Associazione culturale “Giuseppe Dossetti”

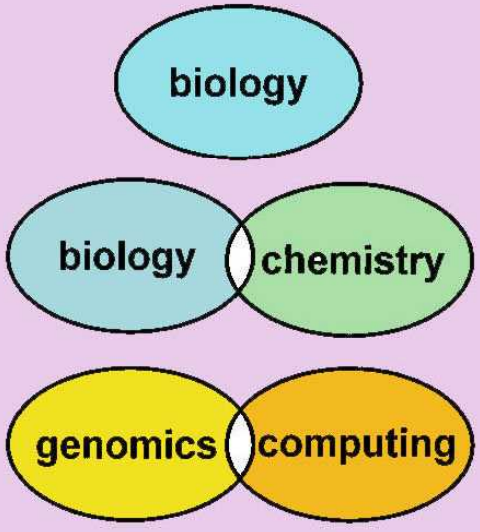
LEONARDO SANTI

“Il concetto di innovazione in campo farmaceutico”

Camera dei Deputati – Palazzo Marini

21 marzo 2007

The Analysis and Application of Principles of Biological Design



- the descriptive narrative

1750-1980

- empirical technology

1980-2010

- mechanistic reductionism

- the encoded information content of biological systems

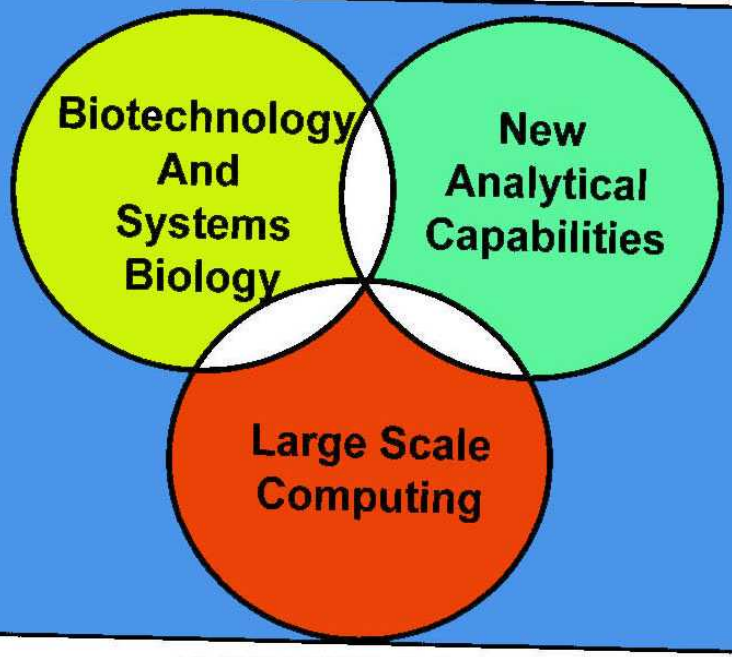
- mapping the basis of biological variation

- rational medicine and customized care

systems biology

21st Century Biology and Medicine

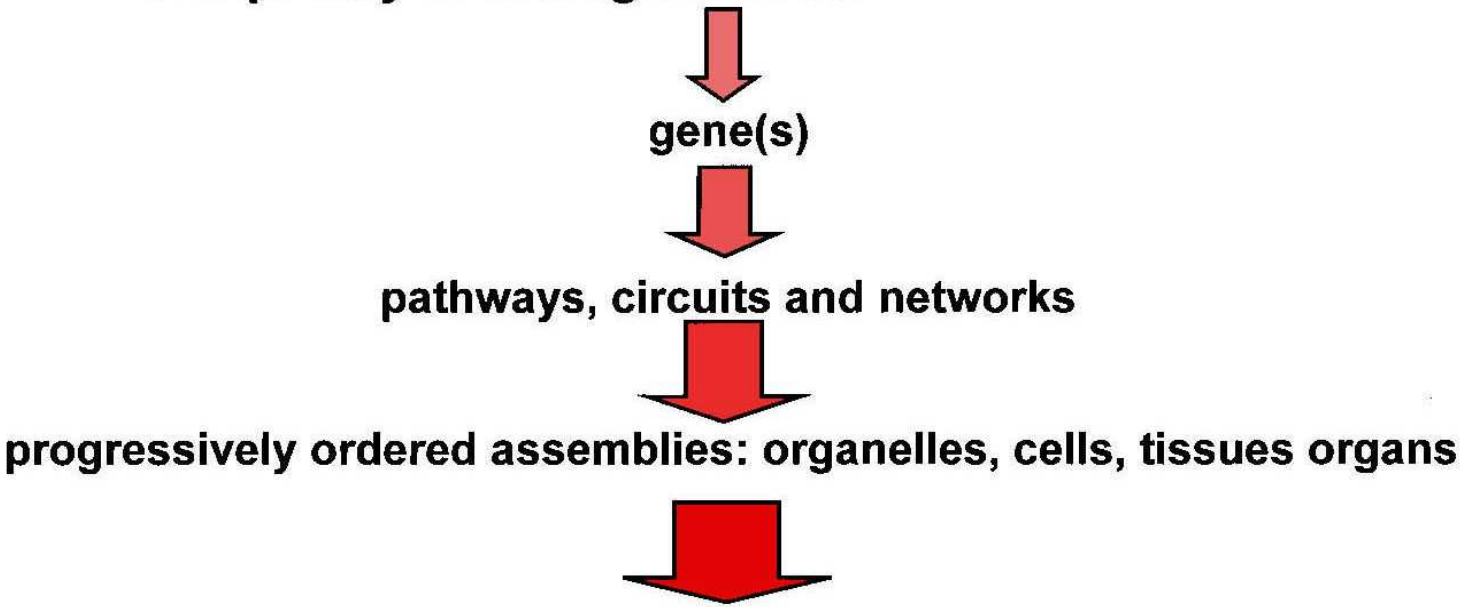
"SYSTEMS BIOLOGY"
- the design principles of biological order and complexity
- mapping the information content of biopathways and networks



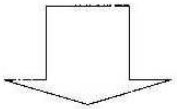
"BIG BIOLOGY"
- interdisciplinary, massive datasets, information-based
- infrastructure, investment and education

From Reductionism to Integrated Systems Biology

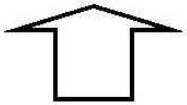
- understanding the information content encoded in biological networks
- mapping the design rules for progressively greater complexity of biological order



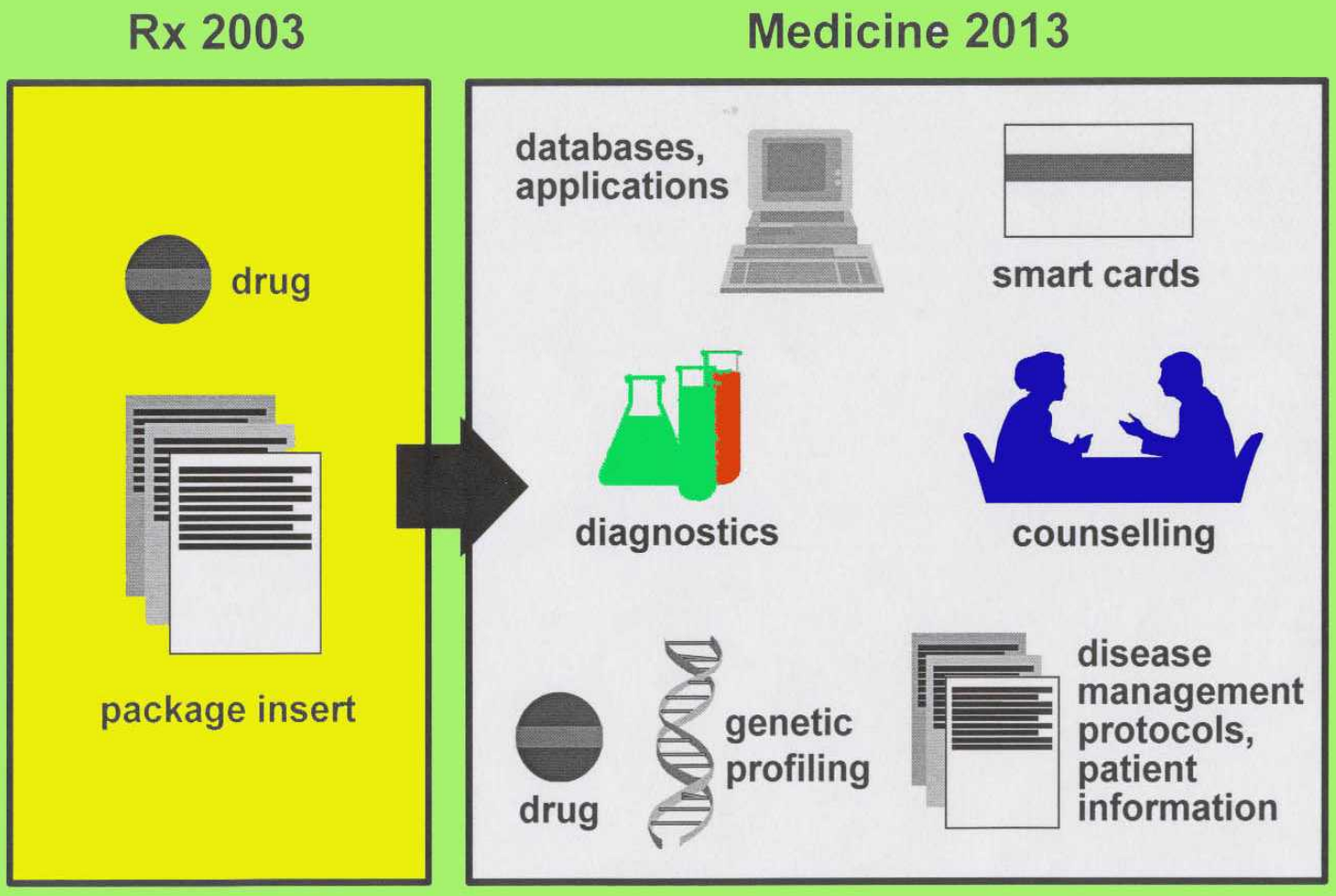
Understanding The Information Content Of Biological Systems



Predictive Biology	Rational Medicine



- INTER DISCIPLINARY RESEARCH
- CROSS-SECTOR INDUSTRIAL CONVERGENCE

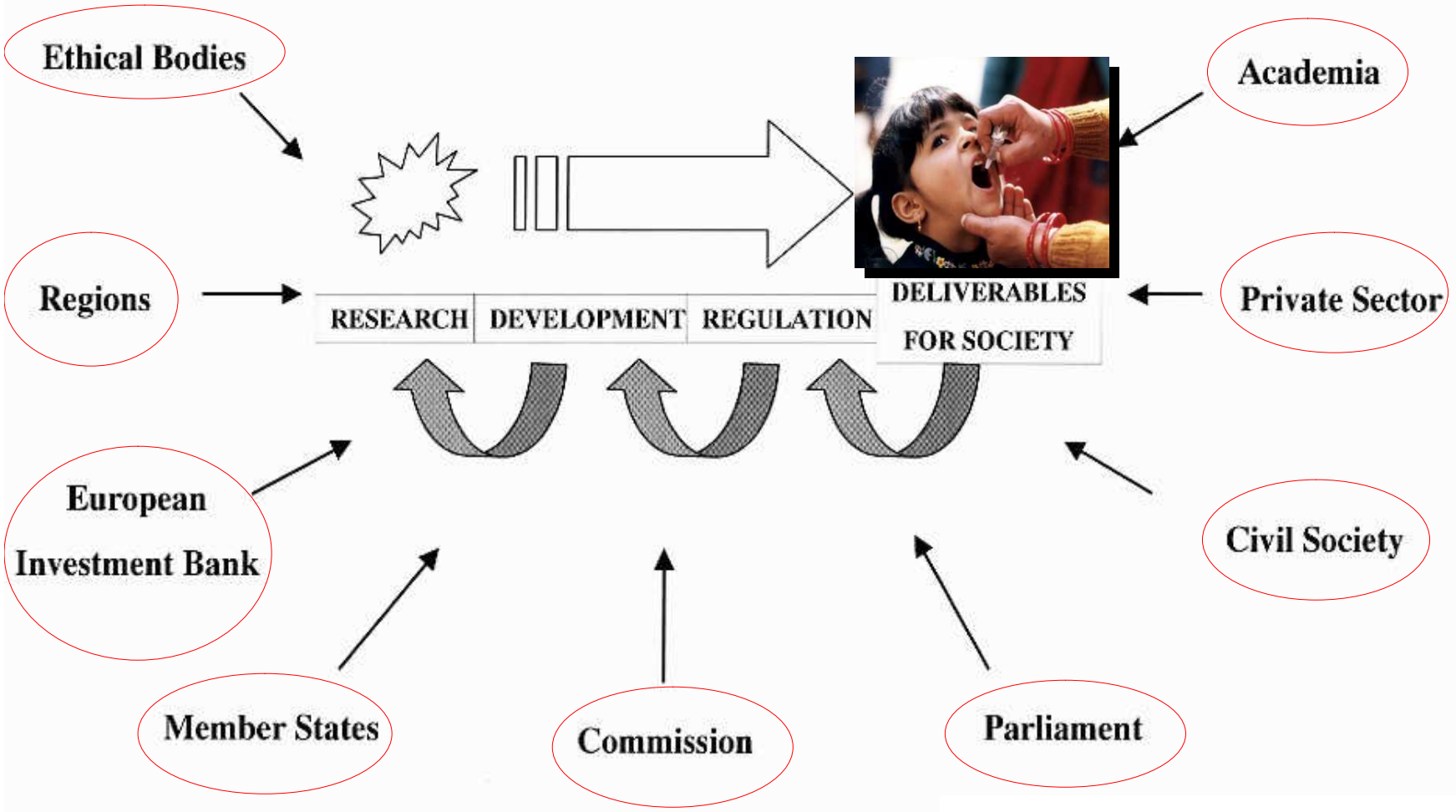

Rx 2003
Medicine 2013
drug
package insert
databases, applications
smart cards
diagnostics
counselling
drug
genetic profiling
disease management protocols, patient information

Entering An Era of Dramatic Change

The Quest for Innovative Technological Solutions

- Purposeful integration of diverse, and previously largely separate, constituencies
  - science, medicine, engineering, telecommunications, ethics, law, social sciences, economics, technical policy and law
- Increasing focus on bio-inspired solutions
  - mimicing biological design/processes
  - building systems on Nature's scale
- Moving from 20th Century physical sciences-based concepts/industries to new 21st Century bio-inspired approaches
- From reliance on resource-depleting industries to increasing embrace of renewable/regenerating systems

Success will depend on mobilisation of all actors



The promises of the genomics

- Increase of the drug-discovery process
  - New targets (orphan receptors)
  - Medicines with more targeted activity
  - Drug design (molecular tossicology)
- Faster development process
  - Selections of patients
  - Reaction of the patients to the therapy
- More significant group of patients
- More expectation of success
- Reduction of the *time to market*
- More targeted marketing activity

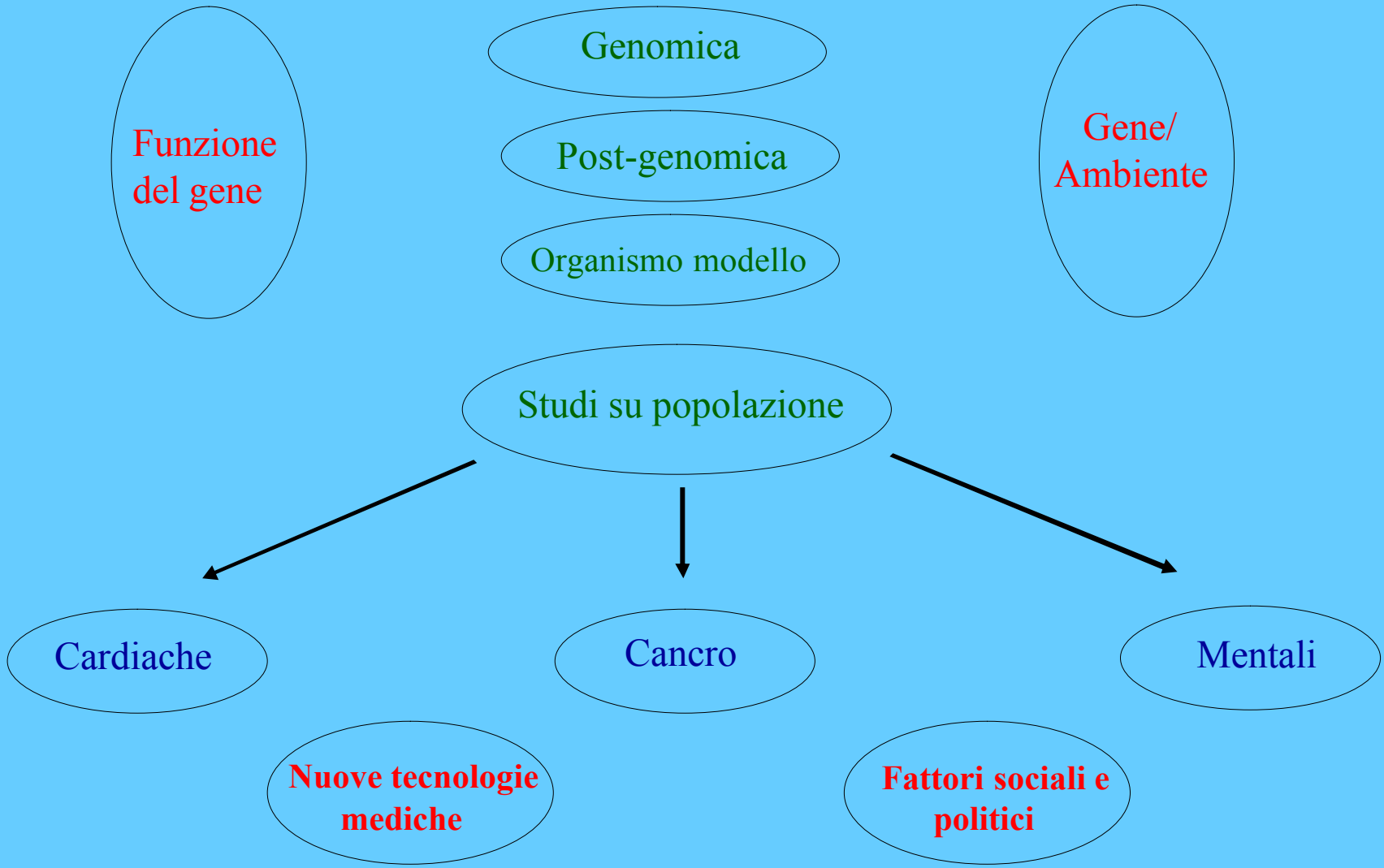
Le sfide dell'attuale ricerca post-genomica

- **Genomica funzionale:** quanti sono, quali sono, a cosa servono e come funzionano i **geni**? Definizione delle basi molecolari dell'individualità biologica (**SNPS**) e delle differenze tra specie (**genomica comparata**).

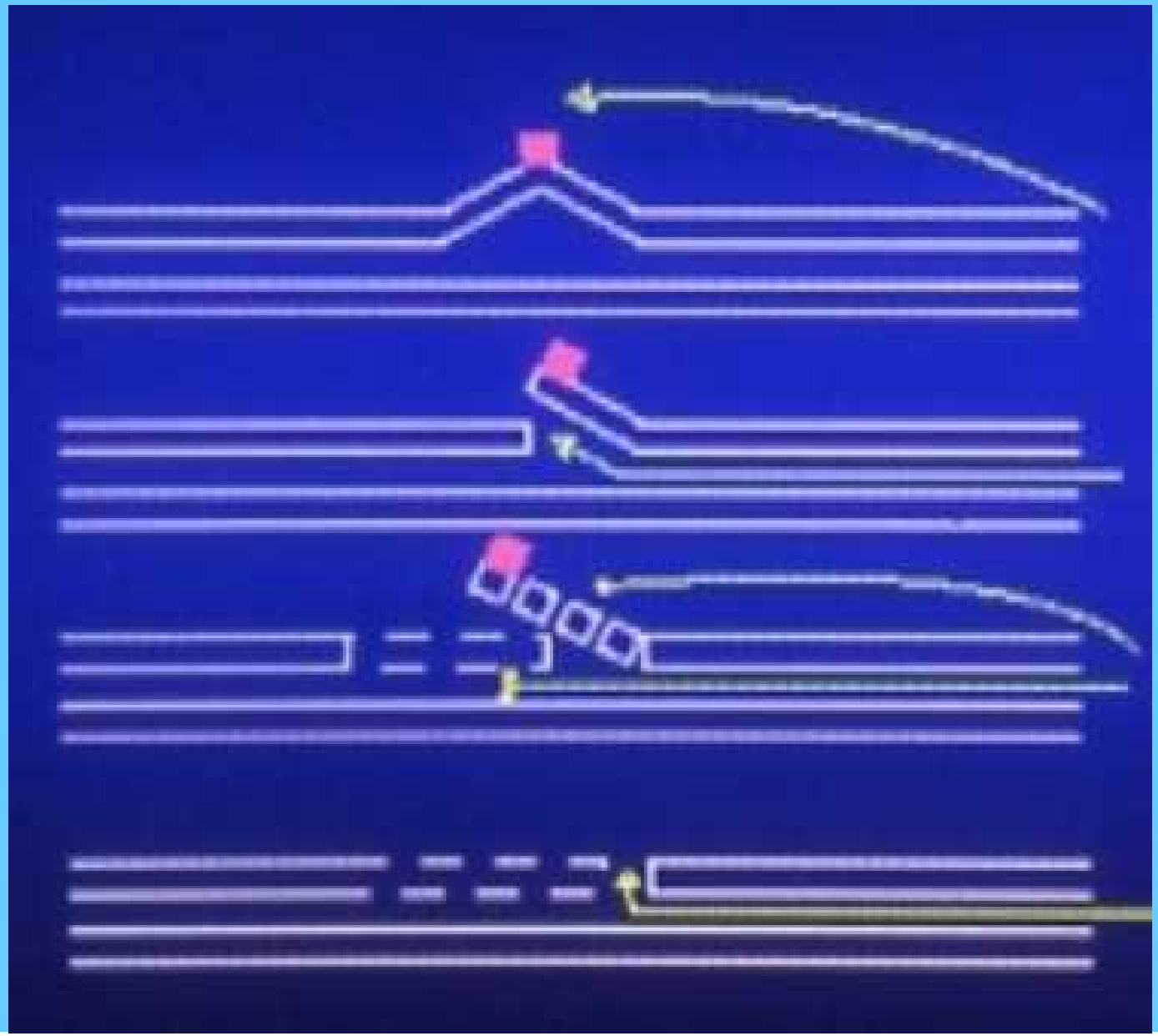
- **Proteomica:** il catalogo delle **proteine** presenti in una singola cellula o in un singolo organismo.

- **Proteomica funzionale:** **rapporti struttura/funzione** delle proteine in correlazione con le sequenze geniche.

Dai Geni alla Salute



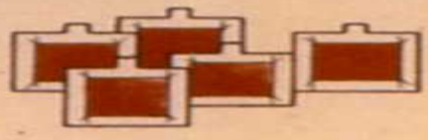
Danno e Riparo del DNA



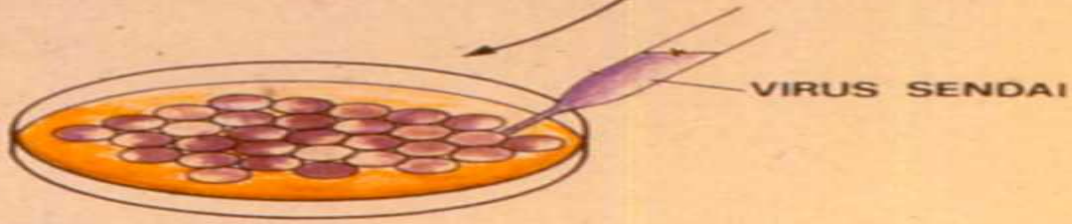
INTERFERON ALFA NATURALE



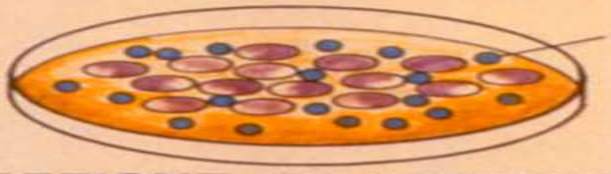
DONATORI



SACCHE DI SANGUE



LEUCOCITI UMANI IN COLTURA
INFETTATI CON VIRUS INDUCENTE



SECREZIONE DI INTERFERON

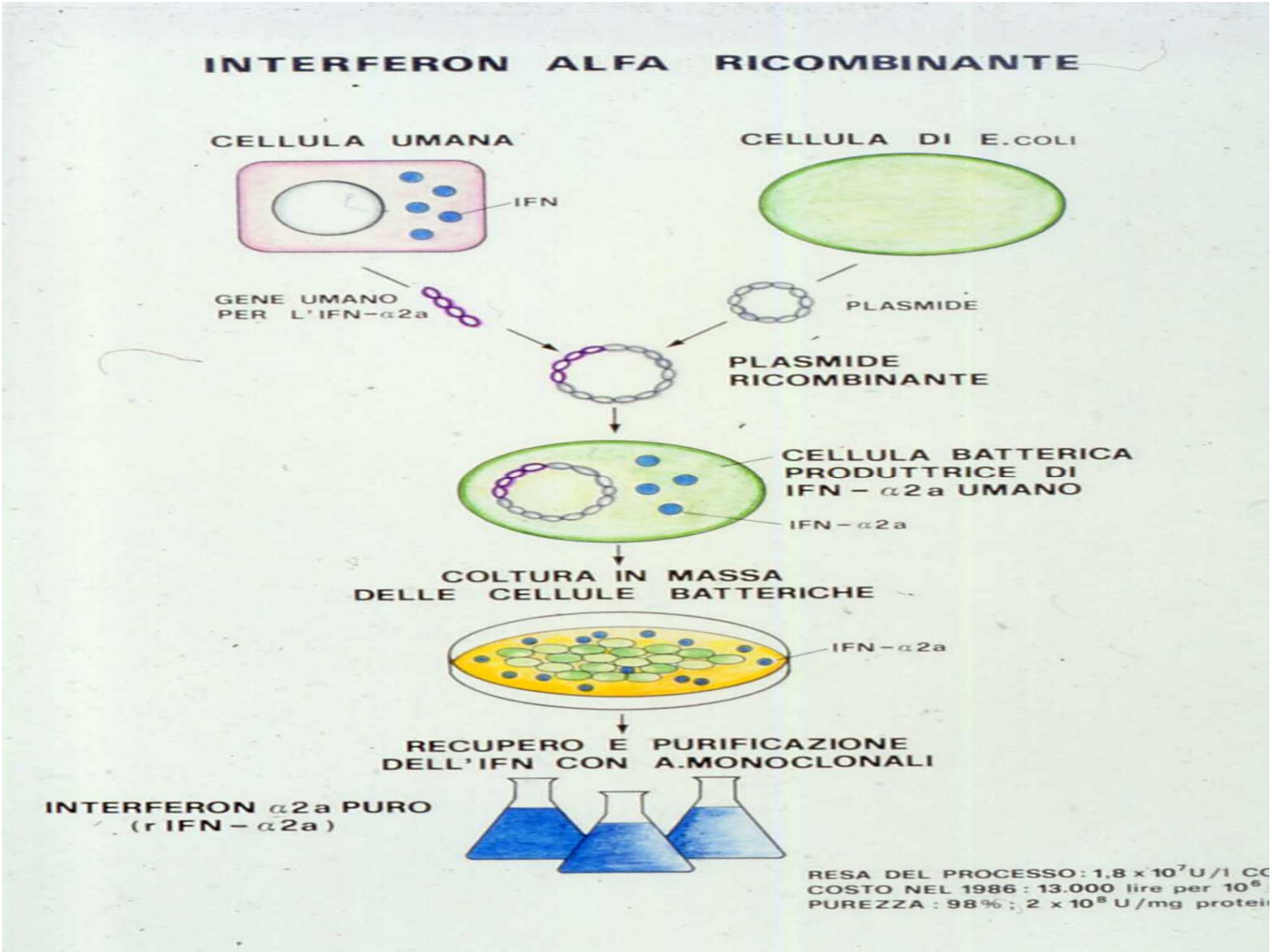
RECUPERO DEL TERRENO E PURIFICAZIONE



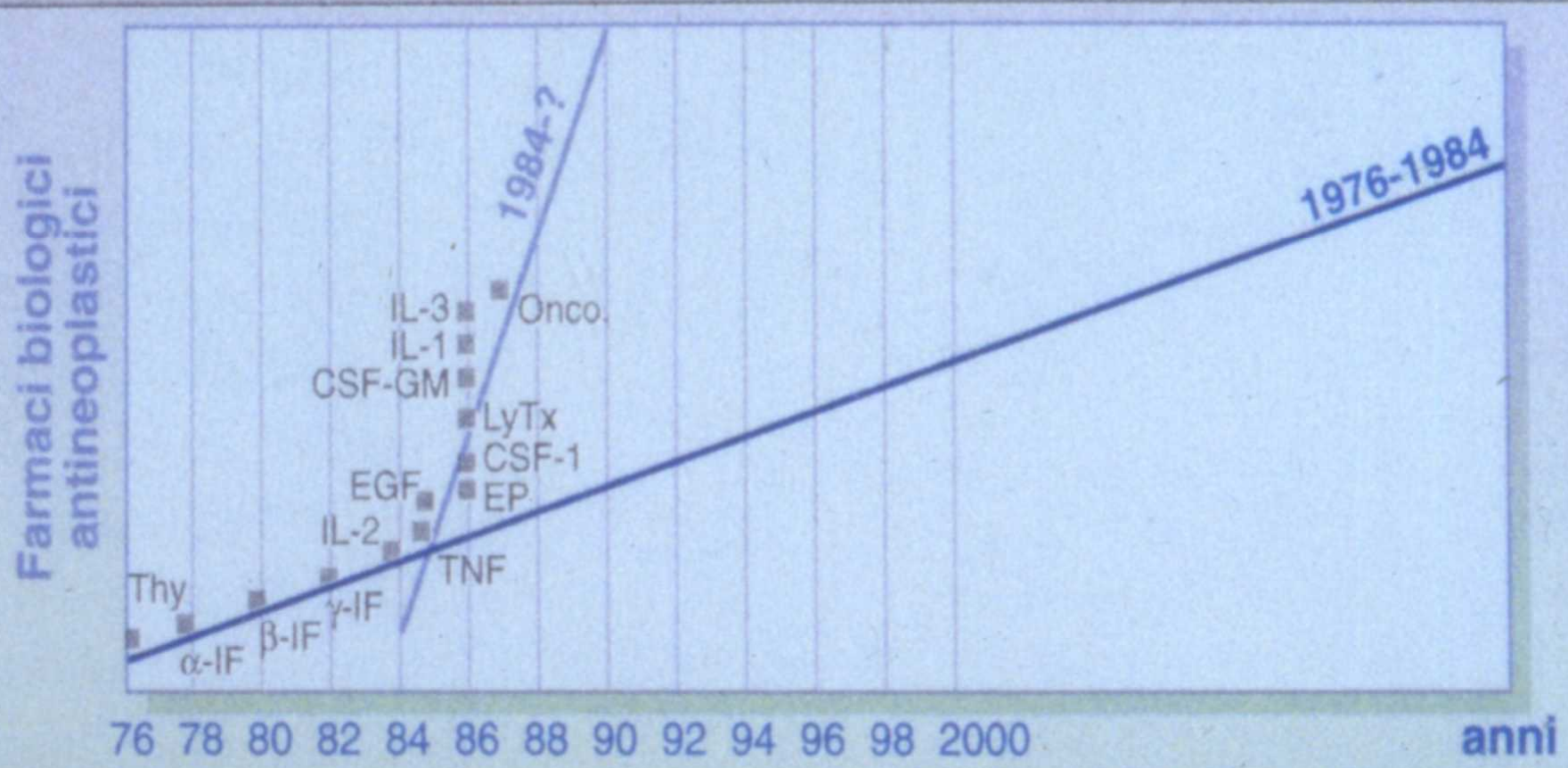
INTERFERON GREZZO
SCELA DI 10 – 15 SOTTOSPECIE
IFN ALFA PIU' ALTRE
ROTEINE

RESA DEL PROCESSO: 2×10^4 U / ml SANGUE
COSTO NEL 1970: 22 USD per 10^6 U
PUREZZA: 1% ; $1-3 \times 10^6$ U /mg proteine

INTERFERON ALFA RICOMBINANTE



Sviluppo dei farmaci "biologici"



Thy=Timosina, **αIF**=Interferone alfa, **βIF**=Interferone beta, **γIF**=Interferone gamma, **IL-2**=Interleuchina-2, **TNF**=Tumor necrosis factor, **EGF**=Epidermal growth factor, **EP**=Eritropoietina, **CSF-1**=Colony stimulating factor, **LyTx**=Linfotossina, **CSF-GM**=Colony stimulating factor-granulocita macrofago, **IL-1**=Interleuchina-1, **IL-3.**=Interleuchina-3, **Onco.**=Oncostatina

Test genetici

Individuali: predittivi
diagnostici

Collettivi: di popolazione

Forensi: banca DNA criminalità organizzata - terrorismo

Quanti farmaci biotecnologici sono in commercio
Sviluppo delle ricerche sui farmaci:

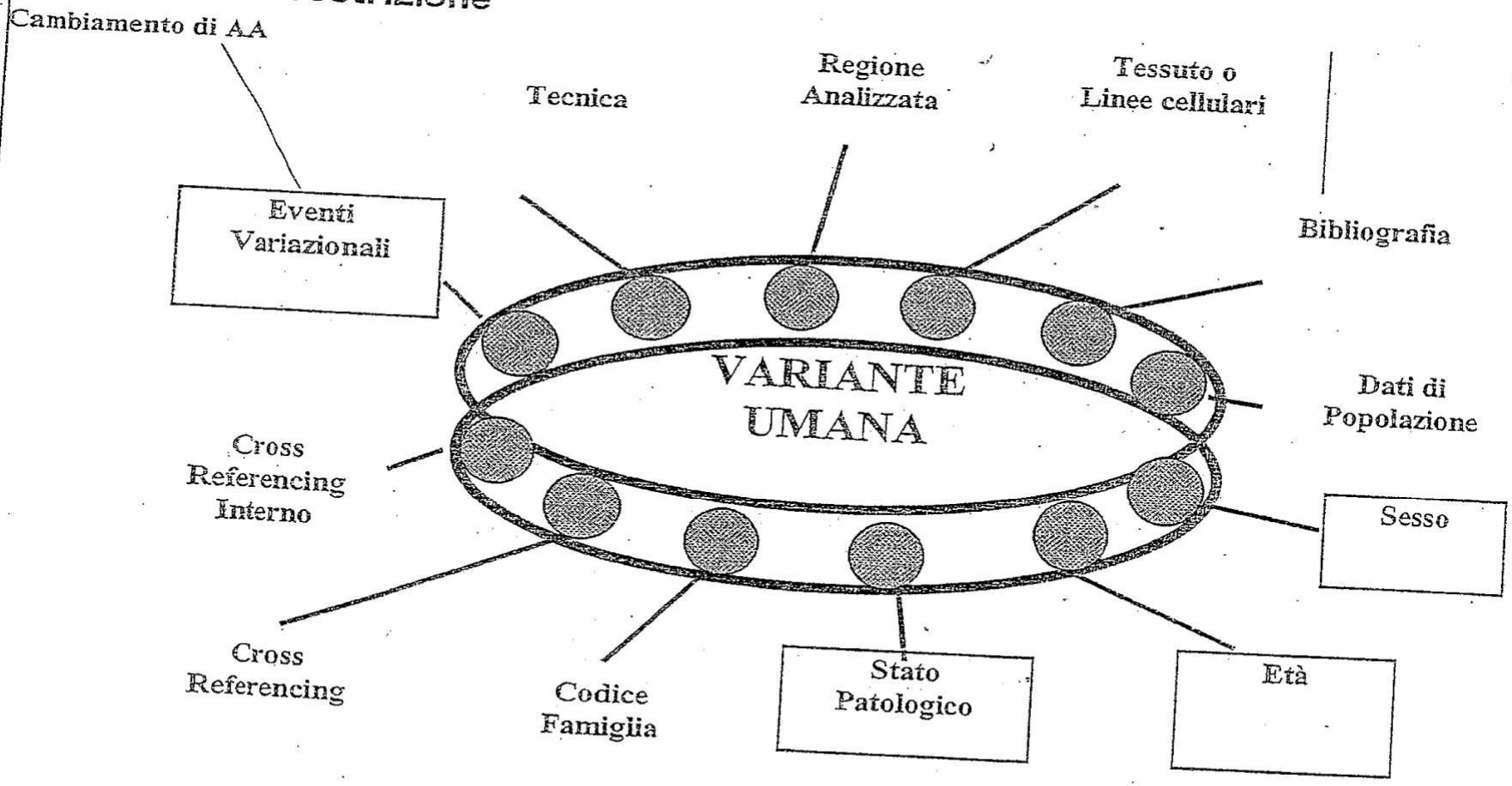
Farmacogenetica: studio nella variabilità nelle risposte individuali ai farmaci per fattori genetici

Farmacogenomica: applicazione delle informazioni farmacogenetiche allo sviluppo di nuove entità farmacologiche.

Genotipizzazione individuale-Carta d'identità genetica?

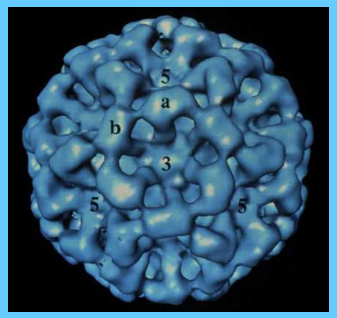
Codice della Variazione
Posizione nucleotidica dell'evento rispetto alla sequenza di Anderson
Gene coinvolto

Perdita o acquisto di un sito di restrizione




Sviluppo di nuovi farmaci
GENOTIPO
del PAZIENTE
efficacia
VALIDAZIONE
reazioni avverse
"IL FARMACO PIU' ADATTO AL
SINGOLO PAZIENTE/GRUPPO DI PAZIENTI

Plant made vaccines



Norwalk virus

1. **Isolate gene from a pathogen (Ex: Norwalk virus)**
2. **Cause the gene to integrate into plant chromosome in the nucleus.**
3. **Regenerate plants with every cell containing the new gene**
4. **Test plant tissue for presence of immunogenic protein (candidate oral vaccine in pre-clinical trial)**







Presidenza del Consiglio dei Ministri
Comitato Nazionale per la Biosicurezza e le Biotecnologie

Linee nazionali di sviluppo delle biotecnologie

- Task force in ambito CNBB costituita con decreto PCM e composta da rappresentanti dello stesso Comitato, dei Ministeri, della Conferenza dei Presidenti delle Regioni, di Sviluppo Italia
- Priorità tematiche
- Nodo centrale, nodi territoriali e coordinamento in rete
- Interazione rete nazionale → rete europea
- Partecipazione Web europeo biotecnologie

Presidenza del Consiglio dei Ministri

Comitato Nazionale Biosicurezza e Biotecnologie

