

Werden Lebensversicherungen durch die Kenntnisse des menschlichen Genoms überflüssig?

Beatrice Baldinger, Dr. sc. nat.
Research Manager

Jan von Overbeck, Dr. med.
Chief Medical Officer

Swiss Re Life & Health
14.9.2001



Phenotypes: Mind the gap !



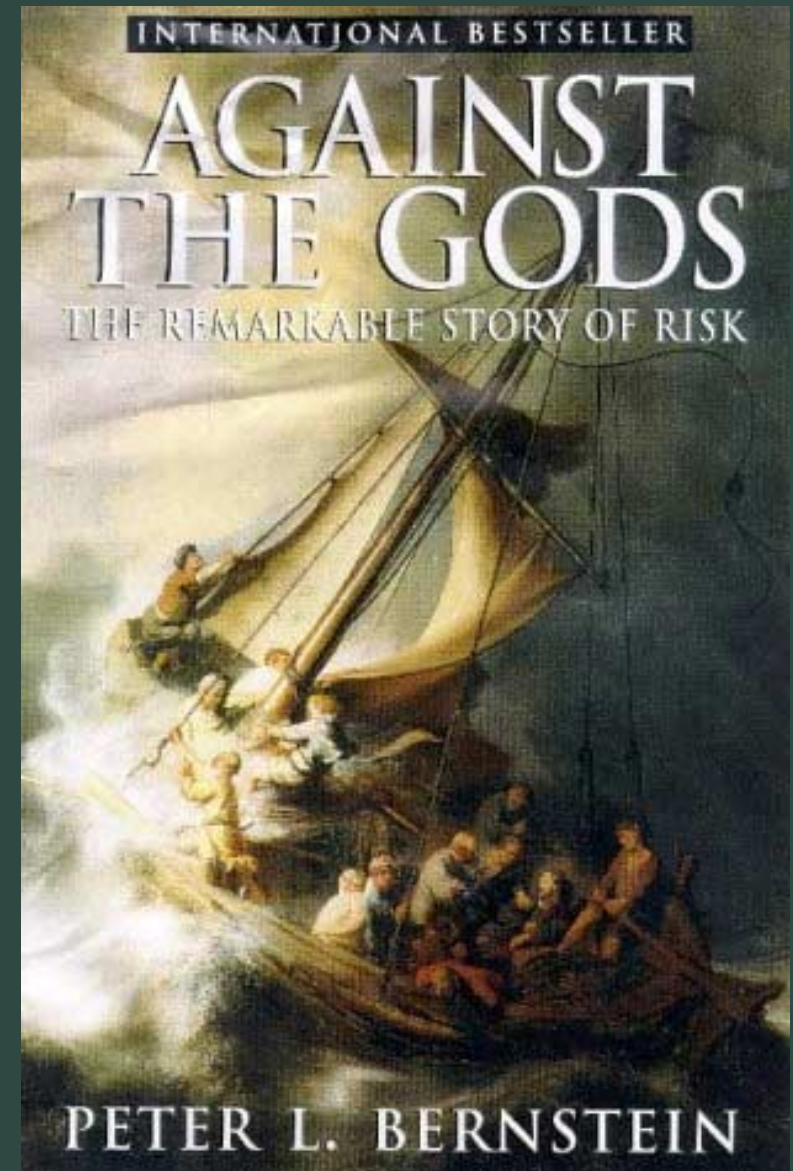
Find the differences !

Against the gods?

The remarkable story of risk

P.L. Bernstein

1996



Taboo, Sin and Risk

The taboo is a social prohibition:

- relationship to magical powers

The sin is an offence against a divine order:

- relationship to God

The concept of risk involves weighing up different possibilities:

- relationship to technology, society and nature

Taboo, Sin and Risk

The taboo is a social prohibition:

- taboo versus non-taboo

The sin is an offence against a divine order:

- sin versus non-sin

The concept of risk involves weighing up different possibilities:

- risk and benefit become complementary
- risk becomes a quantitative consideration

Is risk a choice ?



The word “**risk**” derives from the early Italian *risicare*, which means “**to dare**”. In this sense, risk is a choice rather than a fate. The actions we dare to take, which depend on **how free we are to make choices**, are what the story of risk is all about. And that story helps define what it means to be a human being.

Risk perception,
knowledge,
and freedom
of choice?

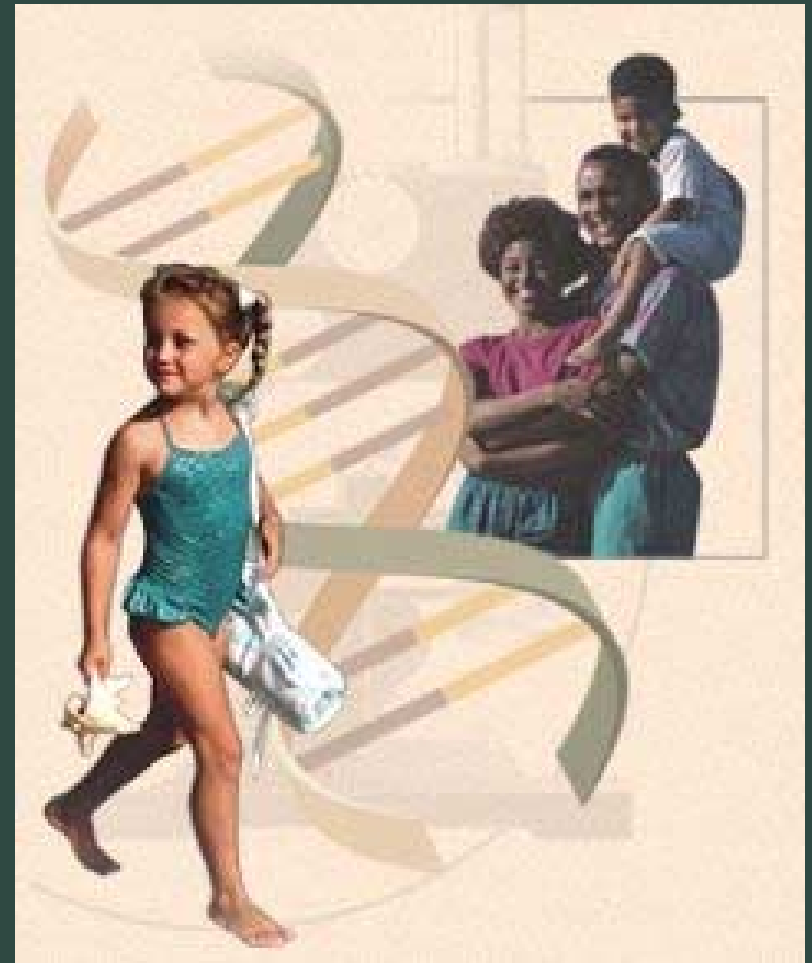
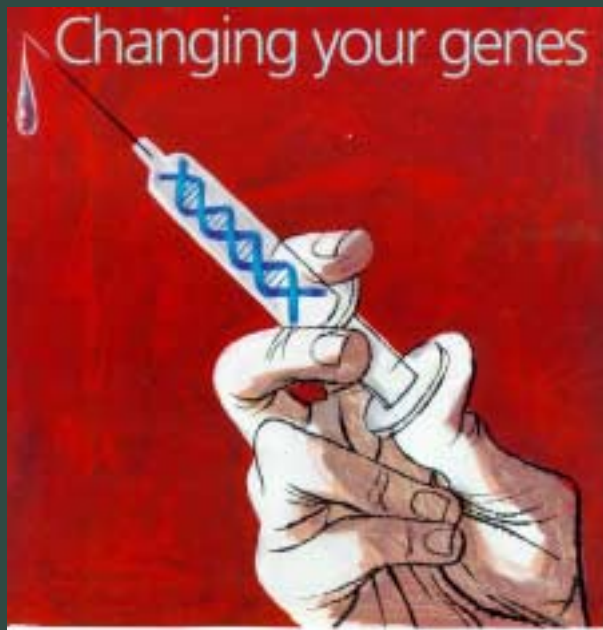


Is risk a choice ?

The public perception tends to ignore the beneficial side of risk and to attempt to reduce complex issues to the simple demand of **zero risk**.

Normally, the **risk aversion** is assumed to be the typical attitude.

The actions we dare to take,
which depend on **how free we
are to make choices**, are what
the story of human life is all about



Genes and longevity

- **Nematode**

- six identified gene variants that extend lifespan
 - age-1 doubles lifespan
 - daf-2/clk-1 double mutants have a 5-fold increased lifespan



- **Yeast**

- aging is related to DNA accumulation, linked to the SGS1 gene

- **Humans**

- Werner's progeria, a rare accelerated aging disease, caused by a gene homologous to SGS1

Genes determining life-expectancy

- Genes with homologues that influence longevity in animals
 - Centenarians, mammals, nematode (*C. elegans*), yeast
- Genes mediating cellular maintenance and repair
 - DNA replication/repair
- Genes associated with susceptibility to major age-related diseases
 - Alzheimer, cardiovascular disease, cancer,

APOE too is a determinant of life expectancy

- Studies of allele frequencies in old compared to young populations (France, Finland, China) reveals:
 - the underrepresentation of $\epsilon 4$ ($p < 0.01$)
 - the overrepresentation of $\epsilon 2$ ($p < 0.001$)

The ??? Guide to Genetic Insurance

Complete guide available at www.cheapest-insurance.com

Your genetic test result is.....

• APOE ϵ 4



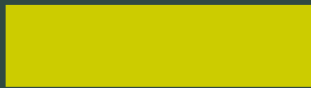
We recommend:

- Life insurance
- Long-term care

• APOE ϵ 2



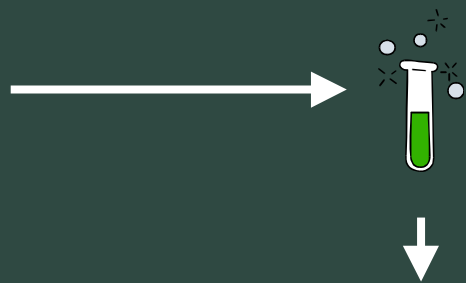
- Annuities
- Critical illness



Looking into the Future



Assessing an individual risk in 2020



DNA full sequencing (gene chip)



Prediction

80%
Cancer
at 45 y

60%
Alzheimer
at 80 y

20%
DM
at 50 y

Full "genetic" risk
assessment



No uncertainty

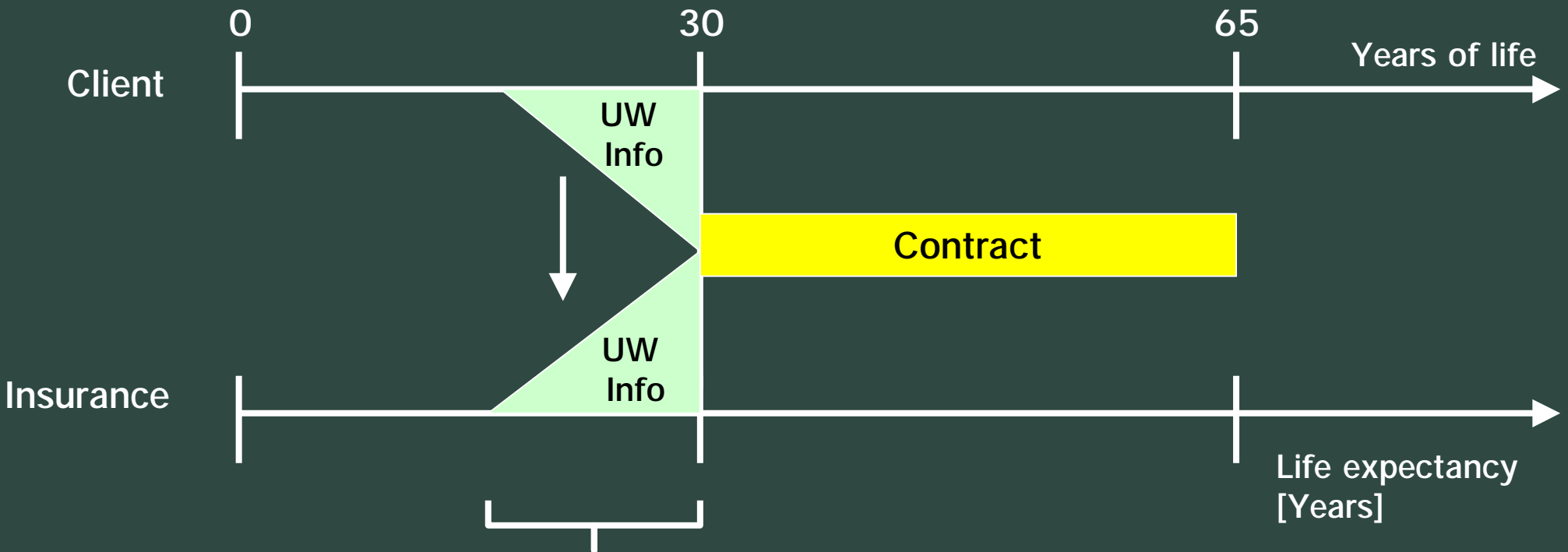


No insurance !

Will the principles of life insurance still be valid in 2020?

- Insuring an uncertain event → **“Randomness”**
- Sharing similar risks into groups → **Law of large numbers**
- Underwriting
 - prevent anti-selection and hidden agenda (assess randomness)
 - assessing degree of risk (standard, substandard)

Traditional individual risk assessment



Symmetry of information

UW info = Underwriting information

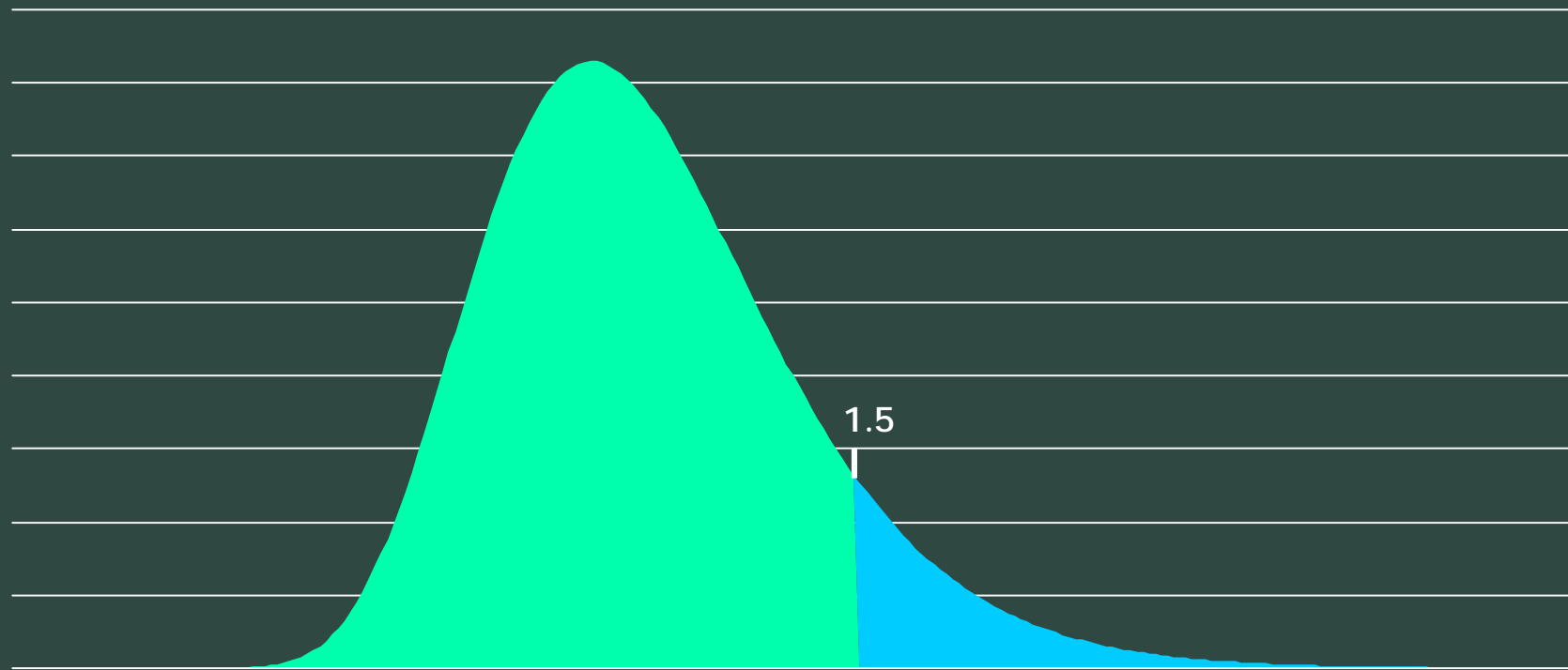
How do private insurers assess risks?

- To establish a fair price for insuring an **uncertain event**, estimates must be made of the probabilities associated with the occurrence, timing and magnitude of such an event.
- These estimates are normally made through the use of past experience, coupled with projections of future trends, for groups with **similar risk expectations**.

Pool of lives "at risk"

Population based

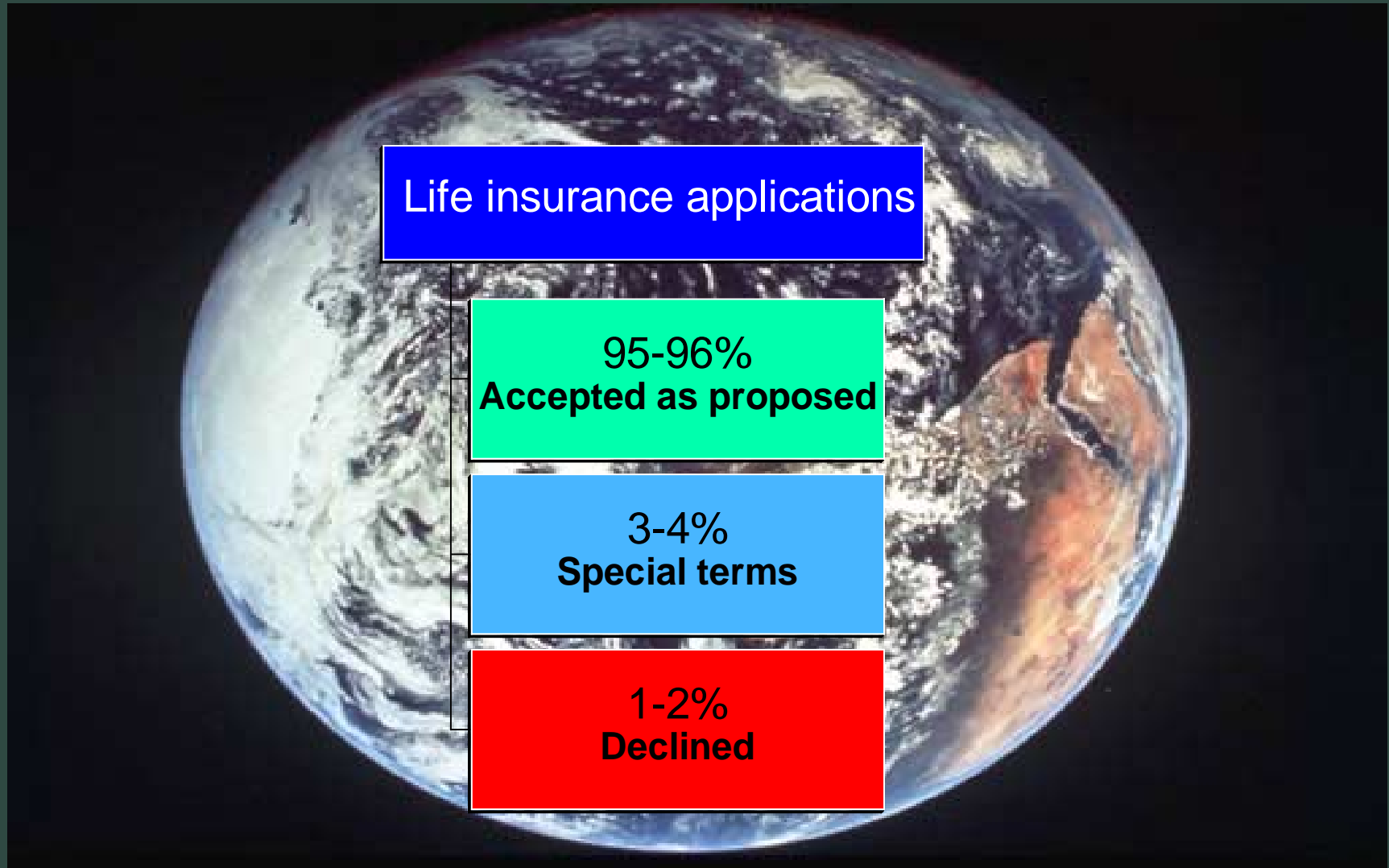
Propn. of Portfolio



■ Standard ■ Sub-Standard

Propn. Expected Mortality

Outcome of the risk classification process



Goals of private insurers

- To allow **as many applicants as possible** to obtain the coverages they need **at the lowest cost**
- Not to exclude people from obtaining coverage
- **Not** to cherry pick



Why do private insurers need to assess risks ?

- To limit adverse selection
- To remain competitive in a competitive environment
- Financial soundness:

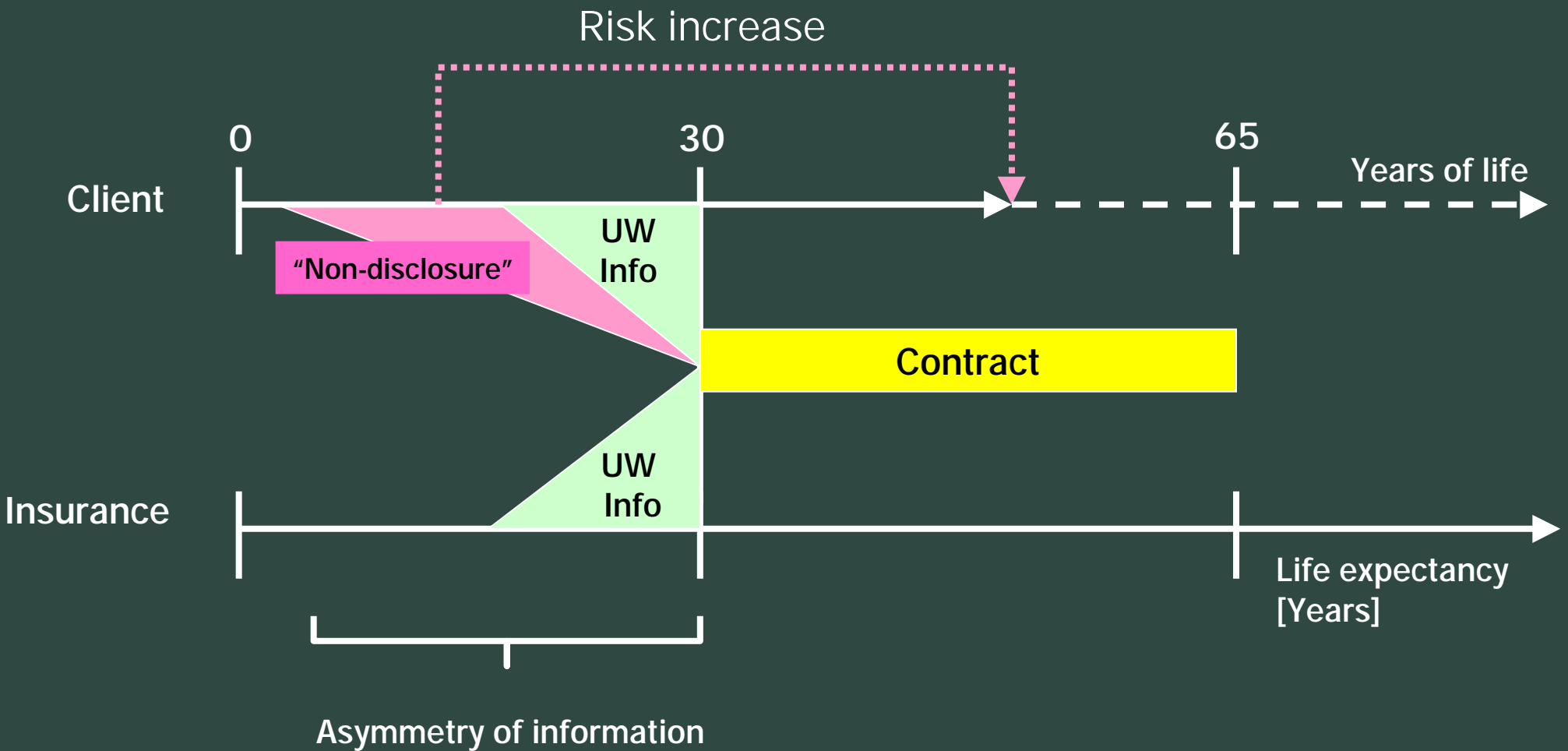
Affordable cover



Financial security and Long term solvency



Anti-selection



Purpose of the risk classification process

- It should
 - protect the insurance system's **financial soundness**
 - be **fair**, and
 - permit economic incentives to operate, thus encouraging wide-spread **availability** of coverage



Concerns of the public about genetic testing

- Invasion of privacy
confidentiality
- No free will
- Rated for risk factors beyond
one's own control
- Job discrimination
- Stigmatism (individual, family)
- Social exclusion
- Undue pressure to have a test



Discrimination ?

- Fair ?
- Unfair ?
- Politically correct ?



American Scientist, May-June 1999

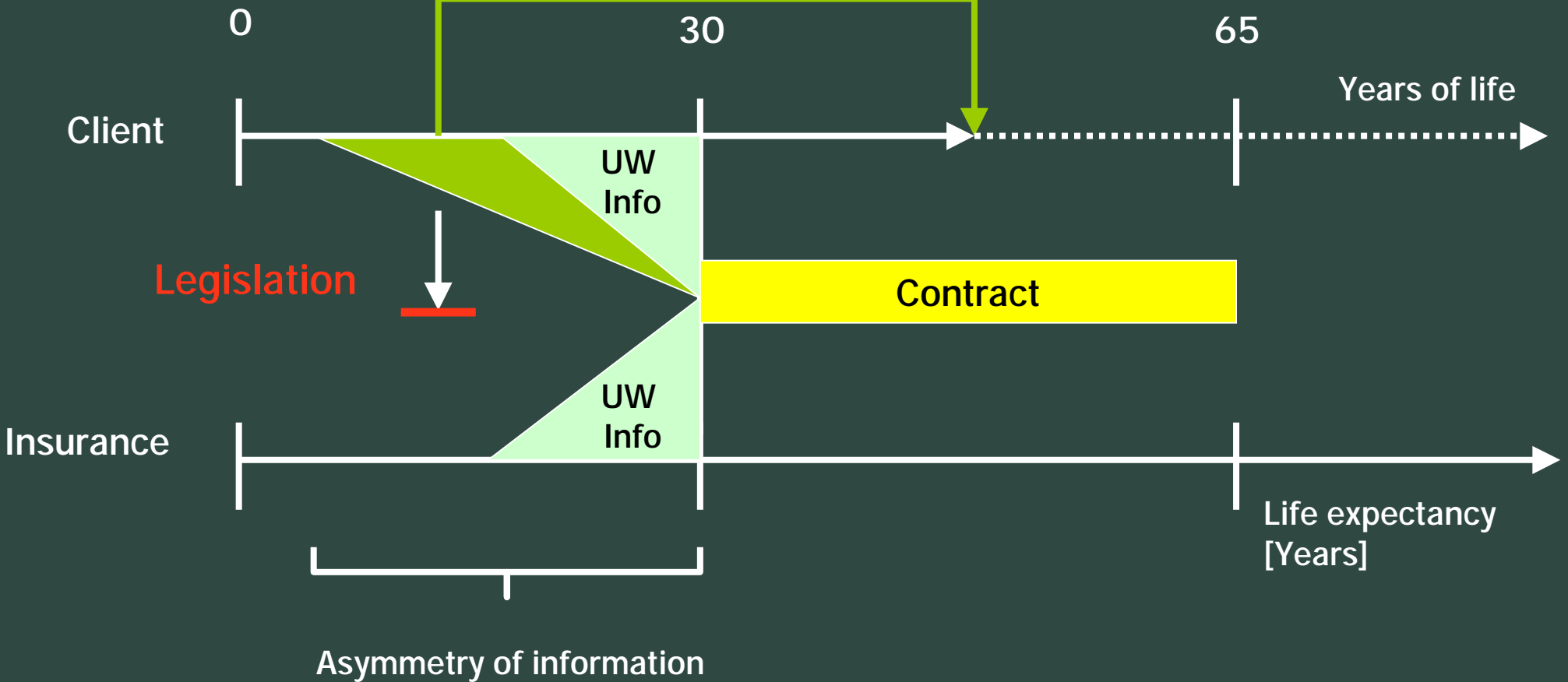
Concerns of private insurers about genetic testing

- Insurers fear that consumers will use genetics to abuse the insurance system, taking advantage of their private knowledge of the risks they are submitting for coverage.
- If insurers are prevented from requiring applicants to undergo too broadly defined genetic tests, they may in the future, as technology evolves, no longer be able to order standard medical tests routinely performed today.
- Insurers have good reasons to be concerned, as in many countries, restrictive legislation is in force or pending.

Cancer gene test

Gene test pos.

Risk increase

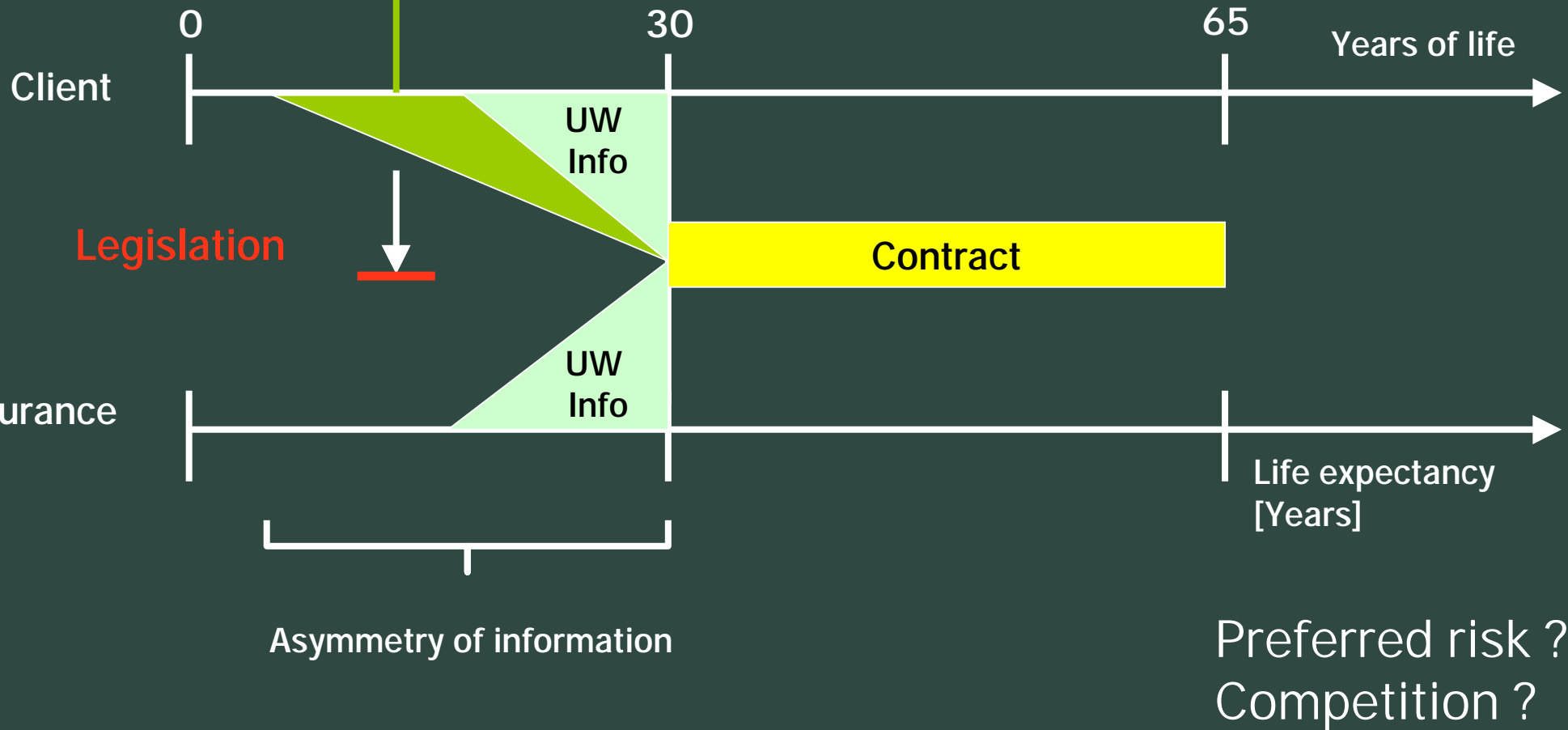


Legal restrictions in various countries

- Switzerland: law pending (2001) to predict insurers access to existing genetic test results
- Council of Europe (Recommendation and Bioethics convention)
- Belgium (1992): Genetic data cannot be transmitted
- France, Austria, Norway, Netherlands

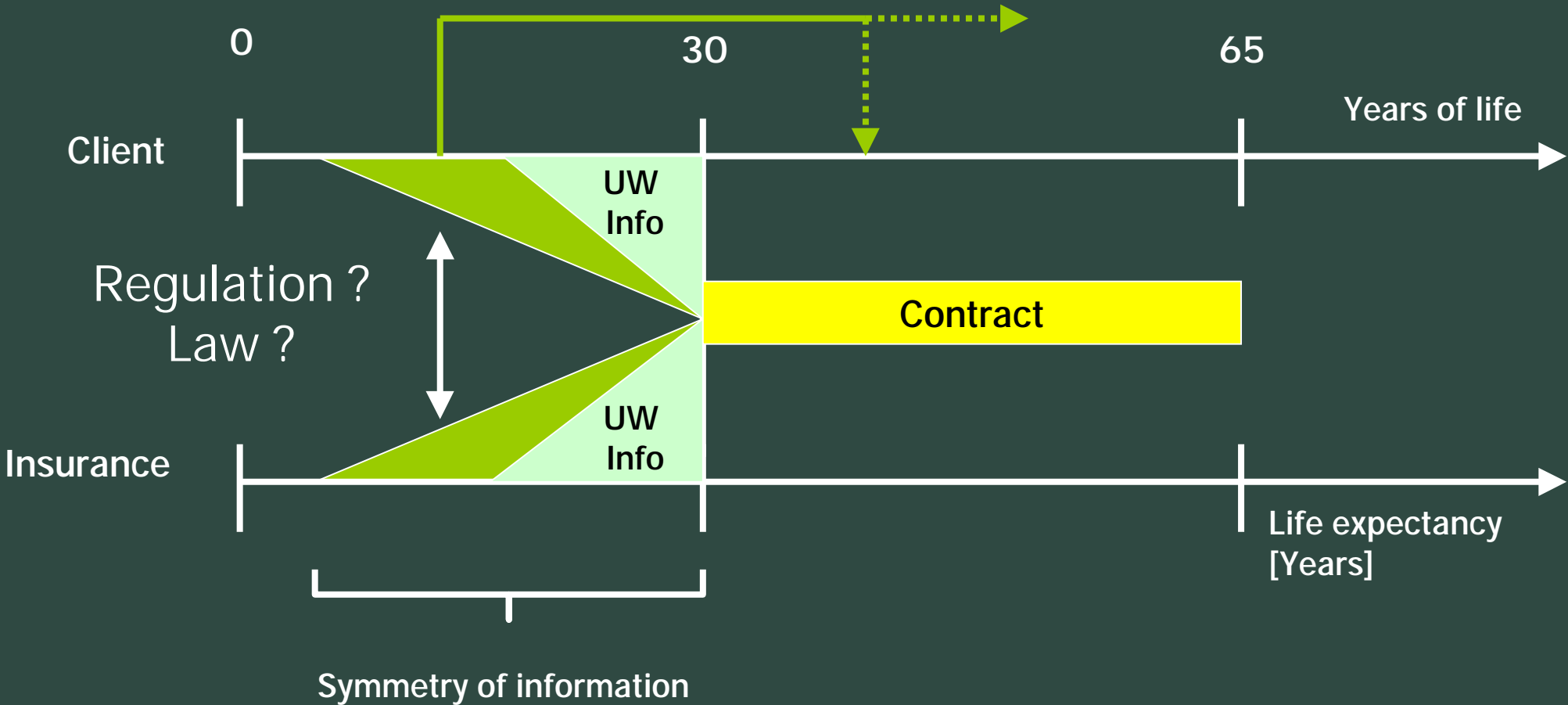
Cancer gene test

Gene test neg.
Risk decrease



Gene tests

Are Gene tests normal tests ?



Is genetic testing different?

- Cholesterol
 - Increased cardiovascular risk
 - Genetic component
- Cystic Fibrosis
 - Clinical diagnosis (sweat test)
 - Genetic testing / carrier status
 - Oligosymptomatic
- Haemochromatosis
 - Screening test, treatment available preventing disease

Cystic fibrosis

Cystic fibrosis syndrome

Pancreatic insufficiency

Pancreatic insufficiency

Atypical CF presentation

Asthma modifier?

Monosymptomatic diseases

phenotype

severity

No disease

CFTR genotype

wt wt	wt other	Polyvariant haplotypes? other	very mild other	mild other	mild mild	mild severe	severe severe
----------	-------------	----------------------------------	--------------------	---------------	--------------	----------------	------------------

Why is genetic testing different?

- Can be performed on healthy individuals
 - Information on future health status to allow preventive or early treatment
- One test for life
- Impact on other family members
- Touches something “sacred”
- Protection of the individual
 - genetic counseling
 - the “right not to know”

Assessing an individual risk in 2020



DNA full sequencing (gene chip)

Environmental risk
assessment



Uncertainty



Insurance



Prediction

80%

Cancer
at 45 y

60%

Alzheimer
at 80 y

20%

DM
at 50 y

Conclusion

- Developments in genetics will dramatically change the way insurers assess their risks.
- Regulation has a major impact on the development of the risk selection process.
- If genetic test information becomes deterministic, an assessment of the risk remains with the environmental factors.