

“Nutrient–fungi–host” tripartite interaction in cancer progression

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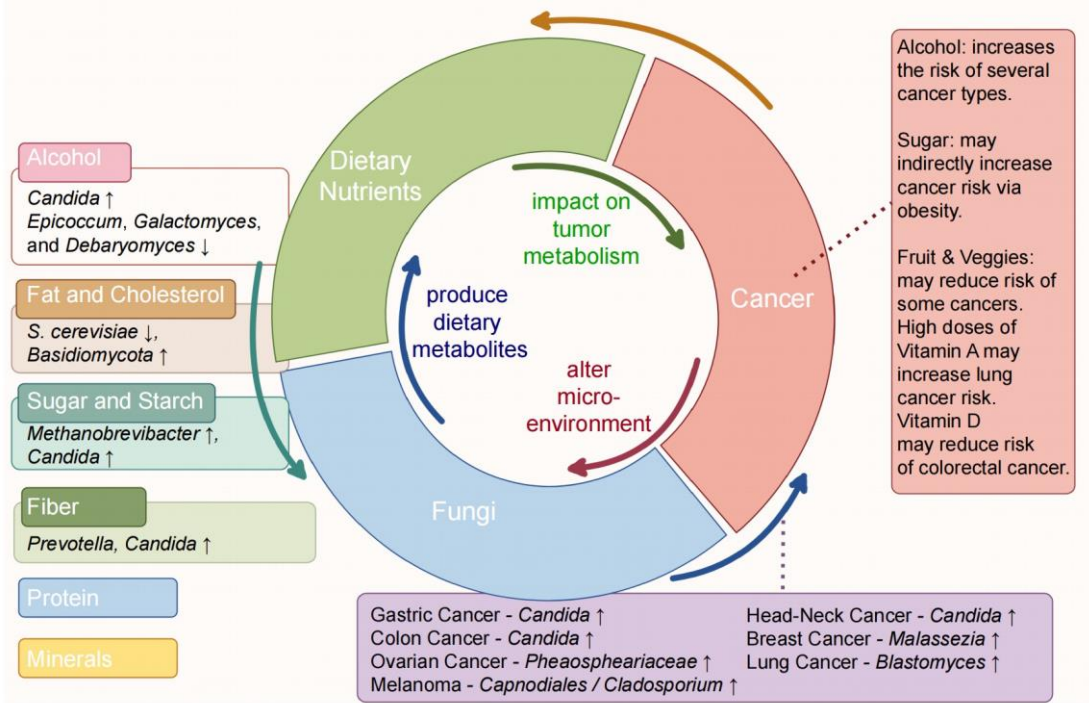
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Introduction

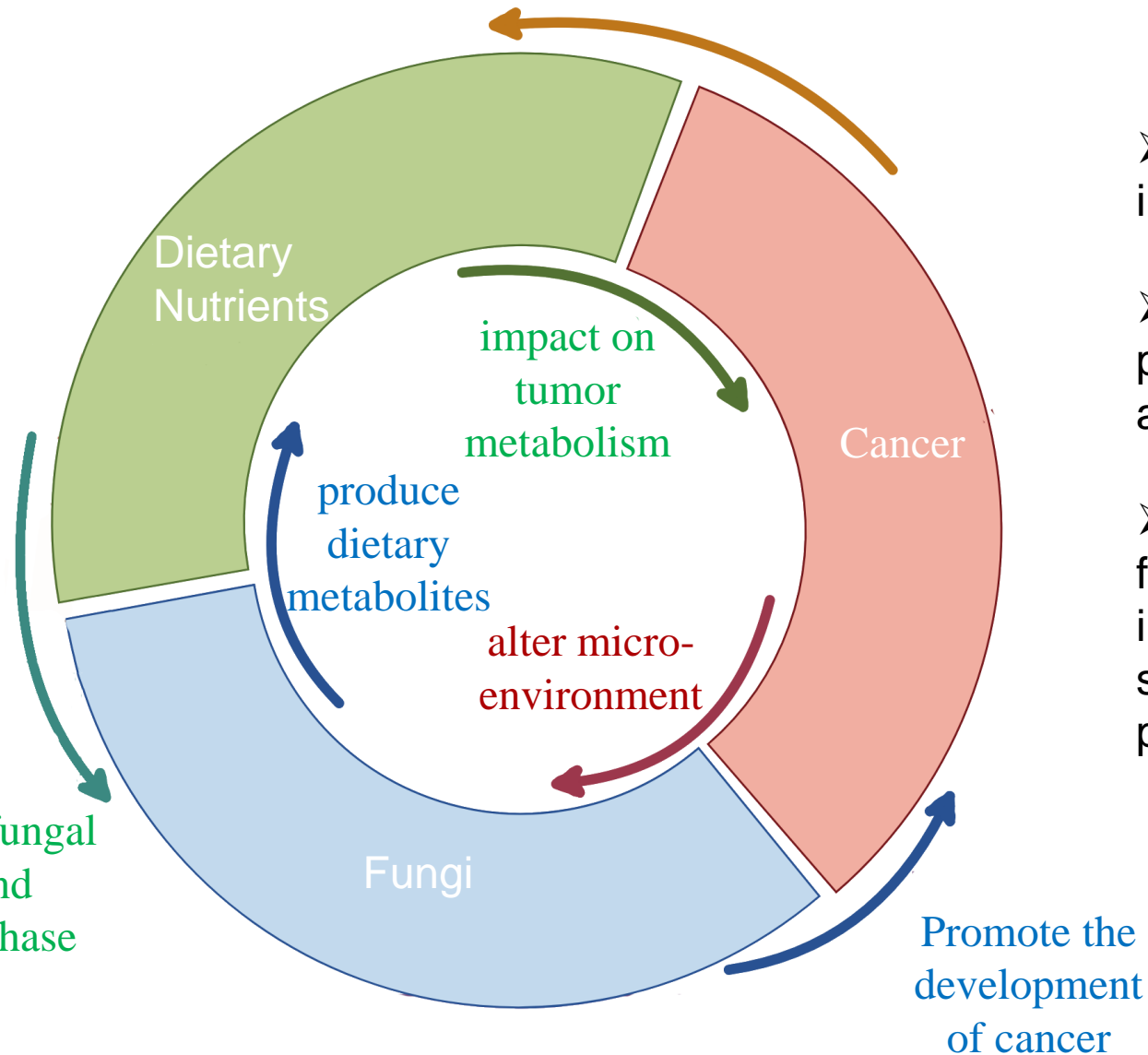


Establishing a causal relationship between nutrients and tumors is challenging, and our understanding of the pathogenic mechanisms by which fungi are regulated by nutrients is still limited. Furthermore, there is a growing interest in exploring the role of mycobiota and precision nutrition in cancer prevention and treatment.

In this review, we aim to provide an overview of the connection between mycobiota and specific tumor types, as well as the differential nutrient sensing exhibited by fungi in response to the external environment. We also highlight the application of fungi-targeted strategies in precision nutrition and cancer prevention.



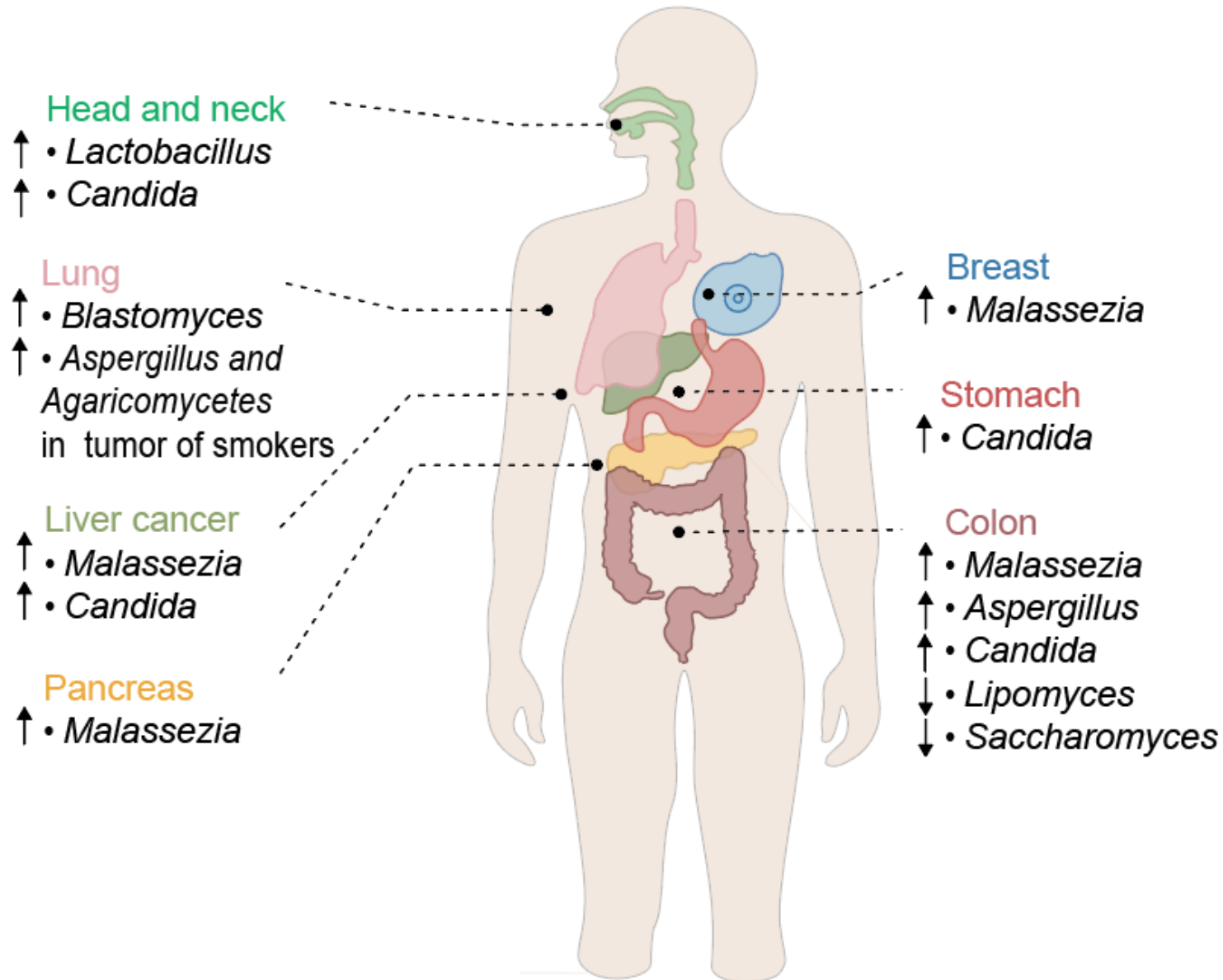
Highlights



- Symbiotic and pathogenic fungi are crucial in modulating various processes of cancer.
- The dietary nutrients play essential physiological roles in growth, reproduction, and invasive pathogenesis of fungi.
- The interactions between nutrients and fungi in cancer development provide valuable insights into the application of fungi-targeted strategies in precision nutrition for cancer prevention and treatment.



Fungi and cancer



Fungi and cancer

Digestive cancer

01

Colorectal cancer

02

Pancreatic cancer

03

Gastric cancer

04

Liver cancer

05

Oral cancer

Non-digestive cancer

01

Lung cancer

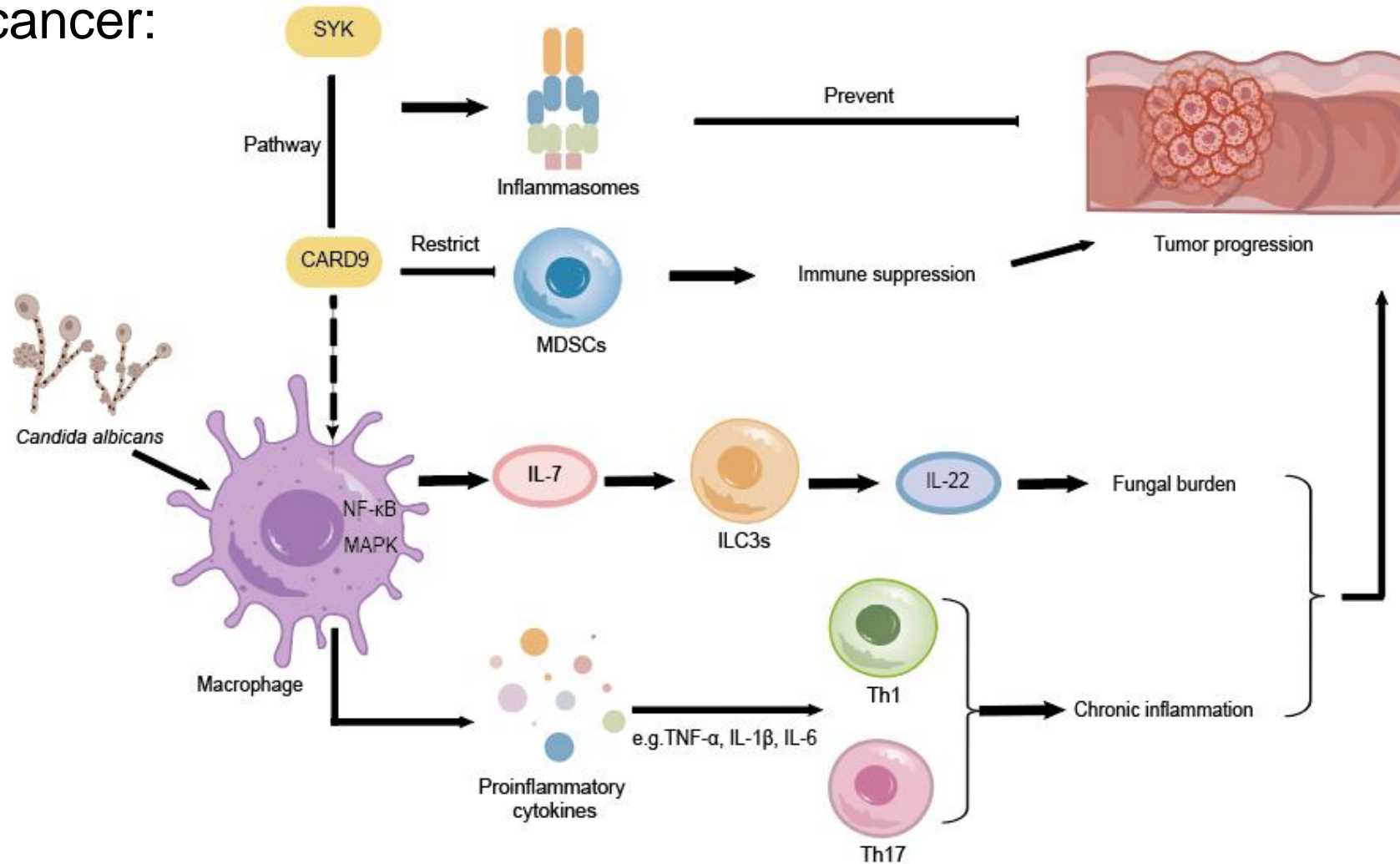
02

Breast cancer



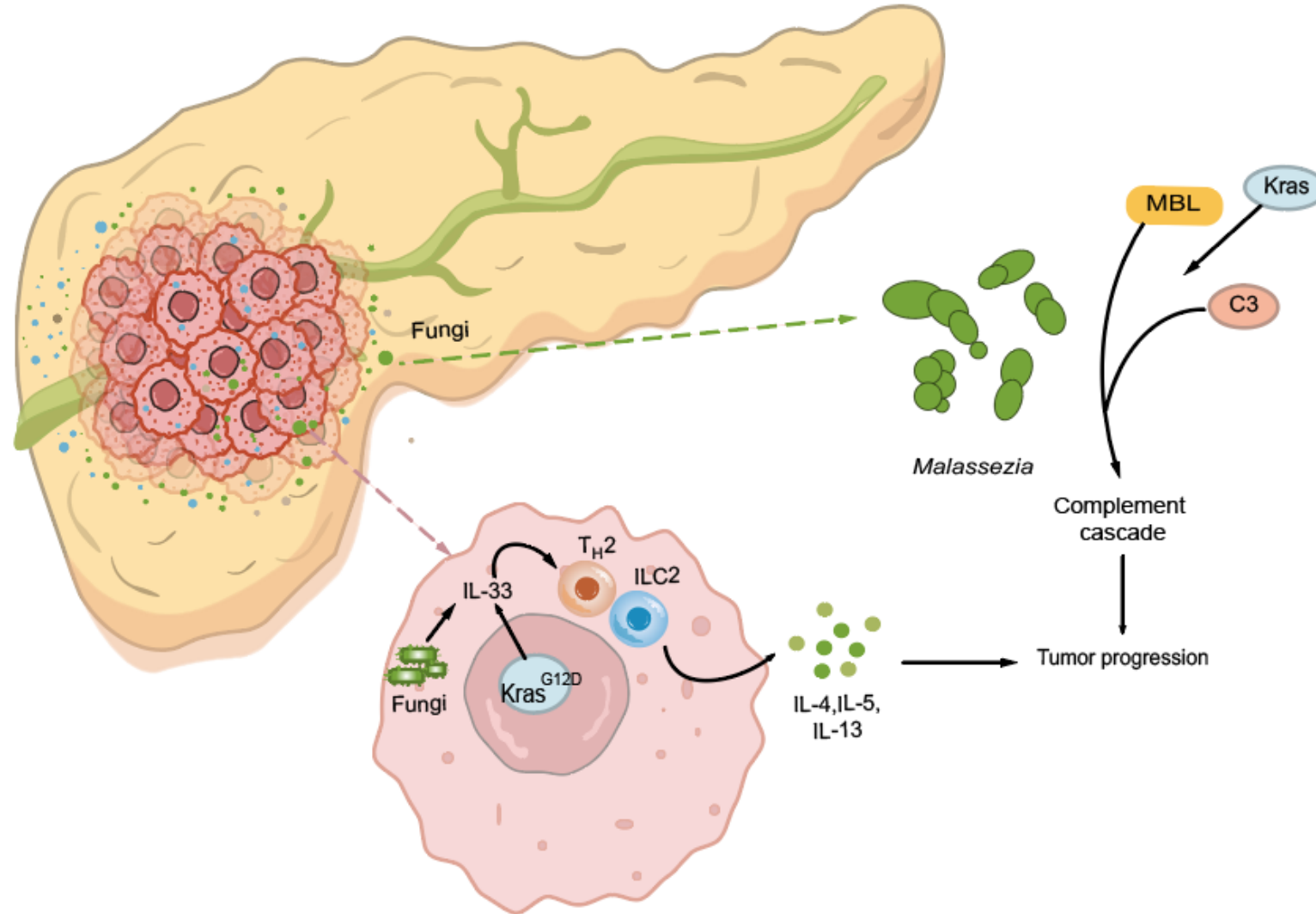
Fungi and digestive cancer

Colorectal cancer:



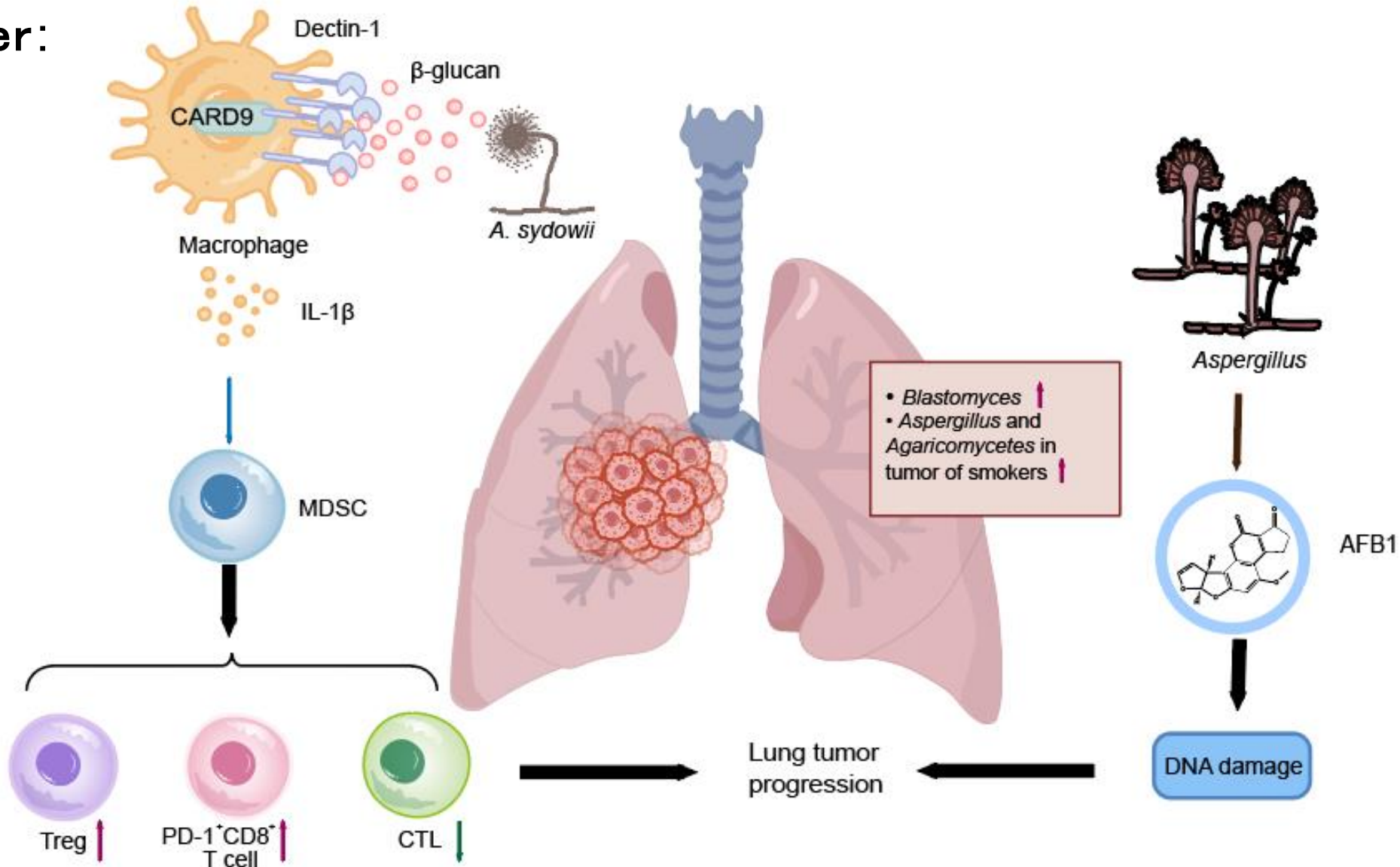
Fungi and digestive cancer

Pancreatic cancer:

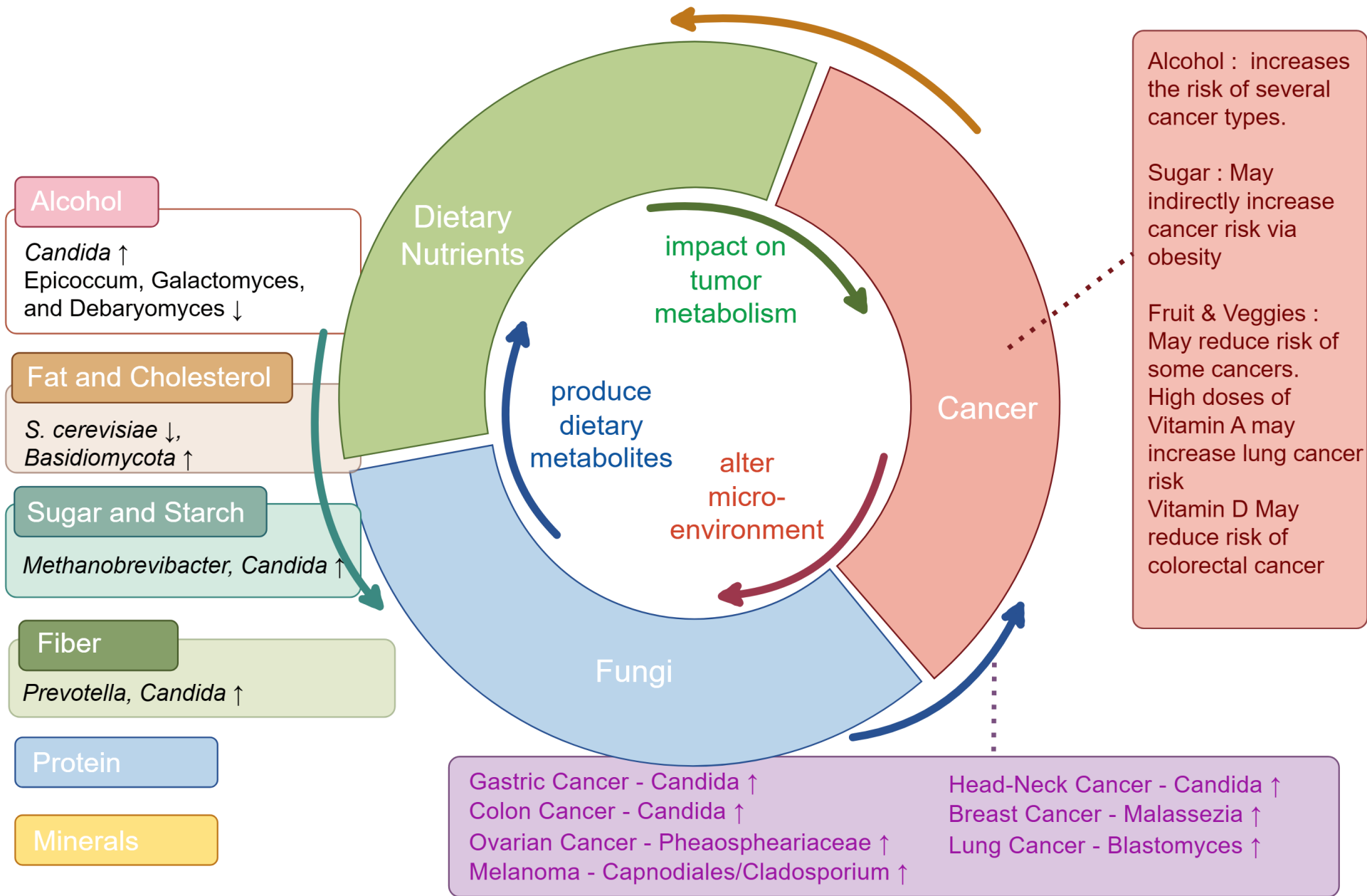


Fungi and non-digestive cancer

Lung Cancer:



Nutritional regulational of mycobiome and cancer progression



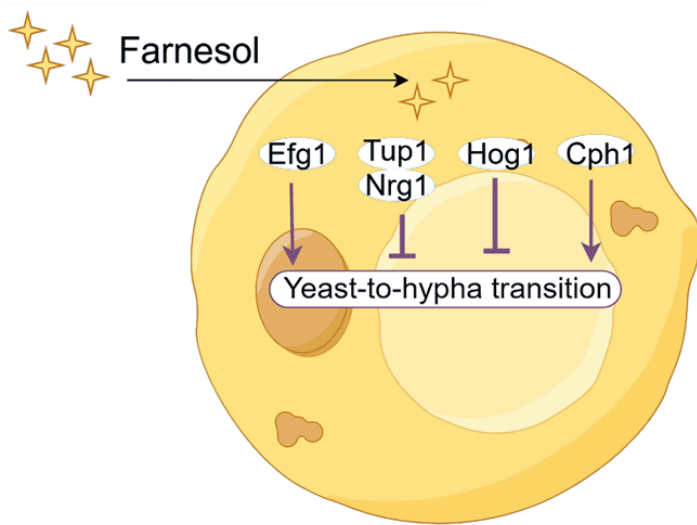
Nutritional regulational of mycobiome and cancer progression

Diet	Fungal abundance alteration	Fungal phenotype conversion	Cancer risk
Alcohol intake	<i>Candida</i> ↑ <i>Epicoccum</i> , <i>Galactomyces</i> , and <i>Debaryomyces</i> ↓	The pathogenicity of <i>Candida</i> for ALD ↑	Liver cancer risk ↑ Pan-cancer risk ↑
Fat and cholesterol	<i>Saccharomyces cerevisiae</i> ↓ <i>Basidiomycota</i> ↑	17-β-estradiol can lead to Candidiasis	Liver cancer risk ↑
Sugar and starch	<i>Methanobrevibacter</i> , <i>Candida</i> ↑	Different glycogen led to different phases of transformation	Cancer risk ↑
Fiber	<i>Prevotella</i> , <i>Candida</i> ↑	–	Cancer risk ↓
Protein	<i>Methanobrevibacter</i> , <i>Candida</i> ↓	Nitrogen source can affect fungal phase, biofilm formation, and antifungal drug tolerance	Cancer mortality ↑
Minerals	–	“Nutrition tug of war”	–

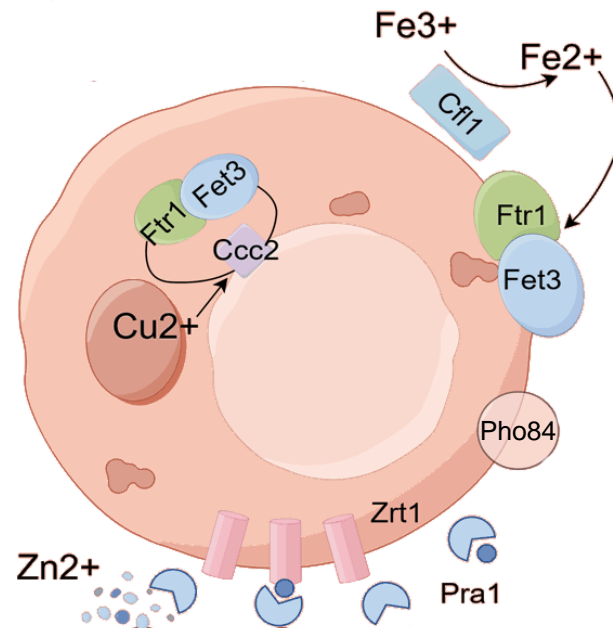


Fungus targeted precision nutritional therapies against cancer

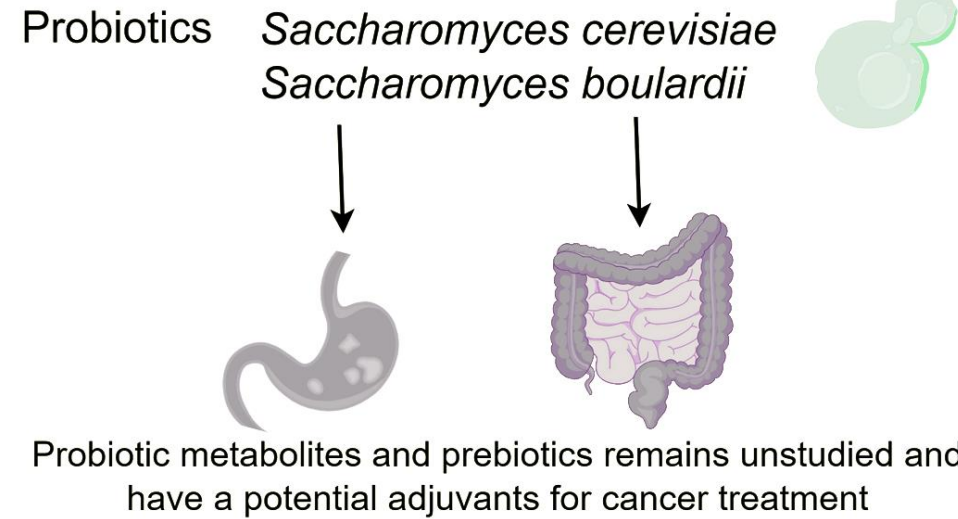
Quorum sensing



Nutritional sensing



Probiotics



Conclusion

- ❑ It is crucial to determine whether the association between fungi and cancer-related processes is causal or consequential.
- ❑ The role of nutrient-mediated mechanisms in the impact of mycobiome on carcinogenesis, metastasis, treatment efficacy, and drug resistance remains largely unexplored.
- ❑ More extensive and rigorous validation tests encompassing mycobiome composition and fungal-bacterial interactions are warranted, necessitating larger-scale sample sizes and multi-center cohort studies.



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