STATE OF WISCONSIN : CIRCUIT COURT : MANITOWOC COUNTY

STATE OF WISCONSIN,	)	
	)	
Plaintiff,	)	
	)	Case No. 05-CF-381
v.	)	
	)	Honorable Judge Angela Sutkiewicz,
STEVEN A. AVERY,	)	Judge Presiding
	)	
Defendant.	)	

AFFIDAVIT OF KARL REICH, Ph.D.

I, Dr. Karl Reich, under oath and under the penalty of perjury, state that:

1. I am a DNA analyst and professional molecular biologist. I have a doctorate in Molecular Biology and am the Chief Scientific Officer of Independent Forensics of Illinois, 500 Waters Edge, Suite 210, Lombard, IL 60148. My *curriculum vitae* is attached and incorporated as **Exhibit A** to this affidavit.
2. Independent Forensics Laboratory adheres to the FBI's Quality Assurance Standards for molecular biology, human genetics and forensic DNA Testing Laboratories. Independent Forensics is accredited by ANSI-ASQ National Accreditation Board (ANAB, FQS-I, ISO/IEC 17025), the American Association of Blood Banks (AABB), and the New York State Department of Health (NY-DOH), for genetic identity and forensic DNA testing. Independent Forensics is the only such laboratory in Illinois.
3. I have been retained by the defense to provide a professional, scientific and critical perspective on: a) the possible biological source of the DNA that generated a DNA profile from item M05-2467 #ID, alleged swabbing of hood latch; and b) forensic DNA results obtained from the item identified as M05-2467 #ID, alleged swabbing of hood

latch. Here forensic DNA results include both the quantity of DNA that was recovered from this item and the DNA profile obtained from the sample marked as M05-2467 #ID. I have also analyzed the amount of DNA on an exemplar key for purposes of comparison to M05-2467 #C, the Toyota key.

4. I am intimately and professionally familiar with the scientific literature, research efforts, commercial technologies and 'home brew' methods used to identify the biological source of DNA that is obtained from forensic evidence. These tests, screens, methods and procedures are sometimes referred to as 'Biology' or 'Serology' or source attribution (the term serology derives from when forensic analysis relied on cell surface antigens tested with antisera, hence the term serology). In simple terms: what did the DNA come from? Dr. Reich to add a sentence regarding expertise in DNA profiling.
5. My familiarity with the analysis and interpretation of DNA profiles derives from personally testing DNA samples, from supervising a fully accredited forensic DNA laboratory that processes a wide variety of sample types, from the professional review of hundreds of forensic DNA cases from both governmental and private DNA laboratories and from the development of new protocols, reagents and kits that enhance the sensitivity and forensic DNA analysis. Hundreds of laboratories use these tests every day.

I. SOURCE ATTRIBUTION / BODY FLUID IDENTIFICATION

6. There are four forensic body fluids for which reliable tests exist: blood, semen, saliva, and urine and most recently, feces. It is of course understood that humans make a variety of other body fluids (here fluid is used in the broad sense of biological substances

shed or deposited or produced by humans); a partial list might include tears, sweat, ear wax, vomitus, mucus (which varies with epithelial origin), etc. There are no tests for these, or other biological fluids/human products and thus these other fluids are invisible to forensic analysis. There are only tests for the listed four (now five).

7. As for all body fluid identification, forensic detection of blood, semen saliva or urine (or feces) is based on detecting a biological marker associated with the body fluid in question – find or identify the bio-marker and the analyst will assume the body fluid is present. This is a reasonable and accepted approach to forensic body fluid identification. Common examples (but not an exhaustive list) might include using hemoglobin (or components of hemoglobin) for the identification of blood, α-amylase for the identification of saliva, acid phosphatase or PSA/p30 or semenogelin for the identification of seminal fluid and urea or Tamm-Horsfall for the identification of urine.
8. The distinction between a presumptive test or screen and a confirmatory test should be noted. A presumptive test does not have the specificity required to unambiguously identify the body fluid; this may be due to a bio-marker that is present in two (or more) body fluids (hence making it impossible to distinguish which body fluid is identified), may be due to the bio-marker being present in multiple species, may be due to the inherent deficiency in the test that reacts with other substances in addition to the bio-marker or to a combination of these factors. A positive presumptive test may indicate that the bio-marker is present and thus may be an indication that the body fluid could be present. A confirmatory test will only identify one body fluid from one species – assuming that the test is working properly (and was properly conducted), a positive test confirms the presence of the bio-marker thus confirming the presence of the body fluid.

9. RSID™-Blood and RSID™-Semen are confirmatory tests (only one body fluid from one species is detected by these tests); RSID™-Saliva and RSID™-Urine are presumptive tests (salivary α-amylase is present in saliva, human milk, feces [we swallow saliva all day long] and in the urine of some individuals; RSID™-Urine will detect the urine of humans and some additional species).

II. ANALYSIS OF SUBMITTED EVIDENCE

10. In the present case, Independent Forensics received the listed item of evidence (M05-2467 #ID) on 12/08/2016 and began an examination on 01/25/2017. As presented the seals on the evidence were intact. The evidence consisted of cotton batting, a portion of which was discolored / soiled and presented in a plastic bag. As no context for the batting material was provided it was impossible to determine what part of the original swab the batting represented, thus making any subdivision of the material impossible. The entire batting was therefore soaked/extracted *in situ*.
11. The process of performing forensic body fluid testing requires that the item / evidence (swab batting or stain on fabric) be 'soaked' or wetted to promote the solubilization of the bio-marker; in more prosaic terms the evidence is dunked in water and agitated to promote the release of the biological material into the liquid phase. Pure water should not be used, but rather a solution specific to and optimized for the specific body fluid test; this buffer solution is generally supplied by the manufacturer of the test.
12. In the present example, we used our extensive knowledge of the RSID™ (Rapid Stain Identification) tests to identify the buffer combination that would provide the most

sensitive and specific bio-marker identification from the limited amount of physical evidence present in M05-2467 #ID.

13. On 01/25/2017 testing for the presence of saliva using RSID™-Saliva was performed. Positive and negative controls were of course used at the same time as the questioned sample extract was tested. Both controls returned the expected result (negative for the buffer control, positive for the known positive sample); the extract from M05-2467 #ID tested negative for salivary α-amylase, the bio-marker used for the identification of saliva. Thus, no evidence of this body fluid from this exhibit was obtained.
14. On 01/30/2017 testing for the presence of human blood was performed using RSID™-Blood. Positive and negative controls were of course used at the same time as the questioned sample extract was tested. Both controls returned the expected result (negative for the buffer control, positive for the known positive sample); the extract from M05-2467 #ID tested negative for glyocophorin A, the bio-marker used for the identification of human blood. Thus no evidence of this body fluid from this exhibit was obtained.
15. On 01/30/2017 testing for the presence of human semen was performed using RSID™-Semen. Positive and negative controls were of course used at the same time as the questioned sample extract was tested. Both controls returned the expected result (negative for the buffer control, positive for the known positive sample); the extract from M05-2467 #ID tested negative for semenogelin, the bio-marker used for the identification of human semen. Thus no evidence of this body fluid from this exhibit was obtained.

16. On 01/31/2017 testing for the presence of urine was performed using RSID™-Urine. Positive and negative controls were of course used at the same time as the questioned sample extract was tested. Both controls returned the expected result (negative for the buffer control, positive for the known positive sample); the extract from M05-2467 #ID tested negative for Tamm-Horsfall, the bio-marker used for the identification of urine. Thus no evidence of this body fluid from this exhibit was obtained.

III. CONCLUSIONS OF SOURCE ATTRIBUTION TESTING ON ALLEGED HOOD LATCH SWAB

17. All four body fluid tests provided negative results from the tested, questioned sample.
18. The documentation from the Wisconsin Department of Justice State Crime Laboratory - Madison provides an estimate of the amount of DNA recovered from their retained portion of the evidence. In technical language: the qPCR analysis returned a value of 0.062 nanograms per microliter from 30 microliters of final extract (0.0616 ng/µL in 30 µL). This computes to a total of ~1.9 nanograms of human DNA recovered from the evidence processed by the Wisconsin Department of Justice State Crime Laboratory - Madison.
19. Given the efficiency of the methods in use at that laboratory we can back calculate the volume of saliva, semen or blood that would be required to be present for the amount of DNA recovered from the cotton batting since the DNA content of these body fluids are well known.

20. Given the known sensitivity of the RSID™ tests, we can be confident the testing regimen used would have detected any of these body fluids had they been the source of the DNA identified on M05-2467 #ID.

21. While not definitive, this analysis lends strong support that the source of the DNA from this sample is unknown and is not likely to be blood, saliva or semen or urine.

IV. QUANTITY OF DNA ON ALLEGED HOOD LATCH SWAB

22. DNA profiles are derived from the molecular biological analysis of DNA; CODIS DNA profiles (laboratory slang for the DNA profile that is most often obtained and that can be stored and searched in a DNA database) and Y-STR profiles (technically a male haplotype) are derived from chromosomal DNA contained in the nucleus of human cells*. Another type of forensic DNA testing, mitochondrial DNA analysis, derives from analyzing the DNA contained in the mitochondria, an organelle in the cytoplasm of human cells. Although obvious to the point of being inane, the DNA that ultimately provides the DNA profile has to come from somewhere, *i.e.,* some biological source of human cells or the remnants / debris of human cells. Identifying the source of the DNA can have profound implications and repercussions in the investigation, prosecution and outcome of a criminal case. *[*For simplicity we are ignoring the fact that higher primates can yield DNA profiles if analyzed by current forensic DNA laboratory methods; this technical detail is not significant in the current case.]*

23. It is well documented that DNA was isolated from the listed item and this DNA generated a DNA profile of the defendant. The process of obtaining a DNA profile from a biological sample includes an obligatory step to determine / estimate the amount of

recovered DNA; this step is called DNA quantification. The current method of DNA quantification uses a technique, quantitative PCR (qPCR), a variant of the polymerase chain reaction. The documentation from the Wisconsin Department of Justice State Crime Laboratory - Madison reveals that ~1.9 ng of human DNA was recovered from the listed sample (technically 30 μL of a DNA solution at a concentration of 0.0616 ng/μL).

24. At trial, it was claimed that the defendant's DNA on the listed item of evidence was deposited from "sweaty fingers". This is of course pure speculation as there is no forensic test for the presence of sweat – nonetheless the DNA that generated the profile came from somewhere.

25. In an attempt to replicate the findings reported by the Wisconsin Department of Justice State Crime Laboratory - Madison, our laboratory performed a series of experiments on a vehicle identical (*i.e.,* same make, model and year) to that impounded by law enforcement in this case (M05-2467 #A).

26. Volunteers were enlisted to open the car hood of this surrogate vehicle using the engine compartment hood latch; the latch was then swabbed and the quantity of DNA recovered estimated by qPCR, the current (and identical) method used by the Wisconsin State Forensic DNA Laboratory, Madison.

27. This experimental test was repeated fifteen (15) times. The hood latch was of course cleaned after each round of hood opening and subsequent swabbing.

28. The results of this test series is instructive: in eleven (11) of the fifteen (15) replicates, no detectable DNA was recovered from the hood latch. In other words, the amount of DNA recovered after swabbing the hood latch used to open the vehicle engine hood was

less than the minimum detection threshold of the qPCR method; *i.e.*, less than 0.005 ng/μL. In four (4) of the replicates, quantifiable DNA was recovered with the following results: 0.0519 ng, 0.0936 ng, 0.0696 ng and 0.0729 ng.

29. In other words in almost three-quarters (73%) of the hood opening trials, no measurable DNA was left behind by the individual who opened the hood. Put another way, even when DNA was left on the hood latch after opening the hood, the amount of DNA recovered was between twenty (20) and thirty-five (35) times less than that recovered from the item identified as M05-2467 #ID. To put it yet another way, the Madison laboratory recovered from six (6) to seven (7) times more DNA than all of the DNA recovered from all of the fifteen (15) hood openings, combined.

30. Given the experimental results, both the body fluid detection data and the DNA recovery data from the hood latch opening trials, the question of what sample M05-2467 #ID really might be, becomes a subject for investigation.

V. ANALYSIS OF DNA CONCENTRAITON ON EXEMPLAR KEY

31. Similar to the experimental work to replicate the hood latch results, an experiment was done to try to replicate the results from the ignition key (item m05-2467 #C) of the victim's automobile. An exemplar key, reportedly held by Mr. Avery as if to start a car, *i.e.*, gripped by ungloved fingers for twelve (12) minutes, was subject to qPCR analysis (*i.e.*, DNA quantification). It was determined that 0.017 nanograms per microliter (ng/μL) was recovered. This result was ten (10) times less NDA than reported by the Wisconsin Department of Justice State Crime Laboratory – Madison on the key they analyzed, item M05-2467 #C. An order of magnitude difference is a significant finding.

VI. EVIDENCE – CHAIN OF CUSTODY, ENHANCEMENT, PRODUCTION

32. For a variety of reasons the forensic evidence in WI v Avery is being seriously scrutinized and re-examined. This includes the forensic DNA analysis conducted by the Wisconsin Department of Justice State Crime Laboratory - Madison on item M05-2467 #ID. The data obtained from body fluid identification testing, from DNA quantification, from the DNA profile and from attempts at replicating the sample in question are contradictory. The data show an acceptable DNA profile from a sample with no indication of a body fluid; a robust amount of DNA recovered from the sample and yet attempts to replicate this finding failing, repeatedly. These facts prompt a re-evaluation of this item of evidence.

33. It is an oft-repeated fear heard from many defendants that the evidence in their case has been enhanced, manufactured or otherwise manipulated to their disadvantage. There is no doubt that evidence tampering occurs, though there is little to support the contention that this is a widespread practice. It is often assumed that creating an item of evidence *de novo* or enhancing an item of evidence is an effective method of evidence tampering; however simply relabeling an errant known standard / reference swab as a questioned item/exhibit, accomplishes the goal of identifying the defendant far more efficiently. There is sufficient evidence to hypothesize that this approach to evidence tampering occurred for sample M05-2467 #ID.

34. The chain of custody and disposition of two groin swabs taken from the defendant during his arrest is neither complete, accurate or transparent. Such a sample, relabeled as taken from the hood latch of the victim's vehicle, would satisfy all of the observed facts: lack of body fluid, sufficient amount of DNA for a profile and would link the

defendant to the victim without all of the messy and complicated effort to actually deposit DNA on a grease and engine grimed engine compartment metal latch.

35. The convenience of this explanation, (*i.e.*, a reference swab relabeled as an evidence swab) and the fact that it accounts for the physical findings observed from the analysis of item M05-2467 #ID does not prove evidence tampering, or more precisely, evidence reassignment. But this hypothesis is a far better 'fit' to the data, experimental trials and needs of the investigators for clear and convincing evidence of a link between the defendant and the victim's vehicle. A swab truly taken from the engine compartment hood latch should have been covered in black engine grime and grease as anyone who has ever had to open the hood of a high mileage car can attest. The swab batting in question was merely very lightly discolored; another fact that does not 'fit' with the claimed origin of this sample.

VII. ANALYSIS OF BEDROOM SLIPPERS AS POSSIBLE SOURCE OF DNA ON M05-2467 #C, TOYOTA KEY

36. Our lab conducted an experiment to examine whether the bedroom slippers (Calumet County Sheriff's Department Property Tag Nos. 8359 and 8360) recovered from Mr. Avery's residence, could have been the source of his DNA detected on the Toyota ignition key, M05-2467 #C, allegedly recovered from Mr. Avery's bedroom. This hypothesis was tested by creating a pair of worn slippers (sockless, nine hours a day for five days) and using this worn item as a source of DNA on an exemplar ignition key. The procedure was to prepare the slippers, rub the key and then measure the DNA that was transferred, again suing the qPCR technique. This approach yielded 0.0393

nanograms per microliter (ng/μL), well below the concentration of DNA reported by the Wisconsin Department of Justice State Crime Laboratory – Madison for the key they analyzed, M05-2467 #C, at 0.17 nanograms per microliter (ng/μL).

37. These data do not support the hypothesis that the DNA identified on the Toyota ignition key came from contact with the slippers photographed in, and recovered from, Mr. Avery's bedroom. If the Toyota ignition key was indeed 'enhanced', then it is likely that some other personal item of Mr. Avery's was used for this purpose; some possible examples might include a toothbrush or a cigarette butt.

VIII. CONCLUSION REGARDING CHAIN OF CUSTODY

38. In order to account for the physical findings of body fluid identification (actually the lack thereof), of DNA profiling, of attempts at evidence recreation, and of the physical condition of item M05-2467 #ID, it is hypothesized that a rubbed groin swab taken from the defendant was relabeled and thus became evidence from a hood latch. This hypothesis has not been proven, but it fully explains all of the known facts regarding this item. Taken in context with other facts and allegations in the case of WI v Avery, this hypothesis deserves carefully consideration from the trier of fact.

FURTHER AFFIANT SAYETH NAUGHT

Karl Reich, PhD

State of Illinois
County of DuPage

Subscribed and sworn before me
this 6th day of JUNE, 2017.

Notary Public

STATE OF ILLINOIS
COUNTY OF DUPAGE

Sworn to and subscribed before me
this 6th day of JUNE, 2017

Allan Suyosa Notary Public
My Commission Exp. March 30, 2018

ALLAN SUYOSA
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
March 30, 2018

Karl A. Reich, Ph. D.

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FORENSIC DNA / MOLECULAR BIOLOGY / MICROBIOLOGY / PROTEIN BIOCHEMISTRY MICROBIAL AND HUMAN FUNCTIONAL GENOMICS / PROTEIN PURIFICATION

Scientist with eight years post-graduate and fifteen years progressive experience in the pharmaceutical and biotechnology industry. Proven track record of initiating, managing and leading product oriented research in forensic DNA, genomics, infectious diseases, pharmaceutical target identification functional genomics, biotherapeutics, molecular biology, microbiology and strain development for industrial fermentation.

- Court Qualified DNA Expert Witness for Forensic DNA, Forensic Biology and Statistics – Testimony and depositions in more than eighty cases in State, Federal and International courts in both criminal and civil litigation.
- R & D project development and management from conception to market launch for forensic laboratory products.
- Developed, championed and implemented market-driven strategies for functional genomics biotech startup.
- R & D management experience in market-driven pharmaceutical, biotech and forensic DNA companies.
- R & D project development experience, including market analysis, target identification and validation, HTS, lead evaluation and animal efficacy trials.
- Led, built and managed research teams to implement strategic alliances, contract research and 'in-house' R & D in molecular biology, anti-infectives and strain development.

PROFESSIONAL EXPERIENCE

INDEPENDENT FORENSICS, Lombard IL **8/2002 – Present**
Chief Scientific Officer for DNA Forensics, Paternity, and Molecular Biology laboratory.

- Responsibility for development, validation, commercialization, production and manufacturing of new forensic-based tests.
- Supervisory responsibility for all laboratory operations, including validation, documentation, Q/A, Q/C, DNA testing, DNA analysis for forensics and paternity.
- Responsibility for lab design, lab set-up, IT, molecular biology, software and system design and implementation.
- PI on R & D contracts from federal law enforcement agency, PI on CDC SBIR grant, PI on DHS SBIR award.

ORCHID BIOSCIENCES, Long Island NY **4/2001 – 6/2002**
Pharmaceutical Development for 'virtual' pharmaceutical company.

- Responsibility for outsourcing of GMP synthesis of small molecule therapeutic compound.
- Initiated, negotiated and supervised CRO managed ongoing Phase II clinical trial.
- Supervised and outsourced FDA and EMEA fillings for Orphan Drug Status in Europe and U.S.A.
- Project fully acquired (and terminated) by strategic partner, 6/2002.

INTEGRATED GENOMICS, Chicago, IL **4/2001 – 2/2002**
Director of Pharmaceutical Development – Executive Management Team
Integrated Genomics is a startup functional genomics company focusing on a bioinformatic approach to solving industrial biotechnology problems.

- Responsibility for developing and implementing small molecule-based R & D for 'niche' anti-infectives markets.
- Developed research programs for strategic partners in anti-infective biology, industrial strain improvement, flavors and fragrance industries and genomic databases.
- Experience in, and responsible for, presenting research programs to pharmaceutical partners, venture capital funds and institutional investors.

DNA & IMMUNOGENETICS INSTITUTE, Chicago IL 6/2001 – 8/2002

Co-Director, Laboratory Services

DNA & Immunogentics Institute was the first independent DNA testing laboratory in Illinois and performed testing for paternity determination, transplant matching and blood banks.

- Paternity & Forensic DNA Testing
- Blood Antigen Testing

ABBOTT LABORATORIES, Abbott Park IL 10/1996 – 4/2001

Abbott Laboratories is a mid-tier pharmaceutical company with a strong focus on small molecule therapeutics.

- Directed, managed and led research group charged with cloning, expressing and purifying protein targets for pharmaceutical discovery and biotherapeutics using bacterial, insect and mammalian expression systems.
- Led effort to identify alternative expression systems/hosts for 'difficult' protein classes.
- Co-developed semi-automated cloning and expression system for HTS of protein targets.

Group Leader, Genomics and Molecular Biology.

- Devised, championed and directed all phases of genomics-based research program for the identification of novel anti-bacterial targets, including microbiology, mol bio, HTS cloning and expression, and database management.
- Identified and validated dozens of novel anti-bacterial targets.
- Conceived and managed small molecule discovery projects; including HTS assay development, hit characterization, animal efficacy models, SAR determination and toxicity profiles.
- Initiated proteomics program in *Haemophilus influenzae*.
- Developed and fabricated *H. influenzae* micro-array for inhibitor mode of action studies.
- Initiated and directed numerous external scientific collaborations.
- Developed broad knowledge base of genomic techniques, applications and technologies including SNPs, pharmacogenomics, proteomics, HTS sequencing, public and proprietary genomic databases.

STANFORD UNIVERSITY SCHOOL OF MEDICINE, Stanford CA 10/1990 - 10/1996

Howard Hughes Research Fellow, Laboratory of Dr. Gary Schoolnik

- Developed research program on luminescent bacterial symbiont, *Vibrio. fischeri.*
- Discovered novel ADP-ribosyltransferase in culture supernatants of *V. fischeri.*
- Purified and cloned (using reverse genetics) novel ADP-ribosyltransferase from *V. fischeri.*
- Developed genetic system for *V. fischeri,* - targeted knock-outs for gene function identification.
- Initiated collaborative research with USC marine biology laboratory on symbiont/host interactions.

Post-doctoral fellow, Laboratory of Dr. Gary Schoolnik

- Developed research program on structure/function relationship of trans-membrane transcriptional activator, ToxR, in *V. cholerae.*
- Analyzed distribution of ToxR genes in environmental *Vibrio* isolates.
- Cloned, sequenced and characterized ToxR gene from luminescent marine bacterium, *V. fischeri.*

INSTITUT PASTEUR, Paris, France 10/1988 – 10/1990

Fogarty Post-Doctoral Research Fellow

- Developed mono-clonal antibodies against membrane active toxin of *Listeria monocytogenes.*
- Developed novel, large scale purification protocol for listeriolysin.
- Participated in *in vivo* tests of single amino acid substituted *L. monocytogenes* isogenic strains.

PRIOR RELATED EMPLOYMENT

UCLA, Los Angeles CA
Dept of Biological Chemistry, Laboratory of Dr. D. Sigman 1979-1982
Research Assistant

- Analysis of non-enzymatic cleavage of DNA by 1,10-orthophenanthroline Copper.
- Synthesized chemical derivatives of 1,10-orthophenanthroline.
- Recombinant over-expression and purification of *E. coli* DNA Polymerase.

HARVARD MEDICAL SCHOOL, Boston MA
Dept. of Neurobiology, Laboratory of Dr. T. Wiesel 1977-1979
Research Assistant

- Developed micro-bore HPLC for amino acid analysis of retinal homogenates.
- General laboratory duties, including ordering, organization and solution preparation for histology and EM.

CORNELL UNIVERSITY, Ithaca, NY summer 1976
Laboratory of Dr. E. Ellson
Summer intern Low angle light scattering analysis of liposome preparations.

ROCKEFELLER UNIVERSITY, New York NY summer 1975
Laboratory of Dr. N. Zinder
Summer intern Production, purification and use of mini-cells as 'cell free' protein translation system.

EDUCATION

UCLA / HARVARD MEDICAL SCHOOL 1982-1988
Ph.D. Molecular Biology

- *Thesis: Enzymic Studies on Diphtheria Toxin Fragment A*

CORNELL UNIVERSITY 1973-1977
B.A. Chemistry

LANGUAGES

- ENGLISH, FRENCH

PUBLICATIONS:

1. D.R. Graham, L.E. Marshall, **K.A. Reich** and D.S. Sigman, "Cleavage of DNA by Coordination Complexes. Superoxide Formation in the Oxidation of 1,10- Phenanthroline-Cuprous Complexes by Oxygen. Relevance to DNA-Cleavage Reaction," *J. Amer. Chem. Soc.*, **102**, 5419 (1980).

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11. **K.A. Reich** and G. K. Schoolnik, "The Light Organ Symbiont *Vibrio fischeri* Possesses a Homologue of the *Vibrio cholerae* Transmembrane Transcriptional Activator ToxR", *J. Bacteriology*, **176**(10), 3085-3088 (1994).

12. B. Wilson, S.R. Blanke, **K.A. Reich** and R. John Collier, "Active-Site Mutations of Diphtheria Toxin. Tryptophan 50 is a Major Determinant of NAD Affinity. *J. Biol. Chem.*, **269**(37), 23296-23301, (1994)

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27. Alexander Sinelnikov, Anna Kalinina, Jennifer B. Old, Pravatchai W. Boonlayangoor and **Karl A. Reich** Evaluation of Rapid Stain IDentification (RSID™) Reader System for Analysis and Documentation of RSID™ Tests, *Appl. Sci.* **2013**, *3*(3), 624; Published online: 5 August 2013

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ABSTRACTS

New Approach to Statistical Reporting for Forensic DNA Analysis: Boonlayangoor, A. W., Reich, K.A., and Boonlayangoor, P.W. Published at the 14th International Symposium on Human Identification, Promega Corporation, Phoenix Arizona. September 29-October 2, 2003.

Utilizing Proficiency Testing Survey Results in Forensic DNA Laboratories.
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A Novel Lateral Flow Strip Test for Rapid Identification of Human Semen (Rapid Stain Identification-Semen), 17th International Symposium on Human Identification, Jennifer Old, Brett A. Schweers, P.W. Boonlayangoor & Karl Reich, Nashville Tennessee October 8-12, 2006.

A Novel Lateral Flow Strip Test for Rapid Identification of Human Saliva (Rapid Stain Identification-Saliva), 17th International Symposium on Human Identification, Jennifer Old, Brett A. Schweers, P.W. Boonlayangoor & Karl Reich, Nashville Tennessee October 8-12, 2006.

A Novel Lateral Flow Strip Test for Rapid Identification of Human Blood (Rapid Stain Identification-Blood), 17th International Symposium on Human Identification, Jennifer Old, Brett A. Schweers, P.W. Boonlayangoor & Karl Reich, Nashville Tennessee October 8-12, 2006.

Developmental Validation of SPERM HY-LITER™: A Specific, Sensitive, and Confirmatory Screening Method for Human Sperm from Sexual Assault Evidence Jennifer Old, Brett A. Schweers, P.W. Boonlayangoor & Karl A. Reich 19th International Symposium on Forensic Sciences, ANZFSS Melbourne meeting – October 2008

Developmental Validation of SPERM HY-LITER™: A Specific, Sensitive and Confirmatory Screening Method for Human Sperm Detection from Sexual Assault Evidence. 19th International Symposium on Human Identification. Jennifer Old*, Brett A. Schweers*, P.W. Boonlayangoor & Karl Reich - Promega HID meeting - October 2008

Case Study: Analysis of an anorectal swab alleged to contain canine sperm using a fluorescently labeled human sperm head specific antibody. 19th International Symposium on Human Identification. Marisa Farhner, Brett A. Schweers & Karl Reich – Promega HID meeting - October 2008

Summary Results of a Blinded Study on the Effectiveness and Efficiency of using SPERM HY-LITER™ to Screen Sexual Assault Evidence for Sperm. 20th International Symposium on Human Identification. Jennifer Old Ph.D., Marisa Fahrner MS, Jie Wu Ph.D., Christian G. Westring Ph.D., P.W. Boonlayangoor Ph.D. and Karl Reich Ph.D.

Mapping Duct Tape for the Presence of Saliva Using Phadebas® Press Sheets, 23rd International Symposium on Human Identification, Lynette Johns B.S., Pravat Boonlayangoor Ph.D. and Karl A. Reich Ph.D.

Substrate Controls – A Simple Story 24rd International Symposium on Human Identification, Lynette Johns B.S., P.W. Boonlayangoor Ph.D. & Karl A. Reich Ph.D.

Solution For Partial Profiles: *Amplicon Rx*™ Post-PCR Clean-up Kit, 24rd International Symposium on Human Identification Alex Sinelnikov and Karl A. Reich

A bridge between two previously separate forensic disciplines: latent examination and DNA profiling. Development of new materials, methods and procedures for the collection of enhanced latent friction ridge impressions (fingerprints) *and* DNA profiling from the same evidence. 101St International Association of Identification, Alex Sinelnikov, Ph.D., Dyer Bennet, Karl Reich, Ph.D.

An Efficient and Effective Protocol for Identifying Sperm from Anal Swabs Using SPERM HY-LITER EXPRESS, 27th International Symposium on Human Identification, Jennifer B Old; Anna K Trobe, Karl A. Reich and P.W. Boonlayangoor

A New Tool to Assist Criminal Investigators: DNA-STR Profiles from "Skin and Oil" Fingerprints, 27th International Symposium on Human Identification, Alexander Sinelnikov, P.W. Boonlayangoor and Karl A. Reich

TRAINING CLASSES

Illinois Institute for Continuing Legal Education (IICLE) – Chicago IL September 2006
Faculty for IICLE DNA Evidence Course. Introduction to DNA and DNA Evidence for legal Professionals. Evidence, DNA Matching, Statistics, Defense and Prosecution Strategies, Case Review

Illinois Institute for Continuing Legal Education (IICLE) – Bloomington IL September 2006
Faculty for IICLE DNA Evidence Course. Introduction to DNA and DNA Evidence for legal Professionals. Evidence, DNA Matching, Statistics, Defense and Prosecution Strategies, Case Review

Illinois Institute for Continuing Legal Education (IICLE) – Chicago IL March 2007
Faculty for IICLE Defending Illinois Death Penalty Case – Cold Hits and Cold Cases: DNA Databases and New Technologies in Forensic DNA.

Illinois Institute for Continuing Legal Education (IICLE) – Fairview Heights IL November 2007
Faculty for IICLE Defending Illinois Death Penalty Case – Cold Hits and Cold Cases: DNA Databases and New Technologies in Forensic DNA.

Southwest Association of Forensic Sciences (SWAFS) – Austin TX October 10, 2007. Training workshop: Next Generation Sperm and Body Fluid Identification Tests: SPERM HY-LITER™ and RSID™-Saliva, Blood and Semen. Instructors: Karl Reich and Nadine Mattes.
Louisiana Association of Forensic Sciences (LAFS) – Baton Rouge LA, October 24, 2007. Training Workshop: Fluorescent Detection of Sperm from Sexual Assault Evidence. Instructors: Karl Reich and Nadine Mattes.

Northwestern Association of Forensic Scientists (NWAFS) – Salt Lake City UT –November 5, 2007. Training Workshop: Sensitive and Specific Fluorescent Detection of Human Sperm. Instructor: Karl Reich

McCrone College of Microscopy, COM700: Body Fluid Identification and Microscopic Methods of Sperm Detection for Forensic DNA/Serology/Biology. Instructor for Training class on human body fluid identification. December 11-13, 2007.

McCrone College of Microscopy, COM700: Body Fluid Identification and Microscopic Methods of Sperm Detection for Forensic DNA/Serology/Biology. Instructor for Training class on human body fluid identification. April 22-24th, 2008.

Mid-Atlantic Association of Forensic Scientists (MAAFS) – Huntington WV – April 30th, 2008. Training Workshop: Body Fluid Identification from Sexual Assault Evidence. Instructor for Training class on human body fluid identification.

McCrone College of Microscopy, COM700: Body Fluid Identification and Microscopic Methods of Sperm Detection for Forensic DNA/Serology/Biology. Instructor for Training class on human body fluid identification. August 19-21th, 2008.

Southwest Association of Forensic Sciences (SWAFS) – Little Rock AK September 25th, 2008 Training workshop: Next Generation Sperm and Body Fluid Identification Tests: SPERM HY-LITER™ and RSID™-Saliva, Blood and Semen. Instructors: Karl Reich and Ruben Nieblas.

Midwest Association of Forensic Scientists (MAFS) – Des Moines IA – September 30th, 2008. Training Workshop: Body Fluid Identification from Sexual Assault Evidence. Instructors for Training class on human body fluid identification Ruben Nieblas and Karl Reich.

McCrone College of Microscopy, COM700: Body Fluid Identification and Microscopic Methods of Sperm Detection for Forensic DNA/Serology/Biology. Instructor for Training class on human body fluid identification. December 2-4th, 2008.

SAFS/SWAFS/MAFS Combined Meeting Workshop: Current Topics and Development in Body Fluid Identification and Source Attribution. Instructor for Training Class on human body fluid identification for forensic DNA analysts. October 20th, 2009

SWAFS Workshop on Identification and Isolation of sperm from sexual assault evidence. Instructor for hands-on training class, LCM and SPERM HY-LITER™. September 23, 2010.

NEAFS/NEDIAI Combined Meeting Workshop: Forensic Body Fluid Identification Techniques – Hands-on Short Course for Saliva, Blood, Urine, Semen and Sperm. November 8th 2010.

CAC Workshop on Body Fluid Identification: Blood, Saliva Semen, Urine and Sperm. Hands-on training class, Instructors Karl Reich and Dina Mattes, Bakersfield CA, May 8th, 2012.

Primer Seminario Taller Iberoamericano de Nuevas Technologia en Analisis de Fluidos Biologicos Y Nueva Generacion de Secuenciacon, Instructors Karl Reich and Helga Langthon, Panama October 19th, 2015

SWAFS Workshop on Body Fluid Identification and New Technologies and Trends in Forensic DNA, Instructors Karl Reich and Dina Mattes, Oklahoma City, October 21, 2015.

COURT & DEPOSITION EXPERIENCE:

Dr. Reich has been court qualified as an Expert in Forensic DNA, Forensic Biology and the interpretation of Forensic DNA Statistics in the following jurisdictions (in alphabetical order):

California
Dublin (Ireland)
Florida
Illinois
Indiana
Iowa
Maryland
Minnesota
Missouri
New Mexico
New York
Ohio
South Dakota
Washington D.C.
Wisconsin

This includes cases in State and Federal courts on both criminal and civil matters. Additional details are available upon request.

Note:
Forensic DNA is defined as the methods, procedures, protocols, regulations, standards, and underlying science used to process samples, both evidentiary and reference, for obtaining genetic identity information. The collection, storage, processing, analysis of forensic evidence and the interpretation of such data are included in this definition.

Forensic Biology is defined as the methods, procedures, protocols, regulations, standards, and underlying science used to identify body fluids (blood, saliva, semen, and urine) and to identify spermatozoa from forensic evidence. The collection, storage, processing, analysis of forensic evidence and interpretation of such data are included in this definition.