Address by

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Chief Science Adviser to the Government

Science and Mathematics Education Conference
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Chief Science Adviser

Chief Science Adviser Key Functions

- Provision of independent expert advice on any aspect of science, technology and innovation as requested by Government
- Provision of analysis and opinion on all major policy proposals being submitted to Government in the area of science, technology and innovation
- Advising on STI issues arising in the context of the EU and internationally
- Advising the Government periodically on the scale and balance of overall State investment in science, technology and innovation, having consulted with all major stakeholders
- Overseeing a system of independent evaluation of STI policy and programmes, with particular reference to cross cutting issues
- Management of the process of gathering data and intelligence, particularly in relation to R&D performance and spending

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Science and Education

- Increase the awareness of the importance of science at all levels of education
  - Training (retraining) of teachers (Primary & Secondary)
  - Curriculum revision (leaving certificate)
  - Stress importance of subjects; Mathematics and Geography

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- Determine the explanation of the fall-off rates (science subjects) from Leaving Certificate to University
  - Identification of clear career opportunities
  - 'Excite' curriculum content
  - Science as foundation for multiple career paths

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- Possibility of continued Science Education in the workplace
  - Post Leaving Cert entry to work force and continued education to degree level
- Raising the standing of Science in Society
  - Contribution of education to wealth and job creation but also quality of life

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Centre for the Evaluation of Education Systems (Joint Research Centre, Ispra)

- Indicator based evaluation of education and training systems
  - Development of new composite indicators
- Impact of Education and Training on economic performance (Lisbon goals)

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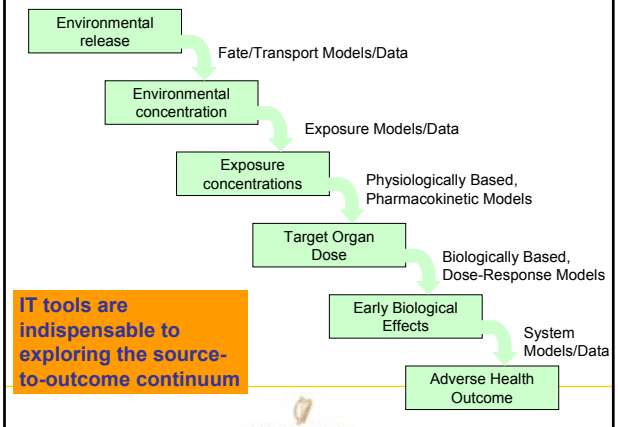
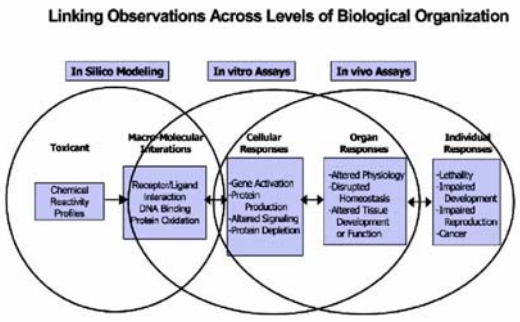
New Application of Mathematics – Examples

- Design and interpretation of clinical trials
  - Bayesian designs
  - Factorial designs for multidrug therapy
- Data mining and pattern analysis
  - Antifraud
  - Complementary to bioinformatics
  - Robotic media monitoring
  - Complex disease
    - Prevention strategies





Human envirogenomics: main elements

- Identification of predisposition genes
- Identification of key environmental factors
- Identification of gene-environment interactions

Example: childhood asthma

Why this example to demonstrate the envirogenomic approach?

- It is the most common disease of childhood
- It runs in families ⇒ genetic component
- Sharp increase in prevalence over the past 50 years ⇒ environmental component, preventable

Example: childhood asthma

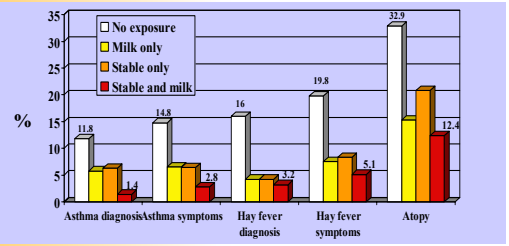
- Strong regional differences in prevalence in the EU
- Different genetic variants in the EU
- Variety of environments and cultures
- Annual cost in Europe estimated at 3 to 5 billion €

So, the EU has a unique chance to solve the riddle of asthma!

This is the reason for investigating Childhood Asthma Envirogenomics and for launching the CASE initiative

The hygiene/infection hypothesis

Exposure to stables and farm milk in the 1st year of life



Riedler et al., Lancet 2001

ALEX-Study

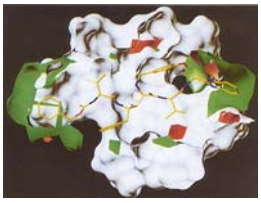
Envirogenomics: multidisciplinarity

For a successful approach a multidisciplinary collaboration is essential:

- Clinical medicine
- Epidemiology
- Toxicology
- Data mining and pattern analysis
- Endocrinology
- Microbiology
- Immunology
- Environmental exposure assessment
- Genetics
- Bioinformatics

QSARs: Computational Assessment of Chemical Hazard

- Quantitative structural-activity relationships are simplified mathematical representations of complex chemical–biological interactions. They are quantitative models yielding a continuous or categorical result (classification).
- The most common techniques for developing QSARs are
  - ordinary or partial regression analysis,
  - back propagation neural nets, and
  - classification methods (discriminant analysis, decision trees, distance-based similarity analysis).
- An estimate calculated using molecular descriptors can be based either on experimental values for each molecular descriptor or on experimental values for several molecules containing a common molecular descriptor.



Converging Technologies

- NBIC (Nano-, Bio-, Info Tech and Cognitive Sciences)
- Impact on
  - Work efficiency and learning
  - Sensory and cognitive capabilities
  - Revolutionary changes in healthcare
    - Improving/decelerating physical and cognitive decline (ageing)
  - Group and individual creativity
  - Highly effective communicational techniques
- However, Societal Concern
  - Uncertainty
  - Risk of Social Rejection