IN THE COURT OF ARBITRATION FOR SPORT

FLOYD LANDIS	)	
	)	
Appellant,	)	
	)	
V.	)	**CAS 2007/A/1394**
	)	
UNITED STATES ANTI-DOPING AGENCY	)	
	)	
Respondent.	)	
	)	

WITNESS STATEMENT OF CHRISTIANE AYOTTE

I, Professor Christiane Ayotte, of 531, boul. des Prairies, Laval, Québec, Canada will say as follows:

Introduction

1. I am Professor at the INRS - Institut Armand-Frappier and I am head of the WADA-accredited Laboratory in Montréal, Canada ("the Montréal Laboratory"). The Montréal Laboratory, created for the 1976 Olympic Games, was first accredited by the IOC and major International Federations and is now accredited by the World Anti-Doping Agency ("WADA") to carry out the analysis of blood and urine samples in order to detect the presence of prohibited

substances and methods in the Prohibited List. It is also an accredited testing laboratory found to comply with the requirements of the norm ISO:IEC 17025:2005 by the Standards Council of Canada (Bureau de normalisation du Québec). As a laboratory that is regularly audited as part of the IEC:ISO 17025 and WADA audit and accreditation process, I am very familiar with that process. As my curriculum vitae (Exhibit 1) shows, I have been involved in anti-doping work since March 1984.

2. The Montréal Laboratory conducts approximately 15,000 doping control tests per year. It is appointed by the National Anti-Doping Organization for the Canadian domestic program (appr. 3,000 tests, 21%), by international testing authorities and by North American professional sport organizations, not signatories to the WADA Code (50% of our tests). The Laboratory received last year around 50 samples from the WADA out-of-competition testing program (0.31% of our tests).

3. The Montréal Laboratory utilizes routinely the combination of GC/MS and GC/C/IRMS techniques for the detection of prohibited "natural"/endogenous steroids such as testosterone, nortestosterone and their precursors.

4. My experience in the specific field of the detection of "natural"/endogenous steroids is as follows: I have directed research on the identification of characteristic metabolites of testosterone precursors and GC/MS and GC/C/IRMS profiling of urinary steroid metabolites. I have presented lectures, was invited to write book chapters and papers and to present our work on that topic in national and international forums. I am a member of WADA's working group on the endocrinological module (urinary steroid profiling) of the Athlete's passport (with Cologne scientist), of the working group responsible for drafting the technical document related to

guidelines for the detection of endogenous anabolic androgenic steroids and drafting the said document.

5. My knowledge of the World Anti-Doping Code International Standard for Laboratories (version 4) comes from my participation to its draft, since I was a member of the Laboratory Committee and Health Research & Medicine Committee of WADA at that period during which we also adopted related technical documents (criteria for identification, chain of custody, laboratory documentation package). My knowledge of the technical document, TD2004EAAS Reporting and Evaluation guidance for testosterone, epitestosterone, T/E ratio and other endogenous steroids, comes from the leadership that I exercised in its draft.

6. I have extensive experience in reviewing documentation supporting adverse analytical findings reported by other accredited laboratories. In my capacity of scientific expert for the International Association of Athletic Federations (IAAF) since 1995, I have reviewed and provided objective opinions on certainly more than one hundred cases, several of which involved an elevate T/E value and an IRMS analysis. I have experience in analysing longitudinal studies i.e. individual steroid profiles and since the inclusion of IRMS analyses, in evaluating evidences provided by that confirmatory technique.

7. I have on multiple occasions, provided objective opinions and witness statements in cases arising from findings reported by other accredited laboratories, most often in my capacity of scientific expert for the IAAF but also on some occasions, for other international organizations, and as a panel-appointed expert.

8. In this witness statement, I have been asked to give an opinion in connection to the adverse analytical finding reported by the Laboratory in Paris, LNDD for urine sample 995474

provided during the Tour de France and to comment on specific issues raised in the athlete's defence. In order to do so, USADA forwarded me hard or electronic copies of the documents produced for the AAA Arbitration last year and for the purpose of this appeal before CAS. I also heard in part, and read the transcript of the opinions of the athlete's experts. The entire list would be too lengthy. Incidentally, in my experience, the amount of technical documentation requested and provided by the Laboratory in Paris is unprecedented and exceeds by far what is described in the International Standard and Technical Document TD2003LDOC. The Laboratory's documentation packages provide all the information that a laboratory was required to produce under TD2003LDOC. Furthermore, not all of the additional documents were useful to appreciate the findings reported.

9. Having reviewed the documentation packages provided by the laboratory, I concluded that the adverse findings were reported on good scientific and technical grounds, that the results of the GC/MS and GC/C/IRMS were coherent, that the IRMS results presented were of high quality, reliable and were consistent with the exogenous origin of 5α-androstanediol and also of androsterone, metabolites of testosterone-related steroids. I will explain why in the following paragraphs.[1]

10. The technical document TD2004EAAS recommends to submit to the IRMS analysis the samples with T/E values greater than 4 and further indicates that "the results of the IRMS analysis and/or the steroid profile shall be used to draw conclusions". The same is found in the WADA Prohibited List. The laboratory in Paris has chosen the IRMS as the confirmatory

[1] In the previous hearing, I testified at length regarding the laboratory's finding of an elevated T/E ratio in Sample 995474. I understand that T/E ratio is not an issue in this appeal and so I will not discuss it further here.

method for T/E values shown to be greater than 4 from the screening assay and consequently, their best efforts are directed there. Although T/E ratio is typically used as a less expensive method to screen for suspicious samples, the International Standard and Technical Document do not require any T/E ratio analysis before a laboratory initiates IRMS.

11. With regards to the IRMS confirmatory analyses: one aliquot of urine sample 995474A was prepared and analysed on July 22 and 23 along with a negative control, the *Blanc urinaire* – a well characterised blank urine sample. Typically, the urinary steroid metabolites present in the conjugated form are hydrolysed, extracted from the urinary matrix and converted to acetates. The mixture is further separated in three fractions to which a standard, androstanol is added. The fractions containing the purified acetylated steroids are dried and solubilised in hexane. Each will be firstly analysed by GC/MS in the full scan mode to verify the purity of each peak, to adjust the concentration and confirm the identity of the analytes, i.e., androsterone, 5α-androstanediol, etiocholanolone and 5β-androstanediol and two reference endogenous steroids, 11-ketoetiocholanolone and pregnanediol. A sample containing authentic standards of the six metabolites as well as the standard, androstanol is analysed to confirm identity and relative retention times (Mix Acétate)[2].

12. The GC/C/IRMS sequence of analyses included a stability check, the injection of calibration standards (Mix cal IRMS) and sequential injections of each fractions from the blank and from sample 995474. A Mix Cal Acétate standard sample was injected before and after the

[2] The GC/C/IRMS instrument converts the analytes into CO_2 which is analysed by the mass spectrometer. Consequently, the analytes can no longer be identified formally that is why the GC/MS analysis is required.

Athlete's sample to verify instrument accuracy and stability. The same process was repeated on August 3, 2006 for the confirmation analyses of the B-sample.

13. I have reviewed all the results and found them to be very consistent, the difference between the delta ^{13}C values of the target metabolites and the reference steroids being the same in both samples, considering the normal variation expected from such measurements. The metabolites were correctly and fully identified in GC/MS by comparison of diagnostic ions with the authentic standards, as stipulated in the technical document. The IRMS chromatography was good, the peaks well resolved, without interferences. The laboratory acceptance criteria were met, i.e. at least three of the four delta ^{13}C values measured for the Mix Cal Acetate standard during sample 995474 testing were varying by no more than 0.5 $^{0}/_{00}$ from their certified value.

14. The laboratory included with each GC/C/IRMS run as a positive control, a mixture of certified standards, the Mix Cal Acétate. The exact delta ^{13}C values of the steroids acetate included (androstanol, etiocholanolone, androsterone and 11-ketoetiocholanolone) are known, having been certified by Eurofins, an external laboratory. The delta^{13}C values of those steroids vary from the high -16.3 to the low -33.8, covering the range of values expected in an athlete's urine sample (normal/endogenous or "positives"). The laboratory keeps record of the values obtained throughout time; the data provided over a period of several months during which samples 995474 A and B were analysed (75 measurements) shows variations of less than 0.2 $^{0}/_{00}$. In my opinion, the Mix Cal Acétate is an adequate positive control for the measurement of delta ^{13}C values of testosterone (or related steroids) metabolites: i) all the relevant markers are present in the negative control, the blank urine ("negative values"); ii) the exact delta ^{13}C values of the steroids, also metabolites, present in the Mix Cal Acétate, are known (certified reference material). There is nothing more to gain from the inclusion of another urine control with delta

values for the various metabolites varying from the reference steroids by more than 3 units. The measurement of delta ^{13}C values is unlike analysis for a prohibited substance (e.g., stanozolol) where the substance is absent in a normal urine sample. For the purpose of formal identification of the metabolites by GC/MS, the laboratory utilizes another positive control, the Mix Acétate, that does contain all the metabolites, as required. In my opinion, the controls used by LNDD in analysing samples in the IRMS method satisfy all requirements of ISO:IEC 17025 and the Internal Standard.

15. The laboratory also provided the data of the repeated analysis of a mixture of characterised alcanes (Mix Cal IRMS) that is utilised for verifying the precision of the instrument and also, from the repeated testing of a blank urine sample.

16. I have also been asked to comment on specific issues related to the independence of WADA-accredited laboratory personnel, the chain of custody record, mistakes in the documentation packages as identified by the Athlete, to the procedures employed by the laboratory in Paris, the ISO 17025 accreditation, compliance with the International Standard and the WADA Technical Documents. I will address each one in turn.

17. With regards to my "independence" as a director of a WADA-accredited laboratory: while I agree that I have never testified directly in support of an athlete challenging test results, trying to imply that I would remain silent and voluntarily support wrong results is simply absurd and contradicts my actions. I will get involved during the result management process and this is what I have been doing for the IAAF for example, for several years. I have always provided objective opinions on laboratory findings and there are instances where I have not recommended further actions, going "against" a laboratory. I am not afraid of challenging publicly WADA's

positions when I disagree and was never threaten by WADA to lose testing or accreditation. Had I not strongly believed that the Athlete's sample in this case should be reported as an adverse analytical finding, I would never have agreed to testify. Further, in providing testimony in this case or any other case, I only express my honest opinions on topics about which I am asked to testify regardless of whether they are favorable or unfavorable to another laboratory.

18. With regards to mistakes present in the laboratory documentation packages: I was asked to review the content of the athlete's "exhibit 49". I have also read the responses and explanations provided by the laboratory director. First, several entries were wrongfully listed as mistakes; the documentation was not understood. Second, the true mistakes remaining, although regrettable, were mostly typographical and present in summaries prepared manually. The traceability and the direct link between the original sample and the analytical data were never lost. Moreover, none of those mistakes could have impacted let alone caused the IRMS positive results.

19. With regards to the chain of custody and the compliance with technical document TD2003LCOC: the purpose of the chain of custody requirement is to confirm the security of the specimens. Chain of custody does not have to be a single document. I was able from the different documents provided by the laboratory, to follow who had possession of the bottles and aliquots (personnel identified, date, and purpose) or where they were stored, on which instrument they were being processed. The laboratory is a controlled area, and its access is, as should be, restricted to authorised personnel. I have not seen an element that caused me concern over the security of the specimens. As long as each staff person in possession of a sample bottle or aliquot is identified in a document, there is no further requirement for a document that shows the transfer of the bottle or aliquot from one staff member to another. The laboratory's method of

documenting chain of custody would have been reviewed in its IEC:ISO 17025 and WADA International Standard accreditation audit by COFRAC. On the reports that I read from COFRAC, it was noted that the quality management corresponded to the norm and that traceability was satisfactory.

20. With regards to the GC/C/IRMS analysis: I was asked whether it is acceptable to i) interrupt the injection sequence, repeat injections, overwrite files; ii) to perform "manual integration and baseline determination" of analytical data. With regards to sample 975474, I was told that the A sample injection sequence was interrupted between the last injection of the sample and the second injection of the Mix Cal Acetate. For the B Sample, the sequence was interrupted between the first injection of the Mix Cal Acetate and the injection of the blank urine and the Athlete's sample because they were not ready for injection at that time. Neither interruption is a problem. There is no prohibition against sequence interruption, indeed this occurs frequently in all laboratories. The interruptions in this case in no way compromised the reliability of the results.

21. With regards to the repeat injections and overwriting files that, I understand, occurred during the April 2007 analysis of the Athlete's other Tour samples, this is occurring, necessary and acceptable when the instrument is being set up for the analysis of the specimens. The purpose of the many preparatory steps is to ensure accurate test results. The analyst will verify for example, that the injector liner is clean, properly conditioned, that the GC column is good, and that the instrument functions correctly. The stability will be checked and if acceptable, the next step will be to inject verification standards. When the analyst notes unsatisfactory performances during those checks, the problem should be fixed, some maintenance could be necessary, and the verification steps will be repeated until target performances are attained (in

Paris as in Montréal). Only then should the athlete's samples, negative and positive controls be processed. There is no requirement or need to keep track and record all the files acquired for the verification and preparation steps.

22. Once the data has been acquired by the instrument, the role of the analyst (in Paris as in Montréal) is to verify that the automatic treatment of the results was adequate. If that automatic process was incorrect, the analyst manually re-processes peaks; that is not only acceptable but necessary. The software could have chosen the wrong peak, or performed a wrong integration. Different instruments have different operating softwares but most if not all permit manual interventions; some permit background subtraction, others not. Article 5.4.4.4.1.4 applies to changes to reported data. When the laboratory technician is manually integrating baselines, the technician is creating data, not altering records and reports in the computer system. Furthermore, the International Standard and TD2003LDOC do not anticipate that electronic data files will be examined during the review of an adverse analytical finding. In my more than twenty years experience with anti-doping laboratories, this is the first time that I have ever heard of this being done.

23. I was asked whether the laboratory in Paris deviated from its own procedure, since for some IRMS runs, the delta ^{13}C value of androstanol when added to the samples as a standard, was more than ±0.5% from the certified, true value. Having consulted their procedure, it is clear that androstanol, which is added after the derivatization step and prior to the analysis, is utilized to calculate the relative retention times of the different peaks and to permit identification of the other analytes / steroids of interest. Since it elutes early and in a region of the chromatogram where several peaks are present, there are interferences and true delta values are more difficult to obtain. That is not a concern, since its purpose is to be an anchor for retention times. The

crucial metabolites, those on which the laboratory relies to form its decision, elute in a much cleaner region and can be measured without interferences. Incidentally, we also utilize androstanol as the reference for calculating the relative retention times.

24. With regards to "violations" of the International Standard, I was asked whether the presence of matrix interferences in individual chromatograms constitute a violation of the ISL. My answer is no. The International Standard provides general guidelines on several parameters that must form part of the validation of a given method, one of which is matrix interference (sections 5.4.4.1 and 5.4.4.2). The method developed must be specific "and avoid interference in the detection of prohibited substances... by components of the sample matrix" or for threshold substances, it "must limit interference in the measurement of the amount of prohibited substances... by components of the sample matrix." Once that is done, since we are dealing with urine samples not "controlled", interferences may show up in a given specimen and that does not constitute a violation of the ISL. I do not see interference in the measurement of the delta ^{13}C values of the Fraction 3 metabolites in Sample 995474.

25. I was asked to clarify the IRMS "positivity" criteria described in the technical document TD2004EAAS. The relevant section is as follows:

> The results will be reported as consistent with the administration of a steroid when the $^{13}C/^{12}C$ value measured for the metabolite(s) differs significantly i.e. by 3 delta units or more from that of the urinary reference steroid chosen. In some *Samples*, the measure of the $^{13}C/^{12}C$ value of the urinary reference steroid(s) may not be possible due to their low concentration. The results of such analyses will be reported as "inconclusive" unless the ratio measured for the metabolite(s) is below -28‰ based on non-derivatised steroid.

Our intent in drafting this document was to state that the administration of a "natural" testosterone-related steroid was supported by the measurement of a delta ^{13}C value for one or several metabolites, depending on the situation, that differed significantly from that of the

endogenous reference steroid chosen. We also indicated that a difference of 3 delta units was considered to be significant (without considering the uncertainty of the measure). Depending upon i) the nature of the steroid taken (DHT, testosterone, DHEA or androstenedione); ii) the mode of administration (oral, injection, topical); iii) the timing of the administration vs. the collection of the sample; iv) individual differences in metabolism, only one or more metabolites can be altered. For example, only the 5α- androstanediol and androsterone will be influenced by DHT, and not to the same extent. Consequently, the differences of 3.5 and 6 $^{0}/_{00}$ measured between androsterone and 5α-androstanediol and their respective reference steroid supported the reporting of an adverse analytical finding and would have also been reported by the Montréal laboratory. Finally, concerning the last two sentences which I have quoted from the Technical Document, when the endogenous reference steroids are present in an amount too low to permit a reliable determination of their delta value, the results are considered as being inconclusive, unless the delta ^{13}C value of one or more diagnostic metabolite is below -28 $^{0}/_{00}$ (underivatized), a value which standing alone so exceeds the range of values normally measured for metabolites arising from natural, endogenous pathways, it is considered consistent with an exogenous origin. Absolute delta ^{13}C values vary in different individuals; in a given individual, a value of -25 may be consistent with an exogenous origin when the reference steroids are at -18, while it can be perfectly normal for another one. That is why the difference in the delta values of the metabolites and the other urinary steroids is considered first.

26. The procedures employed by the laboratory in Paris, and particularly procedure EC-31 (IRMS) with extraction procedure M-EX-24 and GC/MS analysis procedure M-AN-52 and GC/C/IRMS analysis procedure M-AN-41, are under the scope of their ISO: IEC 17025 accreditation. Accordingly, COFRAC, the national accreditation body, confirms that the

laboratory has appropriately validated its methods and its procedures and they comply with ISO:IEC 17025 and the International Standard. The laboratory is accredited for *les analyses de contrôle du dopage humain" en application du référentiel ISL et documents rattachés annexes publiées par l'AMA (collaboration ILAC/WADA).* The laboratory procedures were audited by an independent body, and were found to comply. The report notes that (my translation from French): i) the competence of the laboratory personnel, its very good knowledge of the methods, know-how and knowledge of mass spectrometry, their extensive training record; ii) that the quality management complies with the norm, traceability is satisfactory; iii) that the number of instruments was appropriate as well as their quality; iv) that the IRMS method was well controlled; v) that the criteria for identification were conform to WADA requirements; vi) that the laboratory had highly satisfactory results in the WADA proficiency tests. They also noted the difficult manual process for saving and archiving results acquired on the IRMS instrument that requires dismantling and replacing the hard drive; however, this is a laboratory efficiency issue and does not affect the reliability of results.

In conclusion, it is my opinion that the IRMS results reported by the Laboratory in Paris are conclusive evidence of the administration of a testosterone-related steroid.

I declare under penalty of perjury of the laws of Québec and New York that the foregoing is true and accurate. This statement was signed on March 7, 2008, in Laval, Québec, Canada.

Christiane Ayotte

Exhibit 1

CURRICULUM VITAE

Name: AYOTTE, Christiane
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ACADEMIC QUALIFICATIONS

Université de Montréal, Ph.D. in Organic chemistry (1983)

POSTDOCTORAL STUDIES

1983-1985 Institut national de la recherche scientifique (INRS-Santé)

DIRECTION OF MASTER DEGREE THESIS

- Stéphane Lapointe : " Effets de la contamination microbienne sur la stabilité des androgènes en milieu urinaire" (1998) Codirecteur : Prof. Michel Sylvestre
- Jean-François Lévesque : " Sur l'importance clinique de l'excrétion des stéroïdes sulfoconjugués dans le contrôle antidopage" (1998) Codirecteur : Prof. Alain Fournier
- Marilyn Cléroux : " Identification des métabolites de la nortestosterone et de précurseurs par CG/C/IRMS" (1999-2002)
- Patrick Bhérer : "Caractérisation des métabolites urinaires de l'androstènedione et de la DHEA administrés par voie orale" (1999-2002) Codirecteur : Prof. Donald Poirier, Université Laval
- Claudiane Guay: "Étude de l'excrétion chez l'humain des métabolites des 19-norstéroïdes provenant de diverses origines" (2000 – 2003)
- Josianne Roy: "Caractérisation de métabolites diagnostiques de la DHEA et validation d'une méthode de détection par GC/MS" (2000 – 2003) Co-directeur: Prof. Donald Poirier, Université Laval
- André Lajeunesse : « Utilisation de la spectrométrie de masse d'isotopes stables pour l'identification des métabolites urinaires de précurseurs de la testostérone », (2000 – 2003)
- Sophie Charbonneau : « Utilisation de la HPLC/MS pour l'analyse des métabolites urinaires de corticostéroïdes chez l'humain », (2001 – 2004)
- Isabelle Robillard-Frayne : « Analyse de la teneur en ^{13}C des métabolites urinaires de stéroïdes androgènes naturels », (2002 - 2005)
- Julie Gauthier, Caractérisation des métabolites de stéroïdes de contrefaçon produits par cultures d'hépatocytes, (2005 – 2007)

- Julie Gauthier, Caractérisation des métabolites de molécules de contrefaçon par l'utilisation de cultures d'hépatocytes (doctorat 2007 -)
- Nguyen Hai Dang, Détermination des plages de référence des valeurs de delta ^{13}C des stéroïdes androgènes urinaires chez l'humain (doctorat 2007 -)

POSTDOCTORAL TRAINEE

Paule Émilie Groleau, Purification et caractérisation par spectrométrie de masse de l'érythropoïétine urinaire (2005 – 2007)

CURRENT GRANTS (in the field of doping control)

- C. Ayotte, M. Ueki and W. Schanzer: Project: Analysis of testosterone and precursors metabolites in human urine by GC/C/IRMS: a comparative inter-laboratory study (2001-2004).
- C. Ayotte and W. Schanzer, Excretion of 19-norsteroids from consumption of pork meat and offal: combined GC/MS and GC/C/IRMS analysis (2001-2003)
- C. Ayotte, P. Ayotte, D. Cyr, D. Poirier, Characterisation of chemical and pharmacological properties of new steroids related to doping of athletes (2 years: 2005-2006)
- C. Ayotte, A. Fakirian, W. Schanzer, H. Geyer, U. Flenker, Determination of the origin of low urinary levels of 19-norandrosterone by GC/C/IRMS (2006)
- C. Ayotte, P.É. Groleau and P. Desharnais, Purification of EPO in urine samples prior to detection by Isoelectric focussing (2007)
- C. Ayotte, P.É. Groleau "Development of detection method of hydrolysed rapid-acting insulin analogues in human urine by ion trap mass spectrometry", 2008

INRS DOPING CONTROL LABORATORY

Laboratory accredited by the International Olympic Committee, International Federations and World Anti-Doping Agency since 1976, it is compliant with the norm CAN-P-4E ISO/IEC 17025:2005 (Standard Council of Canada laboratory no. 413). The laboratory employs twenty-five professionals, research assistants, associates, universities and college trainees. National and international sport organizations are utilizing the expertise and analytical services of the INRS laboratory: the Canadian Centre for Ethics in Sport, professional leagues MLB, NBA, NHL, MLS, and international federations, ITF, IAAF and FINA. Around 15,000 samples are analyzed for the presence of prohibited drugs and medications.

REVIEWER

Scientific papers and Applications for funding

COMMITTEES AND COMMISSIONS OF NATIONAL AND INTERNATIONAL BODIES

- International Association of Athletic Federation (IAAF):
  - Scientific Advisor / Member of the IAAF Doping Commission, 1995 –
- World Anti-Doping Agency (WADA):
  - Member of the EPO Working group (2008 –
  - Member of the Working group "Athlete's passport: endocrinological module" (2008-
  - Member of the Working group in charge of reviewing some technical documents
  - Member of the WADA Health, Research and Science committee (2000 - 2004)
  - Member of WADA Working Group on Harmonization and Accreditation of Laboratories (2001 - 2004)
  - Member of the WADA Harmonisation and Standardisation Committee (May to November 2000)
- International Olympic Committee (IOC):
  - Invited Member of the IOC Medical Commission during the Salt Lake City Olympic Games (2002)
  - Member of the IOC Sub-Commission Working Group on IRMS Criteria (2001)
  - Member of the Working Group on Protocols Harmonization of the IOC sub-commission Doping and Biochemistry of Sport (March 1996 –1998)
  - Elected representative of IOC accredited laboratories, to the IOC sub-commission Doping and Biochemistry of Sport (April 1995 - April 1996)
- Canada:
  - Member of the Evaluation Committee of IRSST (Bourses d'études supérieures), 2005, 2006, 2007
  - Member of RCMP Revision Committee for Anti-Doping Policy (2005)
  - Member of the Expert Committee "Prévention du dopage au hockey mineur québécois (2004)
  - Member of the Jury – Prix du Québec Wilder-Penfield (2002)
  - Chair of the Jury – Prix du Quebec Wilder-Penfield (2003)
- Québec :
  - Membre de l'Ordre des Chimistes du Quebec (1982 –

HONOURS and AWARDS

- Medal of Honour of the Canadian Medical Association, 2006
- Honorary President - Forum provincial " Carrière en chimie ", Université Laval, 2006 and 1998
- Honouree – Collation des grades, Faculté des arts et des sciences, U. de Montréal, 2004
- Honorary president – National Conference on Doping in Sports, Canada, February 2001
- Scientist of the Year 1999 – Société Radio-Canada (Les Années-lumière)
- Week's personality – La Presse (January 2000)
- Women Honouree – Businesswomen in Action committee, Board of Trade of Metropolitan Montreal, May 2000
- Membre du Cercle d'excellence de l'Université du Québec, August 2000

MEETINGS, WORKSHOPS AND ROUND TABLES

- Training Workshop :
  - ILAC/WADA Auditors, Montréal, 2004 - 2007
  - Network "Intervenants – présentateurs", Anti-Doping Education, RCMP Headquarters, March 2006
  - Trainers Montérégie, November 2005
  - Trainers, Team Physicians LHJMQ, 2005
  - Canadian Doping Adjudicators, 2001, 2004, 2006
  - Canadian Doping Control Officers, 1999, 2001, 2003, 2005, 2007
- International Symposium:
  - 5th Annual USADA Symposium on Anti-Doping Science: "Intra-Individual Reference Ranges: Implications for Doping Control", Lausanne 2006 (Invited Speaker)
  - "Follow-up Meeting on Intra-Individual Reference Ranges: Implications for Doping Control" in Emory Conference Center, Atlanta, Georgia, U.S.A. February 13-15, 2007 (Invited)
  - 2006 IAAF World Anti-Doping Symposium, Effectiveness of the Anti-Doping Fight, Lausanne (Invited Speaker and Scientific Organizer).
  - Symposium WADA/CCES Food Supplement, Montréal, May 2004
  - Conference: "Oxygen transport enhancing agents and methods", Atlanta, USA, October 2002
  - IAF International Seminar, From a Great Past to an Even Brighter Future Women's Athletics on the Eve of the New Millennium, Granada (1998)
  - International Research Symposium and Consensus Conference, USOC, San Diego, January 1997.
  - IAF Seminar 1995, "Harmonisation of Doping Issues in the IAAF", Paris 1995
  - Cologne Workshop on Dope Analysis, Cologne, 1990-
  - 4th World Conference on anti-doping in Sport, London, September 1993
  - Canadian representative on the Research Working Party of the Monitoring Group of the Anti-doping Convention, Council of Europe, Second Meeting, Strasbourg, December 1992, and Third Meeting, Paris, April 1993.

- Public Activities
  - Bar/café des sciences des Années-lumière/Québec Sciences, Montréal, September 2004
  - Bar des sciences du Cegep St-Laurent, September 2004
  - Round Tables: « Sciences et médias, avons-nous l'heure juste? », Café scientifique – Les 24 heures des sciences, Cegep Montmorency, mai 2006
  - Table ronde : «Les défis du sport d'aujourd'hui », Dopage, drogues, sports et les jeunes, Forum mondial drogues et dépendances – Enjeux pour la société, Montréal, 24 septembre 2002.
  - Table ronde: "La science a-t-elle mauvaise presse auprès des jeunes? » 14e Colloque de l'Association pour la recherche au collégial, Collège Bois-de-Boulogne, mai 2002.
  - Table ronde : Les défis du sport : en quête d'excellence et d'intégration sociale, Journée Canada – France, Parlement du Canada, mai 2001.

- Journée « Les filles et les sciences, un duo électrisant ! », École de technologie supérieure, février 2001

TESTIMONIES AND EXPERTISE

- Hearings and Arbitration of national and international sport organizations (CAS, IAAF, Canada, USATF, AAA): Expert witness (US Anti-Doping Agency, IAAF, IWF, Australian Olympic Committee, FINA, USA Track & Field, Athletics Canada, CCES, Norwegian Confederation of Sports, USA Swimming, IPC and others).
- Member of an ATP (Association de Tennis Professionnel) Hearing Panel (01/1997).
- Coroner inquiry (Death of hockey player J. Kordic).
- Criminal Court (Anabolic steroid importation and traffic).

FORMATION AND EDUCATION: CONFERENCES AND WORKSHOPS

- Canadian Athletes
- Doping Control Officers (CCES)
- Arbitrators
- Sport Physicians
- Police forces: Organised crime inquiries, prevention of drug use
- Trainers and coaches
- Sport specialists
- Hockey Québec : Stage d'entraîneurs de niveau avancé
- High school and Cegep students
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