

Drug Testing in Sports

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This presentation was modified from its original format for
508 compliancy.

USADA's Vision Statement

To be the highest quality Anti-Doping Agency in every area of endeavor...

WITH

A testing program that achieves both deterrence and detection, designed with athlete concerns in mind;

A results management system that is both fair and timely;

A research program that contributes significantly to the world-wide anti-doping effort; and

A broad based education program that provides a forum for clean sport at all levels, and emphasizes the ideals of the Olympic movement...

IN ORDER TO

Protect the right of clean athletes to engage in fair competition; and through our enthusiasm, innovation, ingenuity, transparency, and communication, influence by example the quality of anti-doping agencies world wide.

Organization of Sport

- International Olympic Committee (IOC)
- World Anti-Doping Agency (WADA)/Agence Mondiale Antidopage (AMA)
- International Federations
 - International Association of Athletics Federation (IAAF)
 - Union de Cycliste Internationale (UCI)
 - Federation Internationale Natation (FINA)
- National Olympic Committees (USOC)
- National Federations (Governing Bodies)
 - USA Track & Field (USATF)
 - USA Cycling
 - USA Swimming
- National Anti-Doping Agency
 - United States Anti-Doping Agency (USADA)
 - Canadian Center for Ethics in Sports (CCES)
 - Australian Sport Anti-Doping Agency (ASADA)
- National Governments
 - Ted Stephens Amateur Sports Act
- Court of Arbitration for Sport (CAS)/Tribunal Arbitral du Sport (TAS)

World Anti-Doping Program

- World Anti-Doping Code (adopted Copenhagen - March, '03; modified Madrid – November, '07)
 - Deals with rights and responsibilities of key stakeholders
 - Athletes
 - International sports federations
 - Governments
 - Harmonizes procedures and sanctions
- UNESCO International Convention against Doping in Sports
 - Ratified by US Senate in July '08; signed by President Bush in August '08
- Four mandatory International Standards
 - WADA List of Prohibited Substances and Methods
 - WADA International Standard for Testing
 - WADA International Standard for Laboratories
 - WADA International Standard for Therapeutic Use Exemptions
- Anti-doping rules
 - Strict liability for athlete
 - Sanction reduction only if athlete can prove lack of negligence or inadvertent use of a medically-justified therapeutic agent

WADA Accredited Laboratories

Country	City
Australia	Sydney
Austria	Seibersdorf
Belgium	Ghent
Brazil	Rio De Janeiro
Canada	Montreal
People's Republic of China	Beijing
Colombia	Bogota
Cuba	Havana
Czech Republic	Prague
Finland	Helsinki
France	Paris
Germany	Cologne
Germany	Kreischa
Great Britain	London
Great Britain	Cambridge
Greece	Athens
India	New Dehli

Country	City
Italy	Roma
Japan	Tokyo
Korea	Seoul
Malaysia	Penang
Norway	Oslo
Portugal	Lisban
Poland	Warsaw
Republic of South Africa	Bloemfontein
Russia	Moscow
Spain	Barcelona
Spain	Madrid
Sweden	Stockholm
Switzerland	Lausanne
Thailand	Bangkok
Tunisia	Tunis
Turkey	Ankara
United States	Los Angeles 5
United States	Salt Lake City

Rationale for Inclusion of Substances or Methods on the Prohibited List

(WADA Code - Section 4.3)

- Medical or other scientific evidence, pharmacological effect, or experience that the substance has the potential to enhance or enhances sport performance
- Medical or other scientific evidence that the *Use ...* represents an actual or potential health risk
- Violates the spirit of sport

WADA Prohibited Substances List

- PROHIBITED PERFORMANCE ENHANCERS

- S.1. Anabolic agents
 - 1.a. Exogenous AAS (boldenone, nandrolone, mibolerone, ... and related substances)
 - 1.b. Endogenous AAS
 - 2. Other anabolic agents (clenbuterol)
- S.2. Hormones and related substances (hCG, hGH, ACTH, EPO, ... and releasing factors)
- S.3. b-2 Agonists
- S.4. Agents with anti-estrogenic activity (aromatase inhibitors, SERMs)
- S.5. Diuretics and masking agents (amilioride, ethacrynic acid, spironolactone, ... and related compounds)
- S.6. Stimulants (amphetamine, cocaine, mesocarb, strychnine, ... and related compounds)

- S.7. Narcotics(buprenorphine, levorphanol, meperidine, ...)
- S.8. Cannabinoids
- S.9. Glucocorticoids

- PROHIBITED METHODS

- M.1. Enhancement of O2 transfer
- M.2. Chemical or Physical Manipulation
- M.3. Gene Doping

- USE LIMITED IN SPECIFIC SPORTS

- P.1. Alcohol
- P.2. b-blockers (acebutolol, atenolol, sotalol, ... and related compounds)

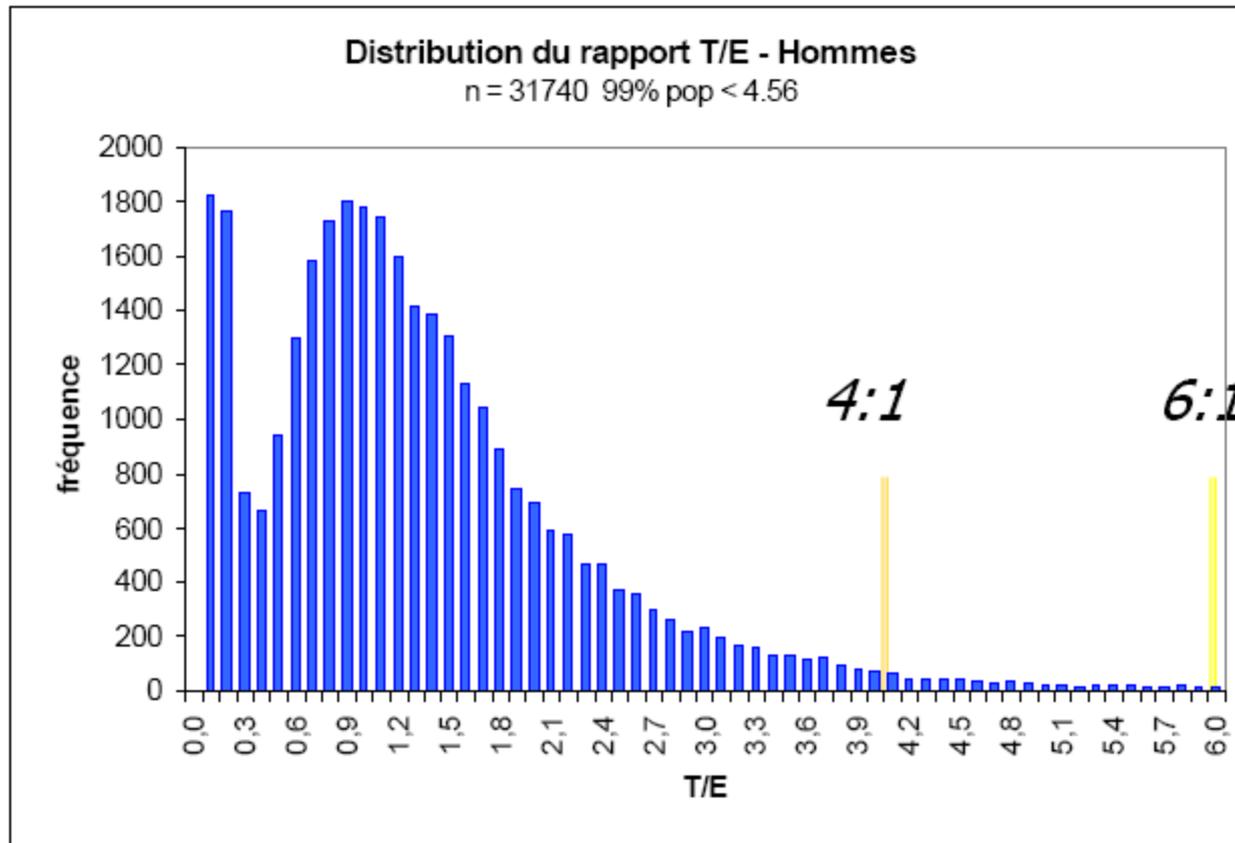
Key Concepts

- Performance enhancement is not limited to adding muscle
 - Recovery (steroids)
 - Euphoric feelings; improved focus and concentration; alteration of the perception of fatigue (stimulants)
 - Improved vision (hGH)
- What is considered a “side-effect” medically may be the desired effect for performance-enhancement (example - pseudoephedrine)
- It is difficult (or impossible) ethically to conduct research at the doses and combinations of substances that could be used for performance-enhancement (example – androstenedione in children)
- It is the effect of a substance, not the source, that is important (example - “natural” dietary supplements)

Endogenous Steroid Metabolism

Steroid	Metabolite 1	Metabolite 2	Metabolite 3	Metabolite 4
17- α -hydroxyprogesterone	Androstenedione	Testosterone Other metabolites	Androstenedione	
DHEA	Androstenedione	Testosterone Other metabolites	Androstenedione	
DHEA	Androstenediol	Testosterone	Androstenedione	Other metabolites

Distribution of Urinary T/E Ratios for Male Athletes



- Courtesy of Christiane Ayotte, INRS Sante Anti-Doping Laboratory

Intra-Individual T/E Pattern

- 4:1 threshold for reporting

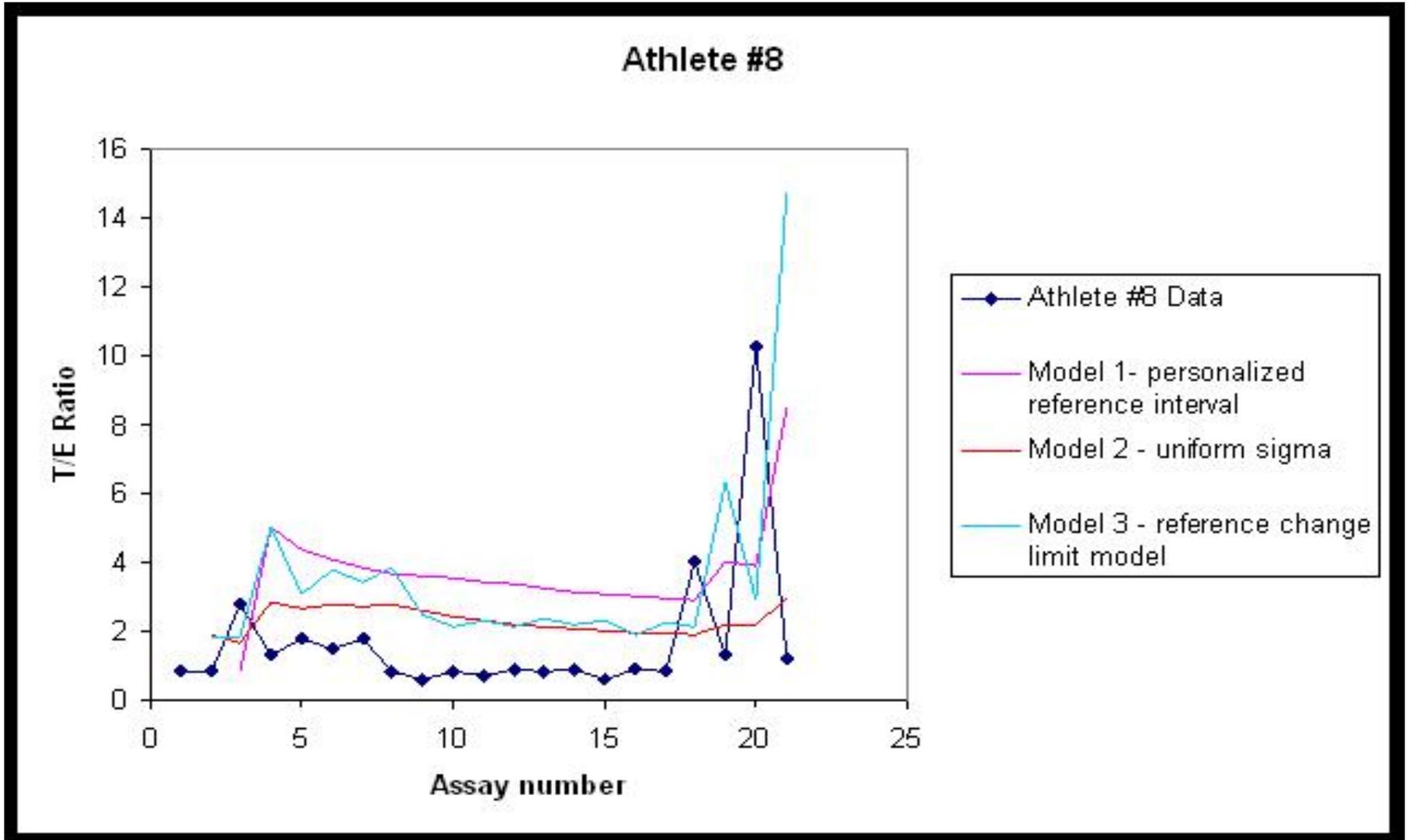
Year	T/E ratios
0-1	0.8, 0.7, 1.0, 0.8, 0.9, 1.0, 0.6, 0.9, 0.8, 1.0, 0.9
1-2	1.0, 0.9, 0.8, 0.7, 0.8, 0.7
2-3	0.9, 1.0, 0.8, 1.0
3-4	1.0, 0.7, 0.8, 0.7, 0.6, 0.8
4-5	0.7, 0.9, 0.7, 0.9

Intra-Individual T/E Pattern

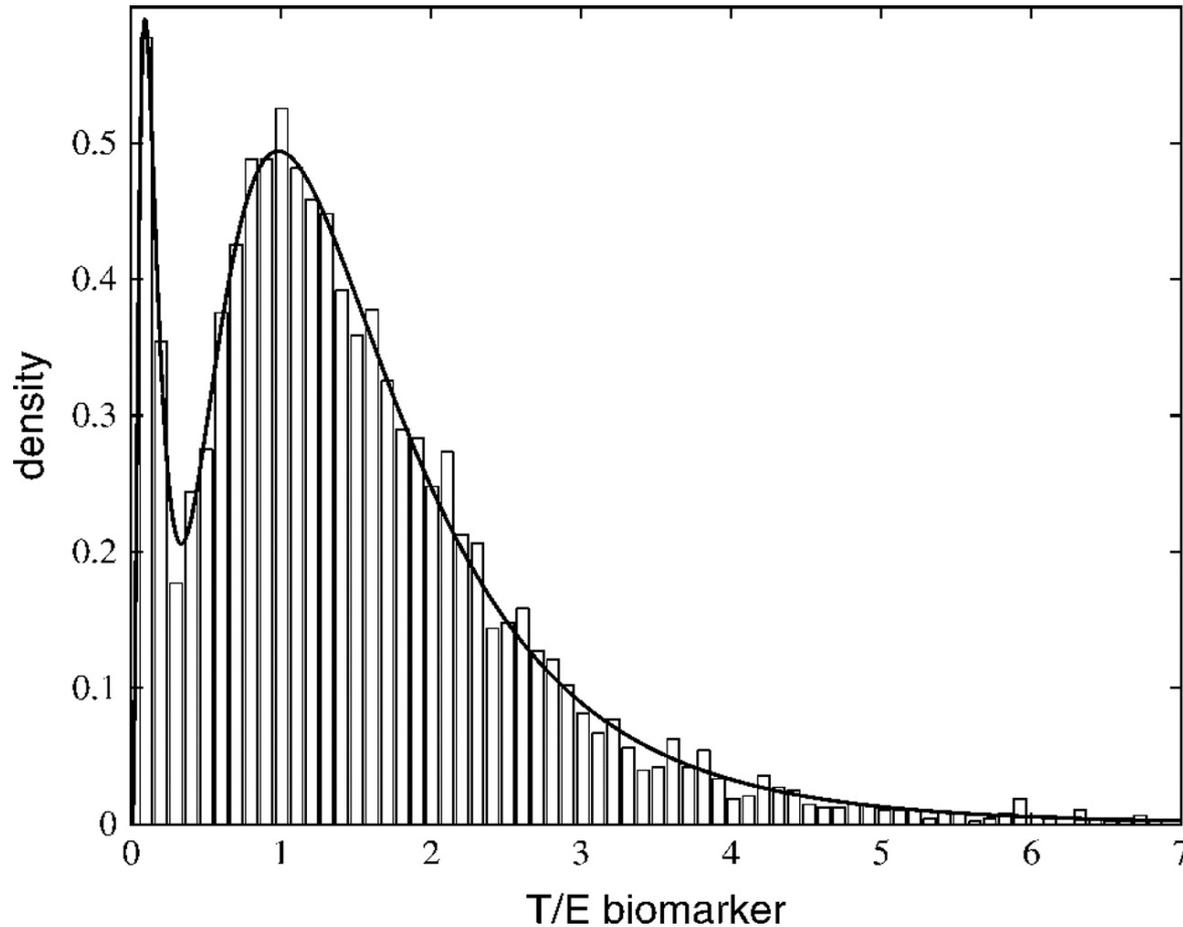
- 4:1 threshold for reporting

Year	T/E ratios
0-1	0.8, 0.7, 1.0, 0.8, 0.9, 1.0, 0.6, 0.9, 0.8, 1.0, 0.9
1-2	1.0, 0.9, 0.8, 0.7, 0.8, <u>8.0</u>
2-3	0.9, 1.0, 0.8, 1.0
3-4	1.0, 0.7, 0.8, 0.7, 0.6, 0.8
4-5	0.7, 0.9, 0.7, 0.9

Modeling an Athlete's T/E Ratio Data

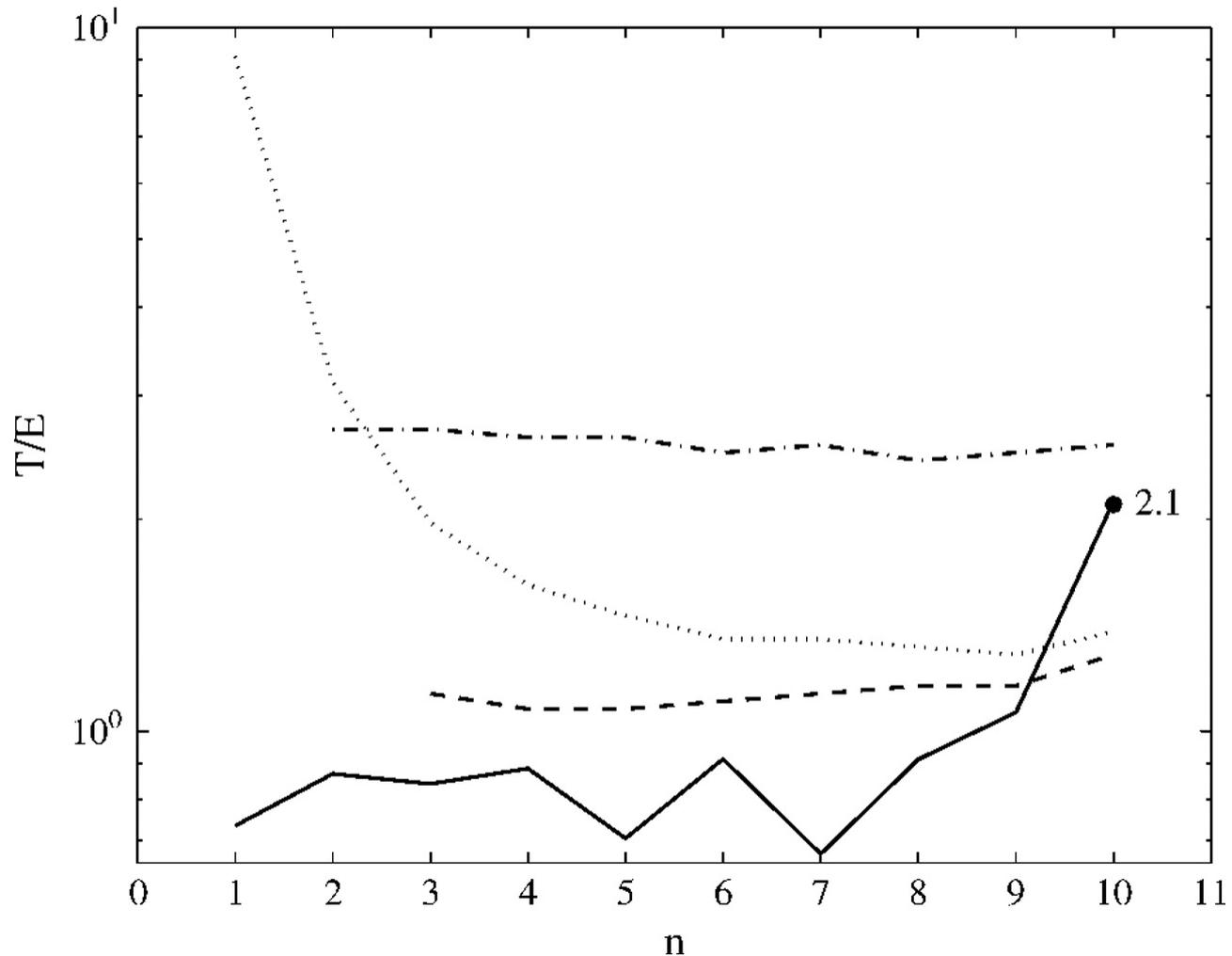


Distribution of Urinary T/E Ratios for Male Athletes



- Sottas et al, Biostatistics 2007; 8:285-296

Reference Change Statistics

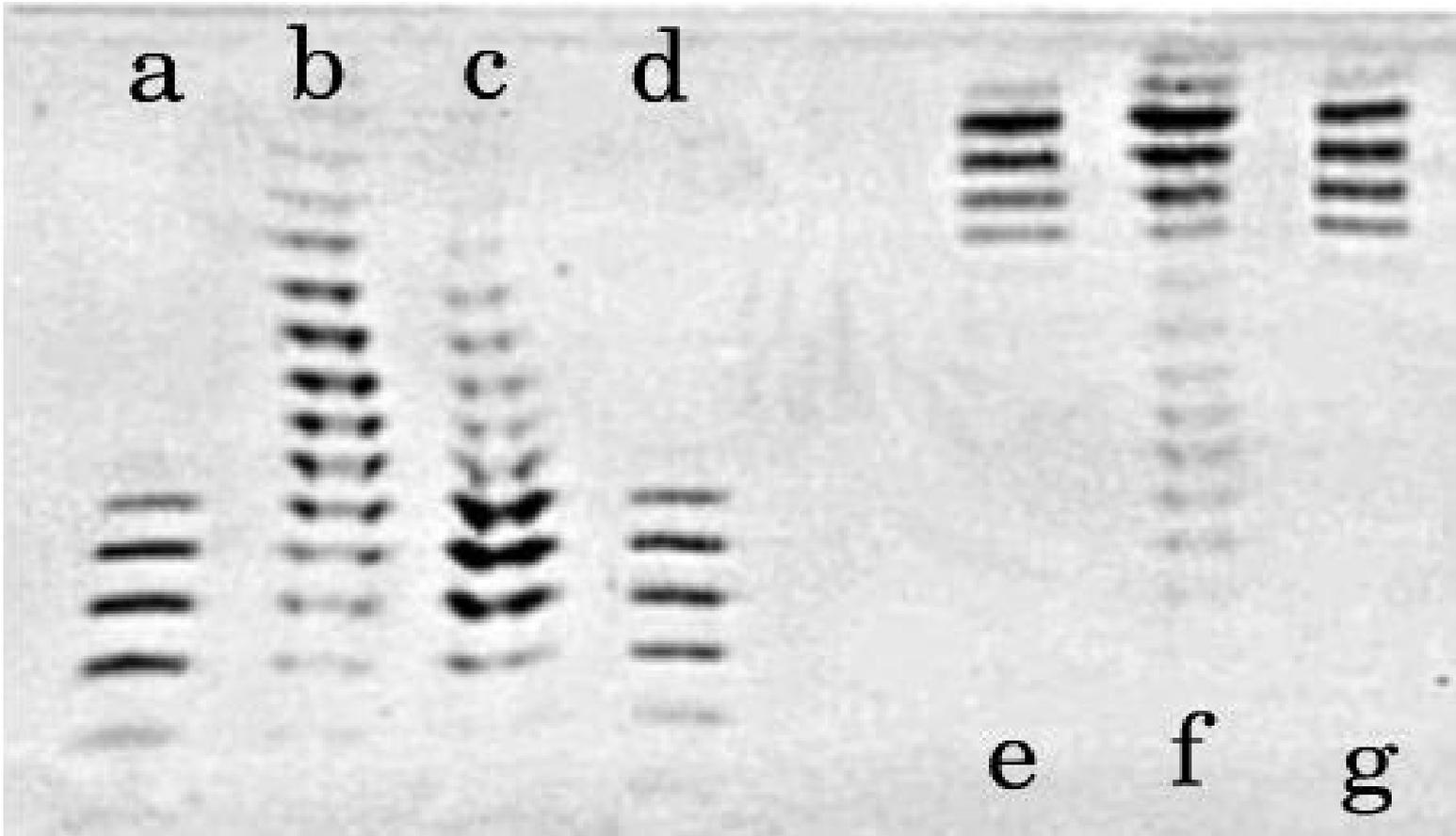


- Sottas, P.-E. et al. Biostat 2007 8:285-296

Detection of rhEPO

- Hormone produced by kidney and liver; responsible for development of red cells
- Single polypeptide chain containing 165 amino acids
- Four glycosylation sites:
 - 3 N-linked sites — ²⁴Asn, ³⁸Asn, ⁸³Asn
 - 1 O-linked site — ¹²⁶Ser
- Several forms of Recombinant EPO available (α , β , γ , ω)
 - Amino acid sequence is identical;
 - N-linked glycosylation can be different;
 - O-linked glycosylation can be different
- Genetically engineered “Novel Erythropoiesis Stimulating Protein”
 - 5 N-linked sites

Isoelectric Focusing - Double Immunoblotting Method for rhEPO



- Courtesy of Don Catlin, UCLA Olympic Analytical Laboratory

The Role of the Health Professional ...

- “How to not test positive using EPO:
 - The EPO test was originally developed by Dr. Francesco Conconi in the early 90’s, but then later perfected by the French Laboratory, Chatenay-Malabry, is a fairly simple, if a bit inaccurate test. In fact, Conconi would not introduce the test as he felt it was too inaccurate with volumes of urine less than 500 mL. The French were the ones who fine-tuned the test to become more accurate with just 75 mL (although accuracy goes down with volume of urine, so the first way to beat the test is to pee not a drop more than 75 mL).”

The Role of the Health Professional

- “To beat this test: First off the test was developed with the assumption of a usage of EPO of about 30IU per Kilogram of Body weight, and injected subcutaneously, Looking at the pharmacokinetics of EPO we could first find that if injected intravenously as opposed to sub cu, we find that the rate of excretion as reduced from 100hrs to less than 24hrs. Secondly, if instead of injecting 30IU per KG 3 times a week, we were to inject 10IU per kg 7 times a week intravenously, you might (theoretically) reduce the rate of complete excretion to less than 12hrs. Otherwise stage ends at 5 p.m., take a quick shot and by 5 a.m. the next morning you are 100% clear. And the next urine test takes place that afternoon... a full 24 hours after the shot.
- Of course each metabolism is different, and some people would be naturally closer to the 80/20 ratio the UCI declares one positive at than others. So, a great deal of money would have to be spent determining excretion rates in a laboratory. Not many athletes could come close to affording this. However, with enough resources the exact dosage to be clear in 10 hrs or less could be determined quite easily. From this perspective it would seem the only rider ever caught using EPO, would be the ones unlucky enough not to have had the money to gain access to top doctors and researchers working in labs to gain the knowledge of exact excretion rates.”

BALCO

Bay Area Laboratory Cooperative

OCV K.W. L=8 C=8

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 <i>SQUANT</i>	4	5	6	7
		L	L E C		L C	
8	9 <i>⊕</i>	10	11	12	13	14
	L	C	L			
15	16	17	18	19	20 <i>S</i>	21 <i>✓</i>
			E	100	100 150	1200
22 <i>E</i>	23	24 <i>LEAVE</i>	25	26	27 <i>OSLO</i>	28
200 250 S	C					
29 <i>E</i>	30	1	2	3	4	
200 4x100 L GLASGOW	C		<i>TRAVEL</i>			

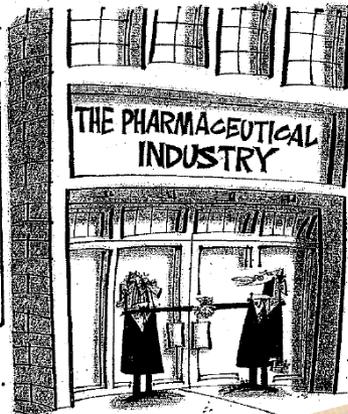
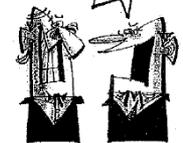
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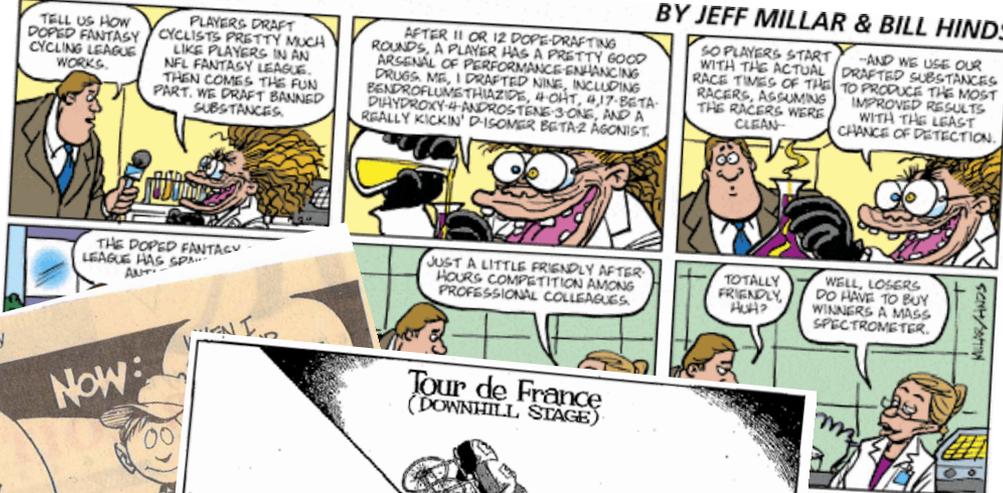
July 2007 NWSL 3477
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BEATING BABE RUTH'S RECORD... THAT'S QUITE AN ACCOMPLISHMENT!



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TANK McNAMARA



BY JEFF MILLAR & BILL HINDS

MALLARD FILLMORE | By Bruce Tinsley

"CONGR.



Harry Potter AND THE DOPING SCANDAL

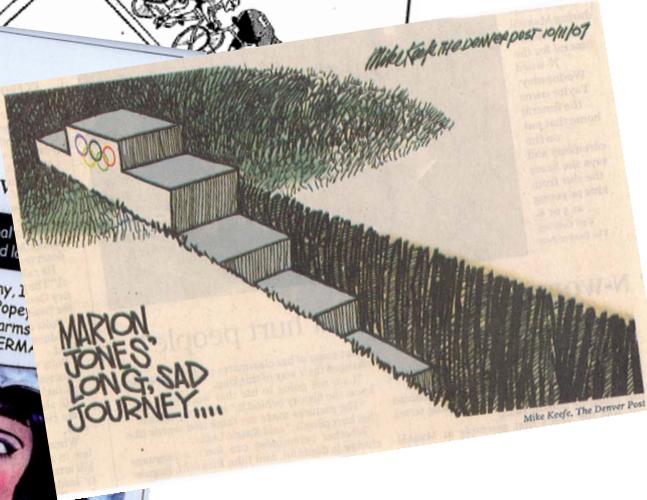


Gryffindor's quest for the... is derailed when Harry tests positive for performance-enhancing drugs

Say It Isn't So, Spider-Man!

Bruce Handy/Glynis Sweeny

Could it be that the steroid scandal reaches even further than...



- **Integrity is doing the right thing when no one is watching you.**

If this topic interests you, the following books are recommended

Dying to Win by Barrie Houlihan

Commission of Inquiry into the Use of Drugs and Banned Practices Intended to Increase Athletic Performance by Hon Charles L Dubin

Faust's Gold: Inside the East German Doping Machine by Steven Ungerleider

Game of Shadows by Mark Fainaru-Wada and Lance Williams