ANTI-AGEING SCIENCE: PRODUCTS READY FOR CONSUMPTION?

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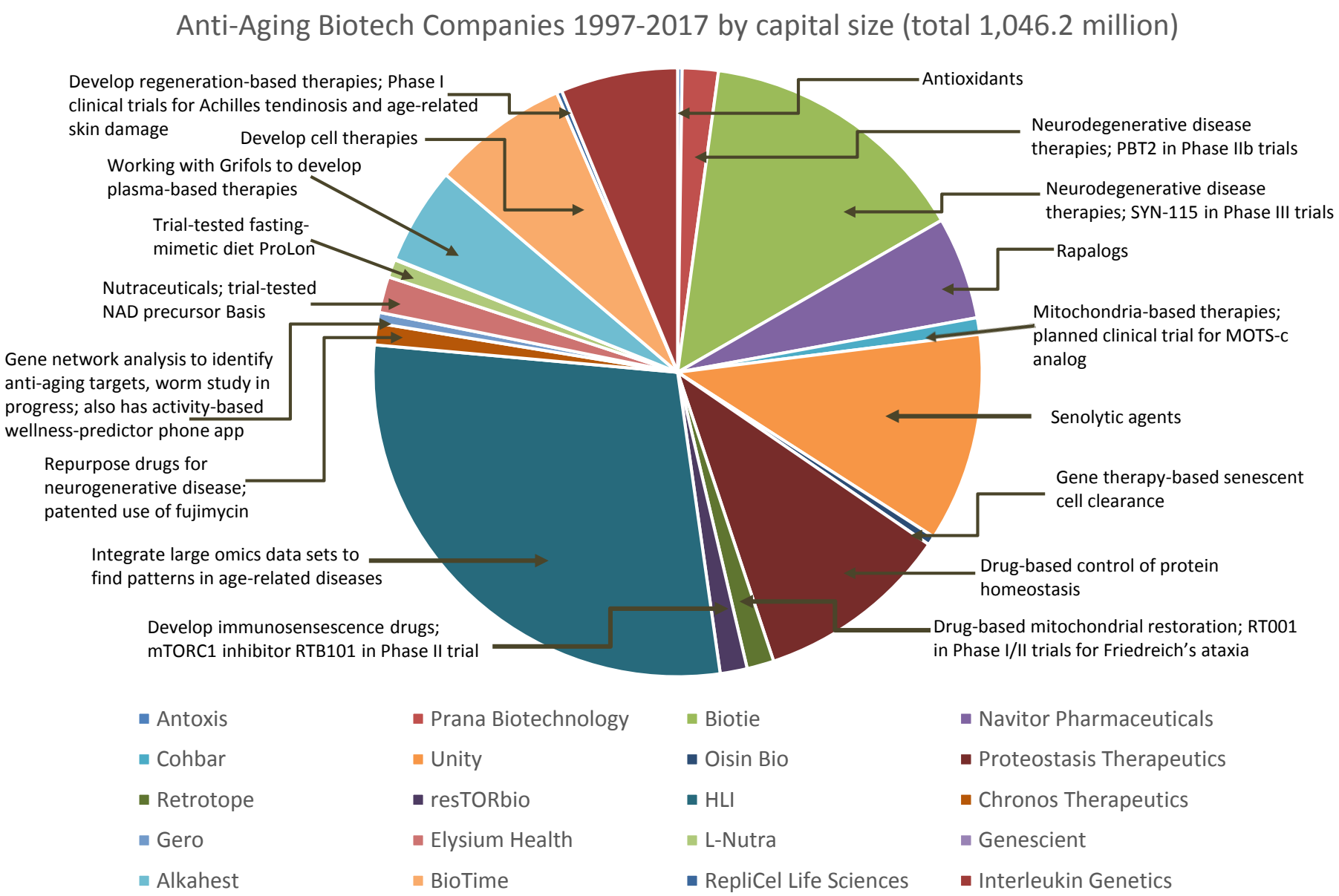
Contents covered

- Current status of the business of anti-aging science
- Three schools of thought about anti-ageing science
- Focus on individual fields, with comments on ethical implications
- Ethical perspectives on research, translation, and marketing practices for profit



[JP de Magalhães et al. Trends in Biotechnology 2017; 35(11): 1062-73]

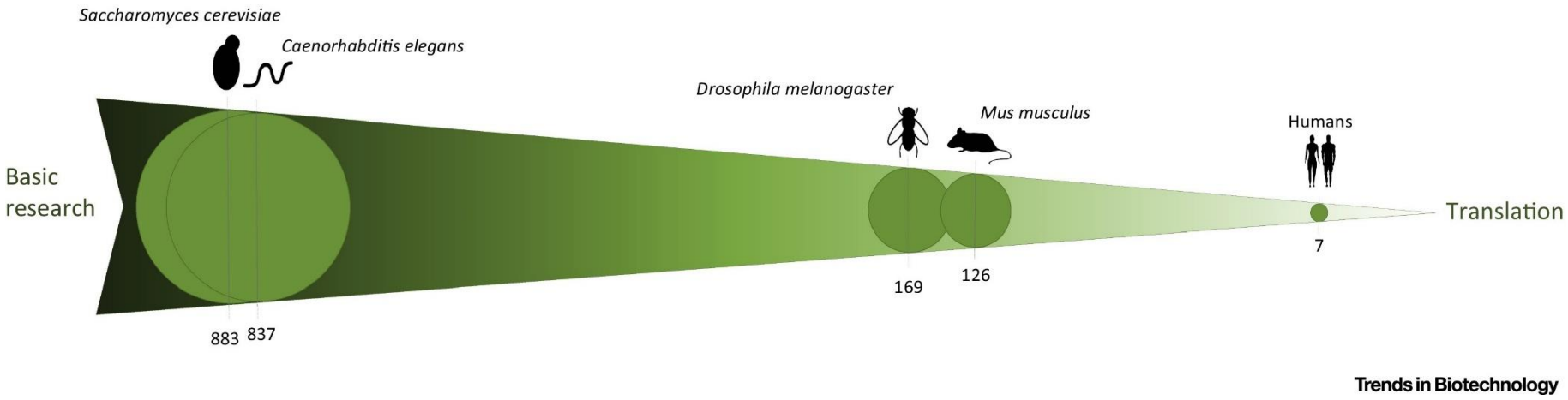


Figure 2. Genetics of Aging from Model Organisms to Humans. The numbers below each organism represent the number of aging- and/or longevityassociated genes for each organism in build 18 of the GenAge database [2]; for humans, only genes directly associated with human aging and/or longevity according to GenAge are included. The area of each circle is proportional to the number of genes.

[JP de Magalhães et al. Trends in Biotechnology 2017; 35(11): 1062-73]

Three schools of thought

- Aging is a good and natural thing to be embraced as a necessary and positive aspect of life: pursues improving quality of existing lifespan and 'compression of morbidity':
  The Life Course approach

- Immortality is possible by correcting biological defects: rejuvenation is possible since scientific basis is there (Aubrey de Grey): The SENS Foundation-Strategies for engineerning neglible senescence

- Life span extension by anti-aging medicines

Challenges

- Ageing is a complex process
- Many theories but no consensus
- Aging can be manipulated in short-lived model systems by genetic, dietary and pharmacological interventions
- Humans are not huge worms or big mice
- Anti-ageing versus rejuvenation

Anti-ageing drugs

- Manipulators of SIRT1 systems: Resveratrol and Rapamycin
- Telomere length manipulators-genetic manipulation of telomerase
- Senolytics-destroys senescent cells
- Drugs targeting longevity genes
- Mitochondrial function-NAD+
- Oxidative stress: alpha lipoic acid; acetyl-l-carnitine

Young blood

- Mice parabiosis experiments:
  blood from young animals reverses some aging processes in old mice
  -reversal of left ventricular hypertrophy
  -improved hepatogenesis; muscle injury repair
  -improved age-related decline in hippocampus-dependent learning and memory

Embryonic, adult, Stem cells

- Embryonic: first used to treat Parkinson's disease: use foetal dopamine producing cells to 'replace' dopamine depletion in basal ganglia
- Regenerative medicine to treat injuries; age-related changes (tissue-specific)

Stem Cell transplantation for frailty

[Le Couteur et al J Gerontol A Biol Sci Med Sci 2017;72(11): 1503-4]

- Reduced circulating mesenchymal stem cells (MSC) associated with frailty
- Many clinical features of frailty involve mesenchymal tissues (musculoskeletal system)
- Represents end-stage consequence of biological ageing and chronic disease accumulation.

Phase 1 trial

- MSC from bone marrow of younger donors (20-45) infused into 15 frail patients (average age 78 years)
- 6 m improvement in 6 min walk test; TNF alpha, FEV1, MMSE, quality of life

[Golpanian S et al J Gerontol A Biol Sci Med Sci 2017;72:1505-1512]

Phase 2 RCT

- Allogeneic MSC versus placebo
- 30 frail patients with average age of 76.
- No adverse effects
- Improvements in physical performance, FEV1, TNF alpha

[Hare JM et al J Gerontol A Biol Sci Med Sci 2017; 72:1513-21]

Ethical concerns

- Anti-ageing medicine field extends from ‘shameless charlatanism combined with potentially dangerous (or ineffective) hormones and drugs to good preventive care practices mixed with expensive dietary supplements.
- Aggressive marketing and misleading claims for profit
- Pay-to-participate clinical trials (young blood)

Seven governance principles for human genome editing

- Promote well-being
- Transparency
- Due care
- Responsible science
- Respect for persons
- Fairness
- Transnational cooperation