

Cross-border cooperation to foster the resilience of clinical management in cancer patients by establishing best practices in personalized molecular-based diagnostics, treatment, and long-term care

RORS00040

Subtitle: **Plant-Derived Bioactive Compounds: From traditional use to Biotechnological Innovations in Anticancer Therapy**

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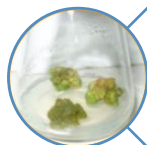
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A.1 Introduction

- Cancer remains a leading cause of global morbidity and mortality
- Plants provide structurally diverse bioactive molecules that can be used as anticancer drugs



A.2 Introduction

Statistics at a glance, 2022

	Males	Females	Both sexes
Population	3 972 735 747	3 912 335 034	7 885 070 781
Incidence*			
Number of new cancer cases	10 311 610	9 664 889	19 976 499
Age-standardized incidence rate	212.6	186.3	196.9
Risk of developing cancer before the age of 75 years (cum. risk %)	21.8	18.5	20.0
Top 3 leading cancers (ranked by cases)**	Lung Prostate Colorectum	Breast Lung Colorectum	Lung Breast Colorectum
Mortality*			
Number of cancer deaths	5 430 284	4 313 548	9 743 832
Age-standardized mortality rate	109.8	76.9	91.7
Risk of dying from cancer before the age of 75 years (cum. risk %)	11.4	8.0	9.6
Top 3 leading cancers (ranked by deaths)**	Lung Liver Colorectum	Breast Lung Colorectum	Lung Colorectum Liver
Prevalence*			
5-year prevalent cases	25 747 272	27 756 915	53 504 187

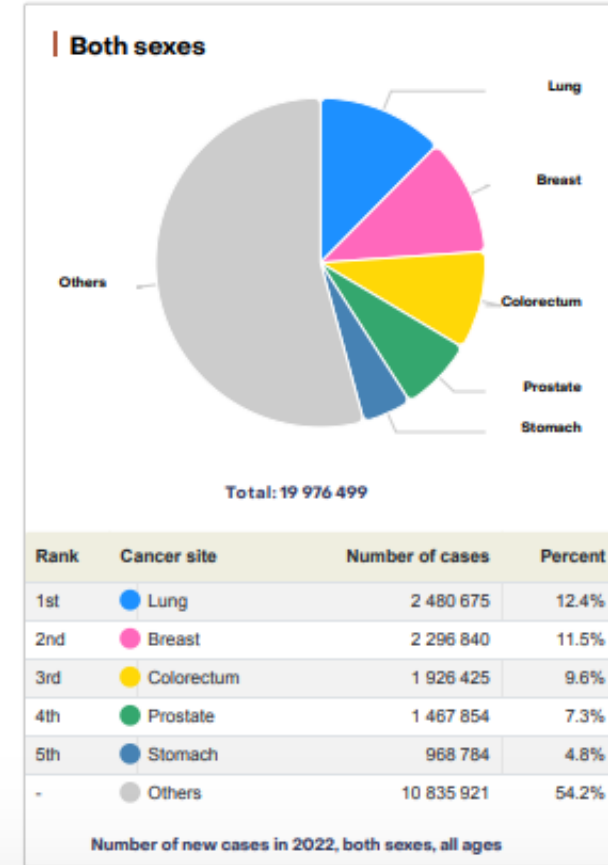
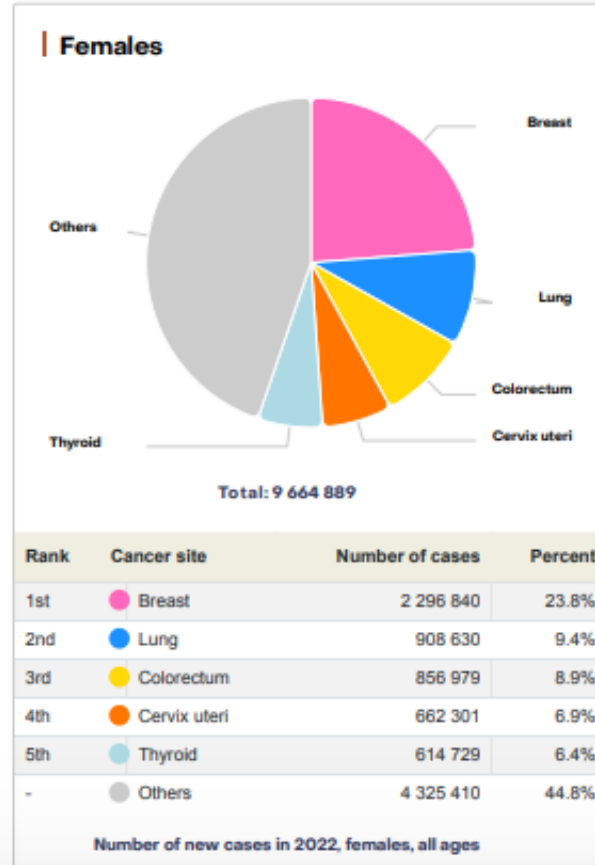
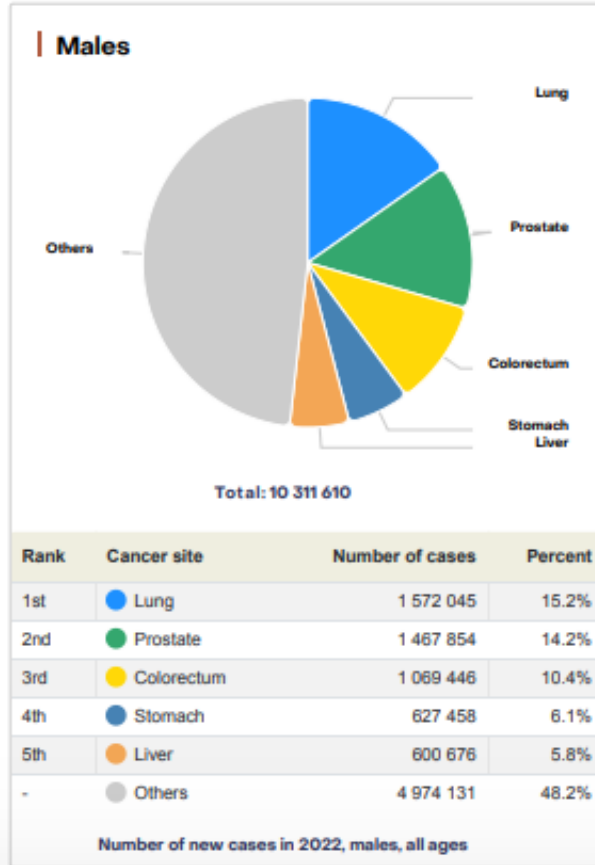
Population(s) included: Northern Africa, Middle Africa, Western Africa, Southern Africa, Eastern Africa, South Central Asia, Western Asia, South-Eastern Asia, Eastern Asia, Southern Europe, Western Europe, Eastern Europe, Northern Europe, Northern America, South America, Caribbean, Central America, Australia, New Zealand, Melanesia, Polynesia, Micronesia



Kilometers
0 250 500 1000

A.3 Introduction

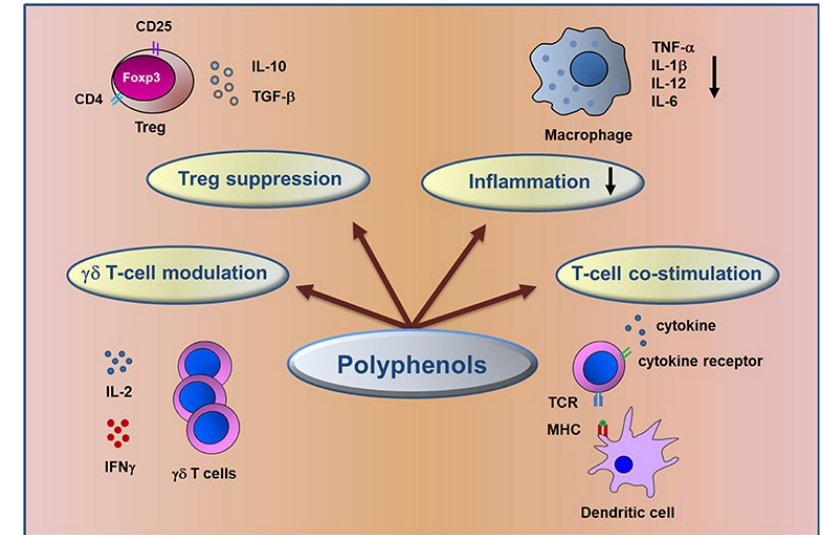
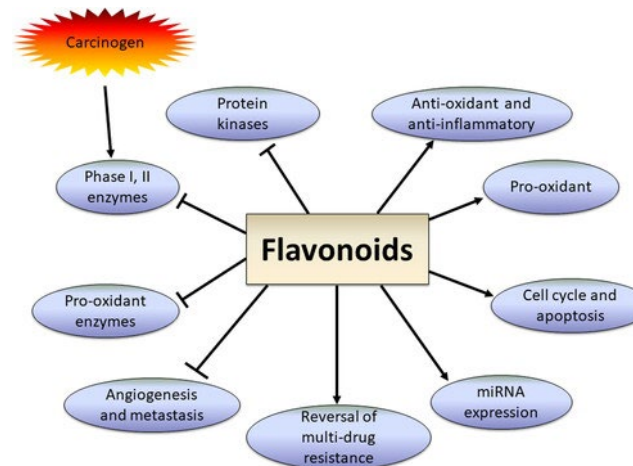
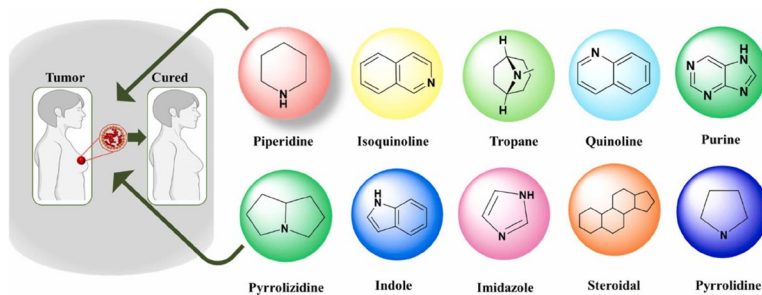
Top 5 most frequent cancers **



B. Classification of Plant-Derived Bioactive Compounds

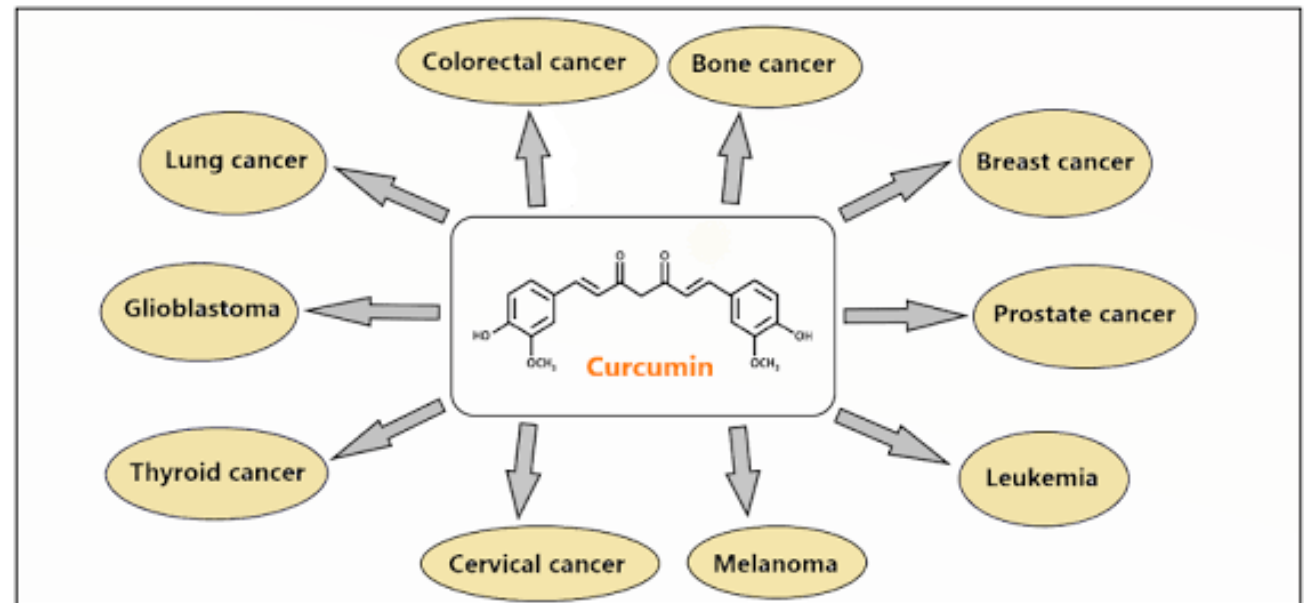
- are natural molecules produced by plants that have a biological effect on human health

- ☐ Alkaloids: vincristine, vinblastine (mitotic inhibitors)
- ☐ Flavonoids: quercetin, catechins (antioxidant, signaling modulators)
- ☐ Terpenoids: paclitaxel, artemisinin (microtubule and ROS-mediated effects)
- ☐ Phenolics: curcumin, resveratrol (epigenetic and inflammatory modulation)



C. Case Study – Curcumin

- Source: *Curcuma longa*
- Multi-targeted anticancer effects: inflammation, apoptosis, epigenetics
- Extensive preclinical evidence; limited clinical translation
- Major limitation: poor solubility and bioavailability



D. Biotechnology - *In vitro* culture

- **Controlled growth environments:** precise control of growth conditions (pH, temperature, light, nutrients)
- **Eliminating variability:** reduced variability that can occur due to fluctuating environmental conditions in nature.
- **Conserving biodiversity:** reduces the need to harvest plants from their natural habitats, thus protecting rare or endangered species.
- **Minimizing ecological impact:** producing metabolites under controlled conditions reduces the impact on natural ecosystems



Commonly used culture media

Murashige and Skoog (MS)

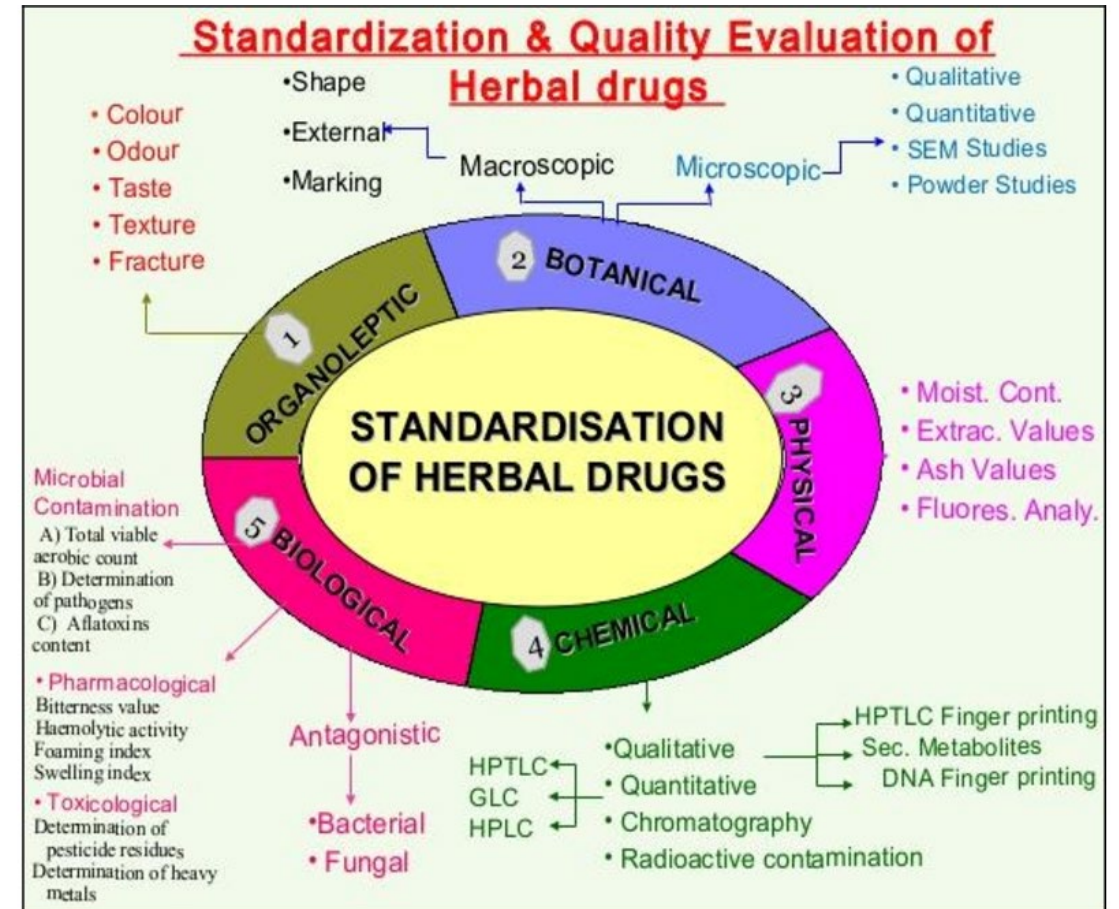
Gamborg B5

Woody Plant Medium (WPM)



E. Challenges and Emerging Research Directions

- Pharmacokinetics and toxicity optimization
- Standardization of plant-derived compounds
- Regulatory approval complexity
- Future focus: combination therapy, precision oncology, AI-guided discovery



FLOW CHART ON STANDARDIZATION AND EVALUATION OF HERBAL DRUGS

E. Conclusion and Future Outlook

- Plant-derived bioactives remain indispensable in anticancer therapy
- Integration of ethnomedicine, molecular biology, and biotechnology is critical
- Future success depends on interdisciplinary and translational research



Thank you!

Vă mulțumesc!



Hvala!

