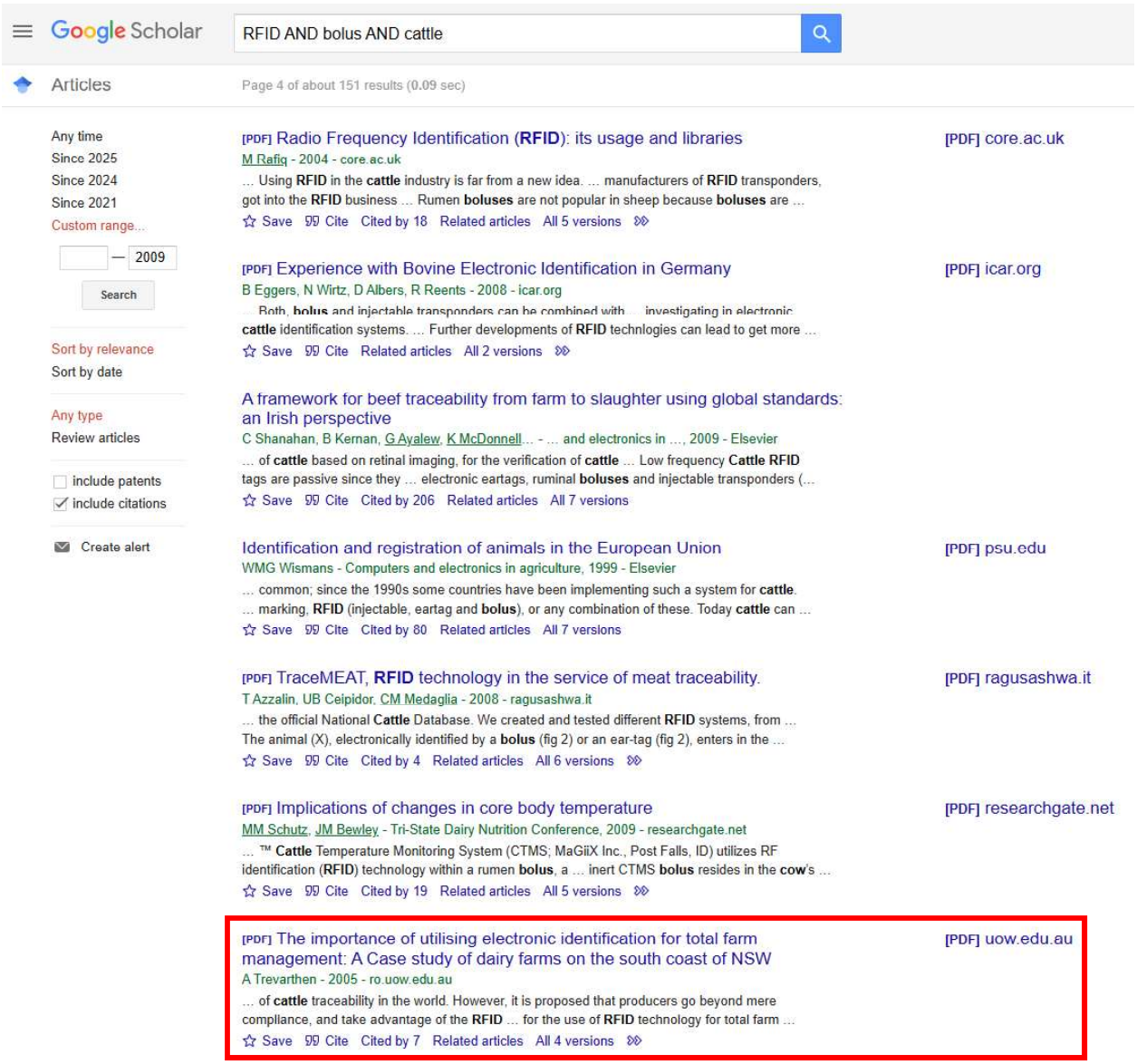
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C. Download Counts for Trevarthen

14. I have reviewed printouts of the page from Research Online hosting Trevarthen and see that it had been downloaded 324 times by September 7, 2007, and 569 times by March 22, 2008. Ex. 1030, 13, 15.

15. I reviewed the deposition transcript of Patent Owner's expert Meredith Knoff. In her deposition, Ms. Knoff testified that download counts for the

Trevarthen may be artificially inflated because a single person could have downloaded the article between 10 and 15 times. Ex. 1038, 64:10–16. I have seen no evidence to suggest that the download counts for Trevarthen are not accurate. Furthermore, even if a single individual downloaded Trevarthen multiple times, it would likely be because he or she is a person of ordinary skill in the art and interested in the subject matter of Trevarthen. I do not believe a person would download Trevarthen multiple times unless Trevarthen was relevant or closely related to the work he or she was doing.

D. Trevarthen on the International Search Report

16. I understand that Trevarthen was identified in 2008 on an International Search Report (ISR) prepared by the Australian Patent Office. Ex. 1028; Ex. 1029. The ISR contains an entry for "Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)." Ex. 1028, 1. According to the ISR, the databases consulted were: DWPI, internet, AusPat, Patent Lens, PCT Gazette, Esp@cenet, and GetThePatent. *Id.*

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI, internet, AusPat, Patent Lens, PCT Gazette, Esp@cenet, GetThePatent "cattle, rfid, gate etc."		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Trevarthen, A., 'The Importance of Utilising Electronic Identification for Total Farm Management: A Case Study of Dairy Farms on the South Coast of NSW', 2005. See url: <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1000&context=thesesinfo>. Entire document.	1-25

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17. I have investigated each of these databases and, other than the internet, it is my understanding that they are databases for searching *patents* or *patent applications*, not scholarly publications like Trevarthen. For example, based on my investigation, I understand "DWPI" to refer to "Derwent World Patents Index," a database containing patent applications and grants from several of the world's patent issuing authorities. AusPat, Patent Lens, PCT Gazette, Esp@cenet, and GetThePatent are similarly patent-searching databases. Thus, based on the disclosure of the ISR, a POSA would understand that the examiner most likely located Trevarthen through internet searches using terms such as "cattle," "rfid," "gate," etc.

V. OPINIONS RELATING TO THE TREVARTHEN-BASED GROUNDS

A. Trevarthen Discloses a Cohesive System

18. In its Response, Patent Owner contends that Trevarthen does not anticipate the challenged claimed because it "does not clearly and unequivocally disclose any system arranged as claimed." POR, 22. I disagree. As I explained in my Opening Declaration, Trevarthen (which is a thesis written by an undergraduate in the Engineering & Information Sciences department at the University of Wollongong) discloses specific improvements that build on an existing farm management system (that of the Cochrane Farm). Opening Declaration, ¶¶ 57–67.

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19. I understand from counsel that a reference can anticipate a claim even if it does not expressly spell out all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would "at once envisage" the claimed arrangement or combination. In my opinion, a POSA, reading Trevarthen, would "at once envisage" the proposed improvements to the Cochrane farm management system as a single arrangement or combination.

20. The author of Trevarthen begins the thesis by describing usage of RFID technology in existing farms, like the Cochrane Farm, which already included tagging cattle with RFID tags. Ex. 1005, 34–98. Trevarthen explains that each cow in the Cochrane Farm is tagged with an RFID tag (*id.*, 70 (Exhibit 5.1)) that facilitates its automatic identification, and the farm "utilise[s] a software package to aid in their herd management" and "to also provide the basis for their RFID operations." *Id.*, 69–71.

21. According to Trevarthen, the Cochrane Farm was interested "in further advancing their RFID operations." *Id.*, 98. Chapter 6 of Trevarthen, thus, provides a framework that "build[s] upon the current RFID usage" in dairy farms like the Cochrane Farm. The framework includes "enhancements and ideas which could be considered as future additions to further add value to the utilization of RFID in farm management." Ex. 1005, 99, ix. Trevarthen's framework connects milk meters that detect a cow's milk production that can be recorded in the database, so that milk

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production for each cow becomes one of the types of information stored in the database. *Id.*, 111–12.

22. Trevarthen's framework additionally builds on the Cochrane Farm by "incorporat[ing] temperature sensing abilities into RFID microchips" to detect "anomalies in temperatures." *Id.*, 121–22. Trevarthen proposes "a temperature sensing RFID device" that is read by "RFID readers" (*id.*, 103), where the readers are connected to the herd management software via a network (*id.*, 102–03).

23. A POSA reading Trevarthen as a whole would have understood it to disclose a complete and cohesive "total farm management" system, which includes (among other things) milk production meters and RFID sensors for temperature. The framework proposed by Trevarthen could have been implemented at the Cochrane Farm, providing numerous potential improvements to the farm. Given the full context and disclosure of Trevarthen, a POSA would "at once envisage" the disclosure as part of a single farm management system.

24. I have reviewed Dr. Bowser's declaration (Ex. 2009) regarding Trevarthen and I disagree with his conclusion that "a POSA would understand Trevarthen's boluses, microchips, and computers at Cochrane Dairy, and milk meter systems that Dr. Brown-Brandl relies on to be independent systems and components that are not used in the same animal tracking method." Ex. 2009, ¶ 124. The improvements to the Cochrane Farm proposed by Trevarthen are all within the skill

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of a POSA. Just because one piece of software used by the Cochrane Farm (*e.g.*, Dairy 2000) did not measure milk production does not mean that a POSA, in view of Trevarthen's disclosure to improve the Cochrane Farm, would not have implemented (and been able to implement) a system that employs in one system all of the enhancements described by Trevarthen, such as the milk production and temperature monitoring. Similarly, a POSA could easily envision the use of temperature-sensing RFID devices in place of the Cochrane Farm's ear tags based on the repeated disclosure in Trevarthen of temperature-sensing RFID devices. It was well known and within the skill of a POSA to use temperature-sensing RFID devices. *E.g.*, Opening Declaration, ¶¶ 36–42.

B. Obtaining Date-Time Information from RFID Devices

25. In my deposition, I testified that there were reasons one would want to retrieve data-time information from an RFID device at the reader, as well as reasons one would want to retrieve the information from the device itself. Ex. 2010, 150–152 ("There are other reasons that you would want to have the time-date on the device itself. And if you want me to explain that, I can explain that as well.").

26. One of the reasons I was referring to in my deposition was that retrieving information from the device itself ensures that the temperature data is accurately recorded at the moment it is taken (as opposed to when it was reported), providing precise and reliable health monitoring for the cow. This is crucial for

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tracking changes in the cow's condition over time and identifying any potential health issues promptly. Furthermore, retrieving date-time information from the device allows multiple measurements to be taken and stored in the device, and then collectively transmitted to the reader. Taking multiple measurements between reporting furthers the purpose of Trevarthen to detect illness based on a time-series of measurements.

27. Patent Owner argues that "the system with device-based timers is more complex and more prone to failure due to issues such as limited battery life, unsynchronized timers, and the need to communicate with the reader." POR, 31. In the context of Trevarthen and the purposes of the measurements taken and reported in Trevarthen, I disagree. Perfectly synchronized timers are not required to detect diseases in individual animals. Rather, what matters is the time-series of measurements for individual animals. The "drift" I testified about in my deposition would not dissuade a POSA from trying device-based time-stamping as taught in Brune. Brune also does not mention issues of battery life, as suggested by Patent Owner. To the contrary, Brune states that its bolus provides data over "an extended period of time." Ex. 1008, 3:37–43, cls. 4–9. Thus, a POSA would not have been dissuaded from using Brune's device-based time-stamping in Trevarthen's system.

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C. Combining Temperature and Milk Production

28. In its Response, Patent Owner contends that "Trevarthen does not disclose any system that incorporated both 'sensed' information (*e.g.*, temperature) along with 'milk' information into a single method. Rather, its discussions of milk production and temperature-sensing devices reflect disparate teachings without providing a reason to combine them." POR, 35. I disagree. As I explain above, it is my opinion that Trevarthen provides a cohesive disclosure of a farm management system that incorporates both "sensed" information (such as temperature) and "milk" information. But even if not expressly disclosed, combining these two parameters would have been obvious to a POSA.

29. Patent Owner argues that the Cochrane Farm's use of ear tags is incompatible with Trevarthen's disclosure of boluses. POR, 36. I disagree. Trevarthen explains that ear tags and boluses "provide the same functionality, reliability and accuracy," and thus are "a matter of personal preference for the farm owners." Ex. 1005, 99. Trevarthen further teaches temperature-sensing boluses as an improvement for the Cochrane Farm. *Id.* In view of these disclosures, as well as the existing knowledge of implanted sensors (*see* Opening Declaration, ¶¶ 36–42), a POSA would have been understood that the improvements to Cochrane's Farm would have included implanted sensors. At a minimum, it would have been obvious to a POSA for the same reasons to use implanted sensors as taught in Trevarthen.

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30. Patent Owner is also incorrect that disclosure of pattern recognition in milk outputs is "speculating" because Trevarthen says it was "[b]eyond their current abilities." POR, 37 (citing Ex. 1005, 109). I read the cited sentence of Trevarthen differently. Trevarthen states, "Beyond their current abilities, it is believed that future development of these automated feed bins could provide enhanced benefits for the farmers." Ex. 1005, 109. Patent Owner appears to interpret "beyond their current abilities" to mean that a POSA would not have been capable at that time of achieving the benefits of automated feed bins. To the extent this is Patent Owner's interpretation, I disagree. A POSA would have understood that sentence of Trevarthen to mean that "in addition to their current abilities," the future development of feed bins disclosed by Trevarthen would have further abilities and benefits.

31. Patent Owner argues that there is nothing in the record demonstrating a motivation to combine temperature and milk production information. POR, 39–41. I disagree. For example, as I explained in my Opening Declaration, citing to de Mol (Ex. 1033), I explained that "detailed multivariate expressions that considered several parameters to determine whether an animal was ill or in oestrus" were known. Opening Declaration, ¶ 51.

32. Patent Owner argues that "de Mol expressly cautions against using his theoretical model—which included temperature and milk production as variables—

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in any 'practical application' because it generates too many 'false positive alerts.'" POR, 40. I disagree. de Mol begins by teaching a POSA the general proposition that relying on more than one variable (including milk yield, milk temperature, electrical conductivity of milk, animal activity, and feed intake) is important for distinguishing between oestrus, mastitis, other infective diseases, metabolic diseases, and lameness. Ex. 1033, 172. de Mol then provides an example of a single integrated expression that enables multivariate analysis for the detection of illness and/or estrus. *Id.*, 174–80. de Mol, in fact, "implemented and tested" its model and states that "results for [detection of] oestrus are satisfying." *Id.*, 182. While de Mol explains that there may have been too many false positives "for practical implementation," de Mol does not denigrate the entire idea of its multivariate analysis. *Id.* To the contrary, de Mol suggests using (but improving) its model. *Id.*, 182–84. False positives would not be a reason to completely abandon a model.

33. Prior to the '515 patent, it was foundational knowledge in the art that relying on multiple variables (*e.g.*, temperature *and* milk production together) provided better predictions (*e.g.*, of illness) than a single variable alone (*e.g.*, only one of temperature *or* milk production). In addition to de Mol, this knowledge is reflected in the following references:

- Bagley, *Logistic regression in the medical literature: Standards for use and reporting, with particular attention to one medical domain* (2001): "For a

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given set of data, introducing more variables will generally produce a model better fit to the data . . . ." Ex. 1058, 980.

- Neter, *Applied Linear Statistical Models* (1996): "[W]e frequently find that predictions of the response variable based on a model containing only a single predictor variable are too imprecise to be useful …. [a] more complex model, containing additional predictor variables, typically is more helpful in providing sufficiently precise predictions of the response variable." Ex. 1040, 217.
- Hair, *Multivariate Data Analysis* (1998): "We have shown how improvements in prediction of the dependent variable are possible by adding independent variables …." Ex. 1041, 172.
- Schlunsen, *Automatic Health and Oestrus Control in Dairy Husbandry through Computer Aided Systems* (1987): "The milk temperature reacted 12 h after the infection with an increase of 0-8 K and reached a higher level in the further experiment. The milk quantity was measured and a yield depression of about 5 kg was observed after the infection was triggered. … Since a variety of factors have an effect on the milk temperature this parameter alone is not sufficient for oestrus diagnosis. … The simultaneous recording of the following parameters is to be recommend for oestrus monitoring … milk temperature; milk yield …." Ex. 1042, 272, 275, 278.

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I note that milk temperature is highly correlated with body temperature. Indeed, by definition, milk temperature is at body temperature as it leaves the body. Thus a POSA would understand that it would be desirable to measure body temperature instead of or in addition to milk temperature, and that body temperature could take the place of milk temperature in a multivariate analysis.

VI. OPINIONS RELATING TO THE LAITINEN-BASED GROUNDS

A. Laitinen's Disclosure of Implant-Based Temperature Measurements

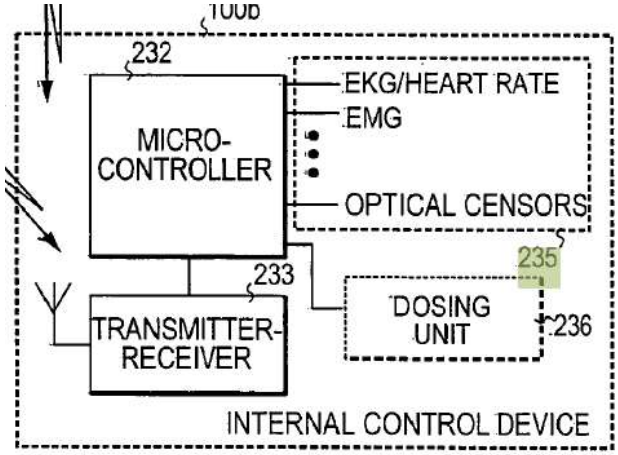
34. As explained in my Opening Declaration, a POSA reading Laitinen would have understood that Laitinen discloses implanted temperature-sensing devices. Opening Declaration, ¶¶ 71–73, 149–50, 177.

35. For example, Laitinen teaches a "pico level device," which may include a "[s]ensor unit connected to the micro controller for the surveillance of the animal's body temperature, occlusion, muscular action, motion or metabolic level. The [s]ensor unit can also be an implant inside the animal, in which case the data it provides can be, for instance, read/transcribed by the pico level equipment using the so-called Radio Frequency Identification Technology." Ex. 1006, 3:51–62.

36. A POSA would similarly understand that the implanted control device of Figure 2 measures temperature. Figure 2 shows "two different pico level devices," one of which is external (100a) and the other that is "implanted inside the animal's tissue (100b)." *Id.*, 5:38–43. As shown below, the "internal control device"

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of Figure 2 (100b) includes three placeholders ("···") in box 235 (highlighted below) for additional sensors (other than EKG/heart rate, EMG, and optical sensors), and Laitinen discloses that one allowable sensor in its devices is for temperature. *Id.*, 3:51–52, 5:38–55, 8:9–11. A POSA would thus understand Laitinen to disclose (as one of the "···" sensors) a temperature sensor, such that the internal control device of Laitinen has temperature measuring capabilities.



Id., Fig. 2 (excerpted and annotated).

B. Combination of Laitinen and Liao

37. Patent Owner argues that "Liao does not teach that milk production is also useful for determining whether a cow is in heat and ready for artificial insemination [because] Liao uses milk yield and DIM solely as an input to make an 'insemination decision,' which is different from detecting heat." POR, 44–45. I disagree that this would dissuade a combination. Heat and insemination decisions are closely related. For example, in Liao, "whether the animal is in heat" is, along

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with DIM and peak milk yield, an "input parameter" to the insemination decision. Ex. 1010, 9–12.

38. In Liao, an insemination decision is based on, among other things, DIM, milk yield, and a heat-detection status. *Id.*, 20–21 (claim 10). Laitinen teaches an expression for determining heat based on temperature. Ex. 1006, 8:5–12. Thus, when Laitinen's expression is combined with that of Liao (*e.g.*, nested within Liao's insemination determination), both temperature and milk information are considered.

39. Separately, as explained in my Opening Declaration, a POSA would have been aware prior to the '515 patent that lowered milk production was an indicator of illness, or related conditions such as heat stress. Therefore, a POSA would have been motivated to modify the second logical expression of Laitinen (which seeks to determine an appropriate medical treatment for an animal) to include milk yield as an input, along with temperature. As explained above, it was well known for decades that a combination of variables was likely to improve reliability of a logical expression that determines whether a cow is ill and advising on medical treatments.

40. It is also my opinion, as explained in my Opening Declaration, that a POSA would be able to rely on the combined teachings of Laitinen and Liao to combine temperature and milk production as input variables to a new logical expression for the detection of heat or illness. Opening Declaration, ¶¶ 157–65.

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Thus, my opinions with respect to combining Laitinen and Liao are not limited to modifying the specific logical expressions disclosed in those references. To the contrary, it was within the skill of a POSA to develop his or her own logical expression, based on the teachings of Laitinen and Liao, that would detect, *inter alia*, illness.

41. It was well known to a POSA that milk yield (like temperature) was correlated with illness and estrus. *See, e.g.*, Ex. 1052, 44 ("[M]ilk production in herds analyzed was significantly reduced in cases of mastitis."); Ex. 1053, 528 ("milk yields of sick cows were lower ($P < 0.01$) than milk yields of healthy cows."); Ex. 1048, 2195, 2201; Ex. 1049, 2792 (Fig. 6). Therefore, a POSA would have been motivated to modify Laitinen or "create a new" expression that included both temperature and milk production information as input variables to detect estrus or illness. Ex. 1033, 172; Ex. 1042, 170–74 ("[M]ilk temperature and yield are both of importance and enhance prediction model for estrus detection for cows.").

42. I note that Patent Owner appears to misunderstand the disclosure from Liao. Liao states: "On the contrary, many other factors may have impact on an actual insemination decision for a particular animal. However, often the farmer himself/herself is not explicitly aware of exactly which these factors are, or how they influence the insemination decision. Therefore, it may be practically impossible to formulate a Boolean, or other mathematical model, for the decision process."

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Ex. 1010, 1. Patent Owner appears to interpret the "impossible to formulate" language to mean that no one, not even a POSA, could formulate a Boolean model to determine whether to inseminate a cow. *See* POR, 46–47. I disagree. A POSA would understand Liao to teach that "the farmer himself/herself" is not able to formulate a Boolean, prior to the invention disclosed in Liao. Liao seeks to "alleviate[] the above problems" and offer a solution that farmers can use to determine whether to inseminate. Ex. 1010, 2–5 ("This system is advantageous because it is capable of modeling decision processes that cannot be explicitly formulated. … The output data produced by the decision engine includes … a second output parameter reflecting whether the animal having this identity should be inseminated within a particular time period."). Thus, there is nothing about Liao's parameters that would dissuade a POSA from using them in an expression, such as that of Laitinen.

43. Finally, Patent Owner states, "when a cow is given medication, its milk is typically withdrawn from production. When that occurs, no milk production data is measured." POR, 48. This is incorrect. A POSA would have understood that even medicated animals are milked, with the milk then discarded. Ex. 1005, 81; Ex. 1050 [Shim (2004)], 2702–03; Ex. 1051 [Jamaluddin (1996)], 751. In my experience, even the yield of the discarded milk is still measured and tracked. *See id.*

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VII. CONCLUSION

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Date: May 16, 2025

Tami M Brown-Brandl

Digitally signed by Tami Brown-Brandl
Date: 2025.05.16 13:15:08 -05'00'

Tami M. Brown-Brandl, Ph.D.