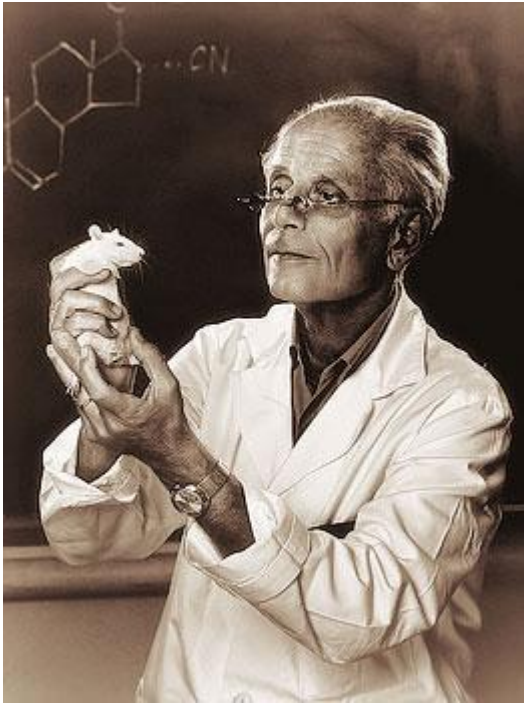


Стресс и стресс-реакции клетки



**Ганс Селье
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STRESS AND THE GENERAL ADAPTATION SYNDROME*

BY

HANS SELYE, M.D., Ph.D., D.Sc., F.R.S.C.

Professor and Director of the Institute of Experimental Medicine and Surgery, Université de Montréal, Montreal, Canada

With the concept of the general adaptation syndrome we have attempted to integrate a number of seemingly quite unrelated observations into a single unified biologic system. I would draw attention briefly to the work of Claude Bernard, who showed how important it is to maintain the constancy of the "milieu intérieur"; Cannon's concept of "homeostasis"; Frank Hartmann's "general tissue hormone" theory of the corticoids; Dustin's observations on the caryoclastic process; the "post-operative" hypersecretory action of foreign proteins; the "nephrotoxic sera" of Masugi; and to the "Goldblatt clamp" for the renal ischaemia. It is clear that all these observations have little in common and that there is no reason to attempt their integration into a unified system of physiological and endocrinological observations. My own work has had to do with the relationship between these and many additional facts, since they were thought to be interconnected in nature. Through the comparison of their similarities we learned how to use the concept of the general adaptation syndrome in life and the treatment

factorily elucidated. In fact, we shall never truly "understand" this phenomenon, since the complete comprehension of life is beyond the limits of the human mind. But there are many degrees of "elucidation." It seems that the fog has now been just sufficiently dispersed to perceive the general adaptation syndrome through that measure of "twilight" which permits us to discern the grandeur of its outlines but fills us with the insatiable desire to see more. We realize that medicine, like all sciences, will have to be hesitant, some even incorrect, if we try to put on paper now what we still see only vaguely. But a preliminary attempt is made here to describe the general adaptation syndrome so much promise (to all who suffer from stress. I hope that these pioneers in uncharted territories will accept my paper as a distorted picture of the territory which it is offered to them. It is in this sense that I should like the reader to consider the following synopsis of what I think I see.

Principal Features of the General Adaptation Syndrome Concept as based

Apart from the many specific defence reactions (e.g., formation of specific antibodies, resistance to cold, habituation to noise, hypertrophy of muscle, etc.), there is a generalized syndrome of widely interrelated adaptive reactions to non-specific stress itself; this has been termed the "General Adaptation Syndrome" (G.A.S.). The stages of the G.A.S. are: the "stage of resistance," the "stage of exhaustion," and the "stage of recovery." Most of the characteristic manifestations of the A.R. (tissue catabolism, hypoglycaemia, gastro-intestinal erosions, distal oedema and function impairment, etc.) disappear when the secretory granules from the adrenal cortex (cortisol, corticosterone, etc.) disappear (atrophy, etc.) during the stage of resistance, but reappear in the stage of exhaustion. This suggests that the ability of living organisms to adapt themselves to changes in their surroundings is a finite capacity or "adaptive reserve" which is limited in its magnitude and appears to depend largely on genetic factors.

In the general adaptation syndrome the manifestations of the stress which elicits the general adaptation syndrome are intricately intermixed. This is an inherent characteristic of the stress which elicits the general adaptation

1936 г. Стресс (от напряжения) ответ организма на действие поражающего фактора. Так как стресс-реакции в основном имеют значение, Селье обозначил их как «общий адаптационный синдром».

Réaction générale d'adaptation. Ses indications pratiques

par GEORGES MASSON¹ et HANS SELYE²

DANS des publications antérieures, l'un de nous a montré que l'exposition d'un organisme à n'importe quel agent d'adaptation entraîne la formation d'un ensemble de phénomènes toujours identiques, qui constitue le syndrome d'adaptation générale¹.

Ce syndrome se divise en trois phases nettement distinctes, chacune d'elles comportant des modifications somatiques, des changements dans la valeur de certains composés du sang (chlorures et glucose, etc.) et des va-

Фазы стресс-ответа

I Фаза тревоги

Проявляются симптомы повреждения и защитная реакция биологической системы (устранение повреждений).

2 Фаза резистентности

Биологическая система адаптируется к новым условиям, происходит относительная стабилизация функциональной активности.

III Фаза истощения

Наблюдается при отсутствии адаптации к новым условиям, либо при длительном воздействии стрессора. Нарушается гомеостаз, метаболизм отклоняется в сторону катаболизма.

Клеточный стресс-сигналинг

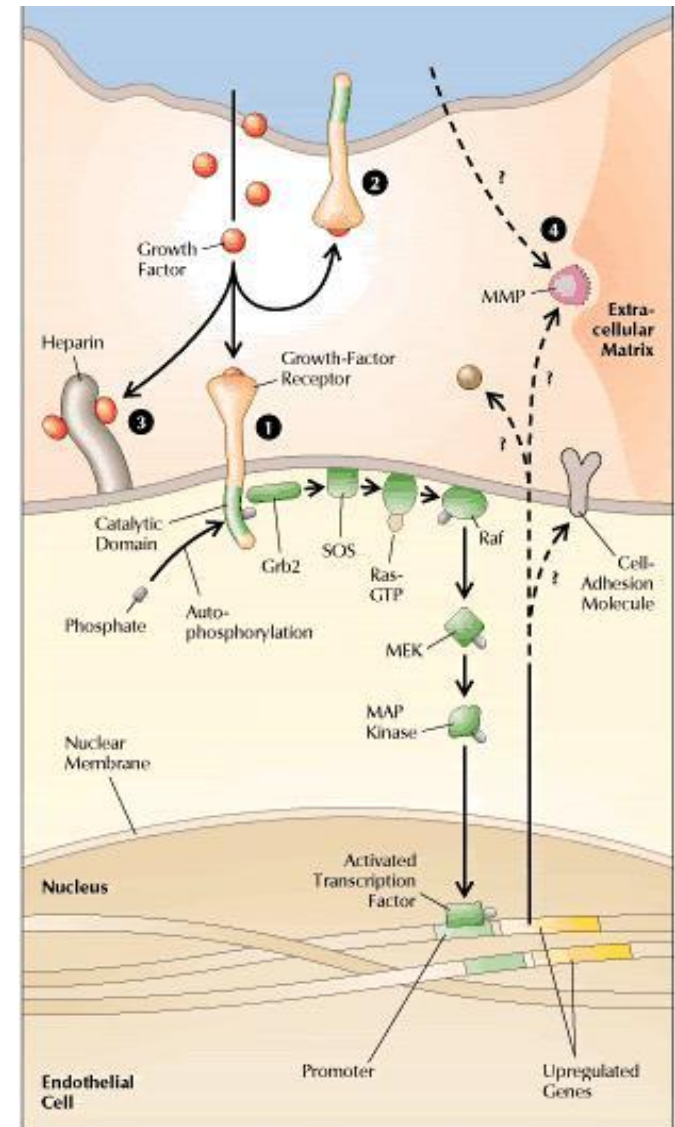
Стресс-фактор

Сенсор

Трансдуктор

Транскрипционный фактор

Эффектор



Функции механизмов стресс-ответа клетки

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Предотвращение

② Репарация

③ Удаление

④ Замещение

- Детоксикация свободных радикалов и ксенобиотиков

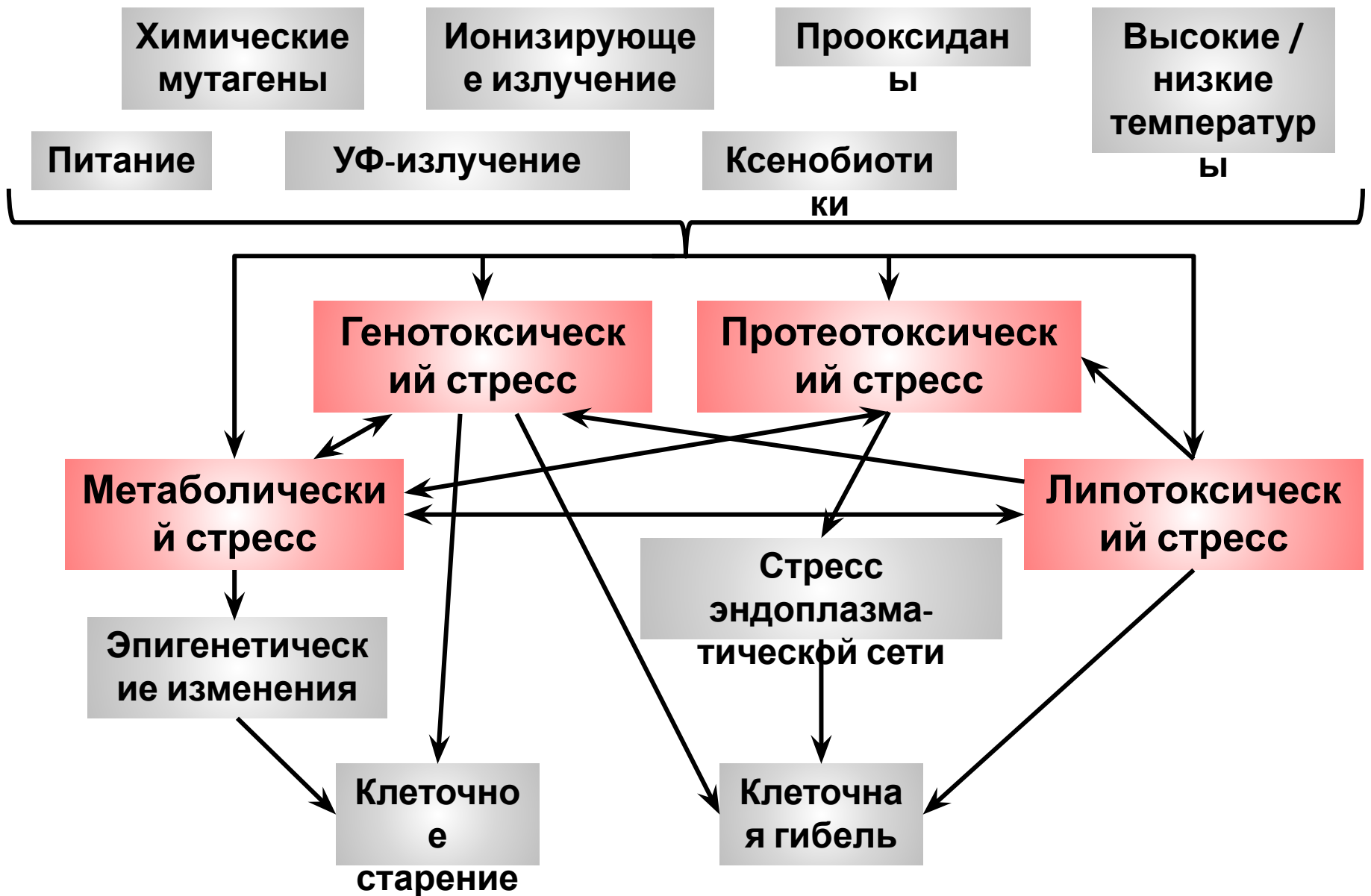
- Репарация ДНК
- Восстановление нативной структуры белков

- Протеолиз
- Автофагия
- Апоптоз

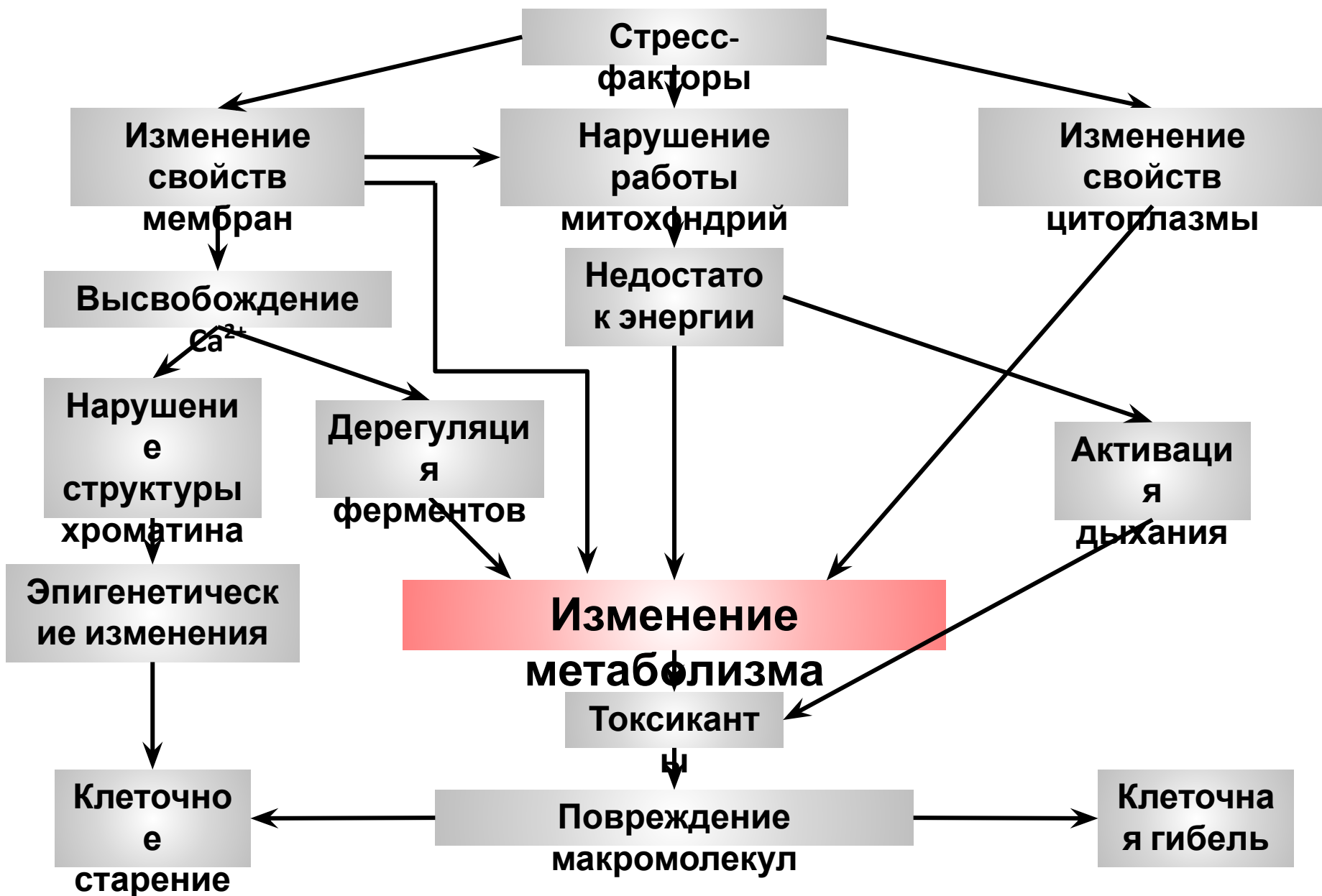
- Синтез макромолекул *de novo*

- Пролиферация клеток
- Дифференцировка стволовых клеток

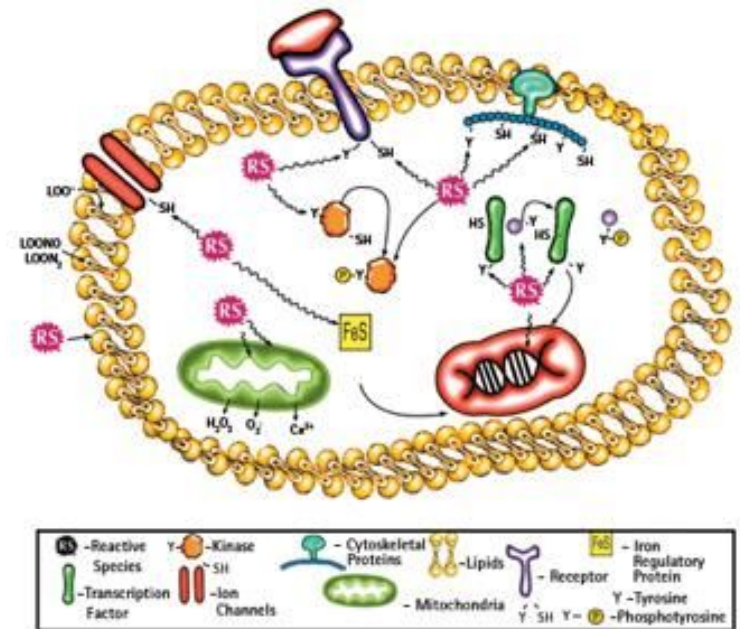
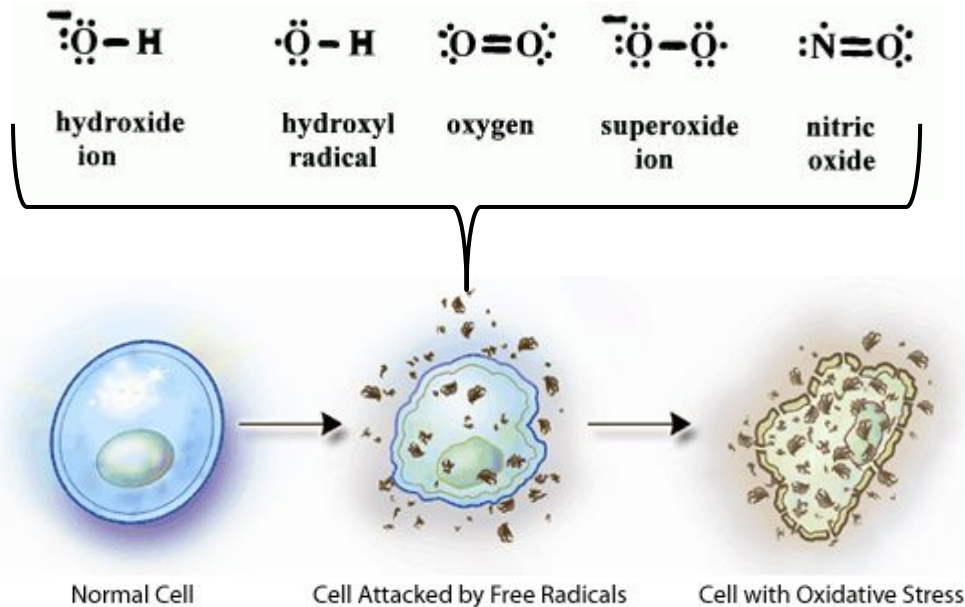
**Изменения в клетке при
стрессе.
Образование и
предотвращение
повреждений макромолекул**



Метаболический стресс

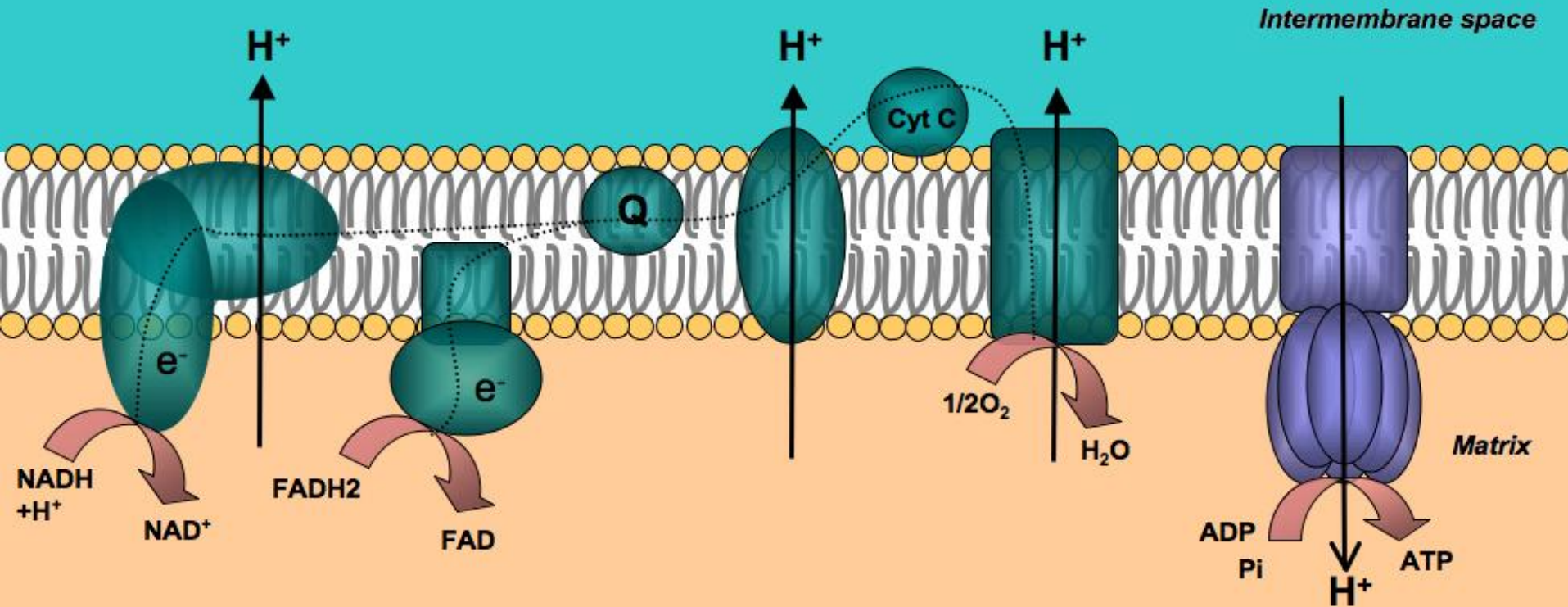


Свободные радикалы



Дыхательная (электронтранспортная)

ЦЕПЬ



Complex I
NADH
dehydrogenase

47 Subunits
7 mtDNA/40 nDNA

Complex II
Succinate
dehydrogenase

4 Subunits
0 mtDNA/4 nDNA

Complex III
Ubiquinol
cytochrome C
oxidoreductase

11 Subunits
1 mtDNA/10 nDNA

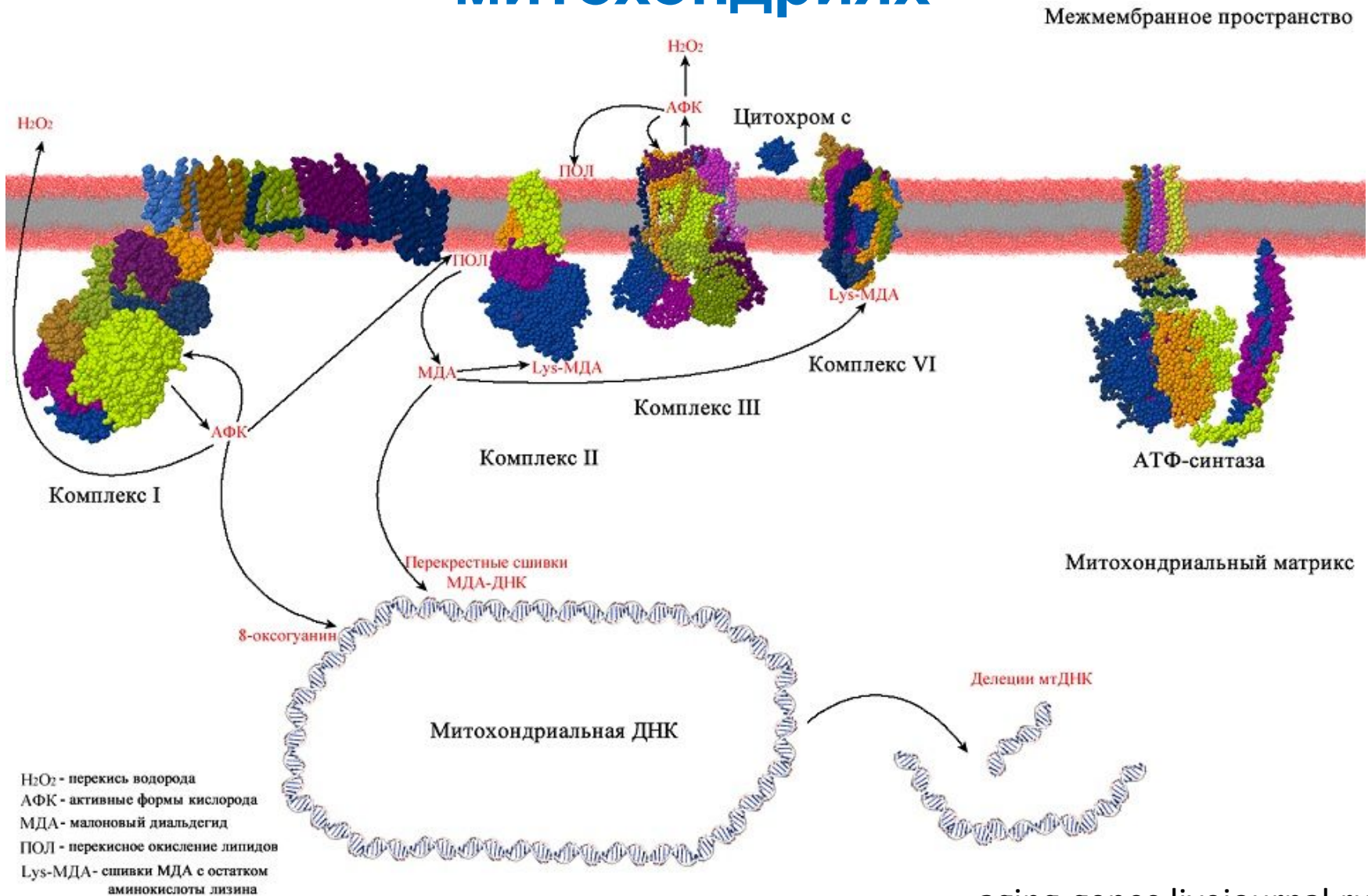
Complex IV
Cytochrome C
oxidase

13 Subunits
3 mtDNA/10 nDNA

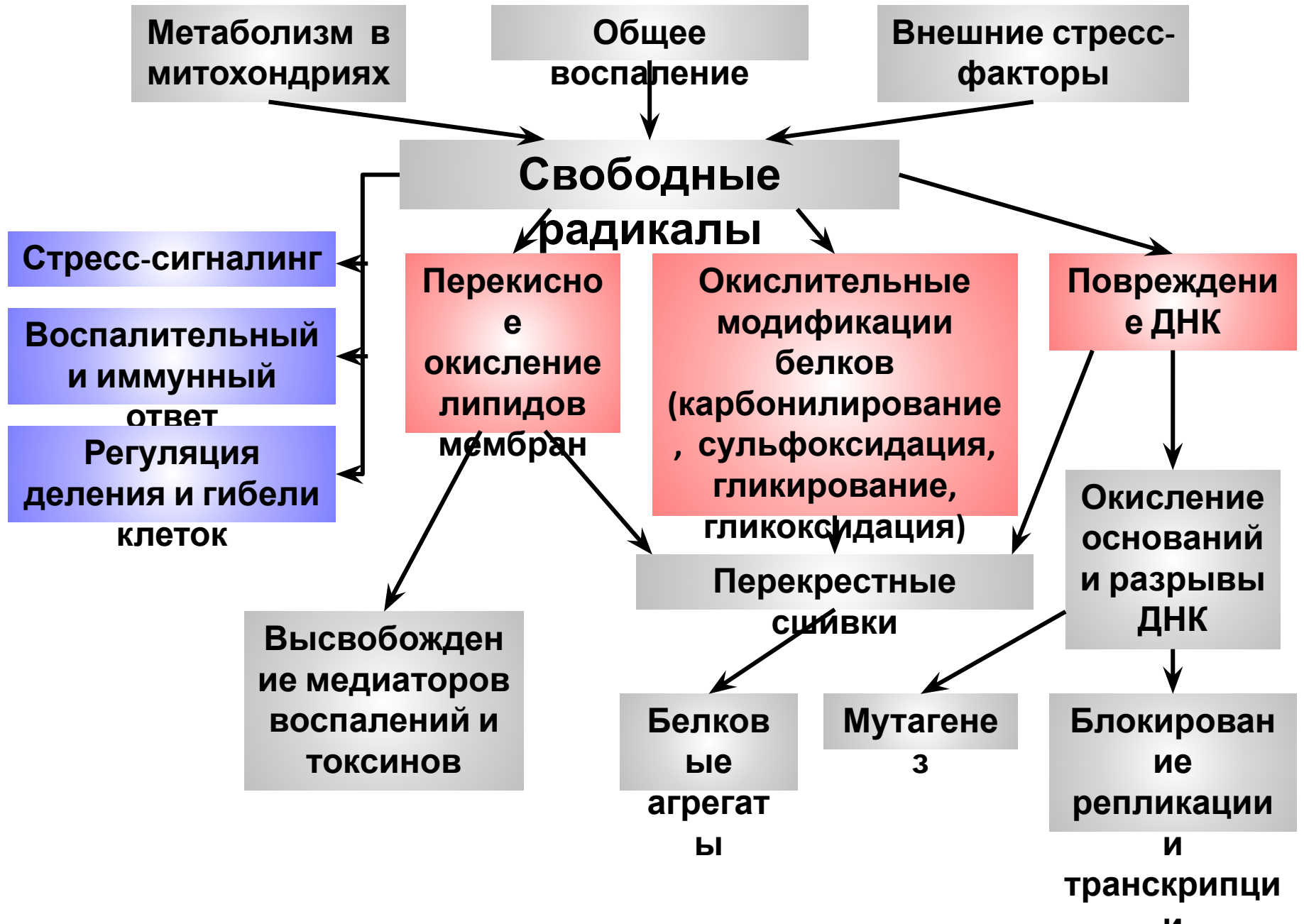
Complex V
ATP synthase

17 Subunits
2mtDNA/15 nDNA

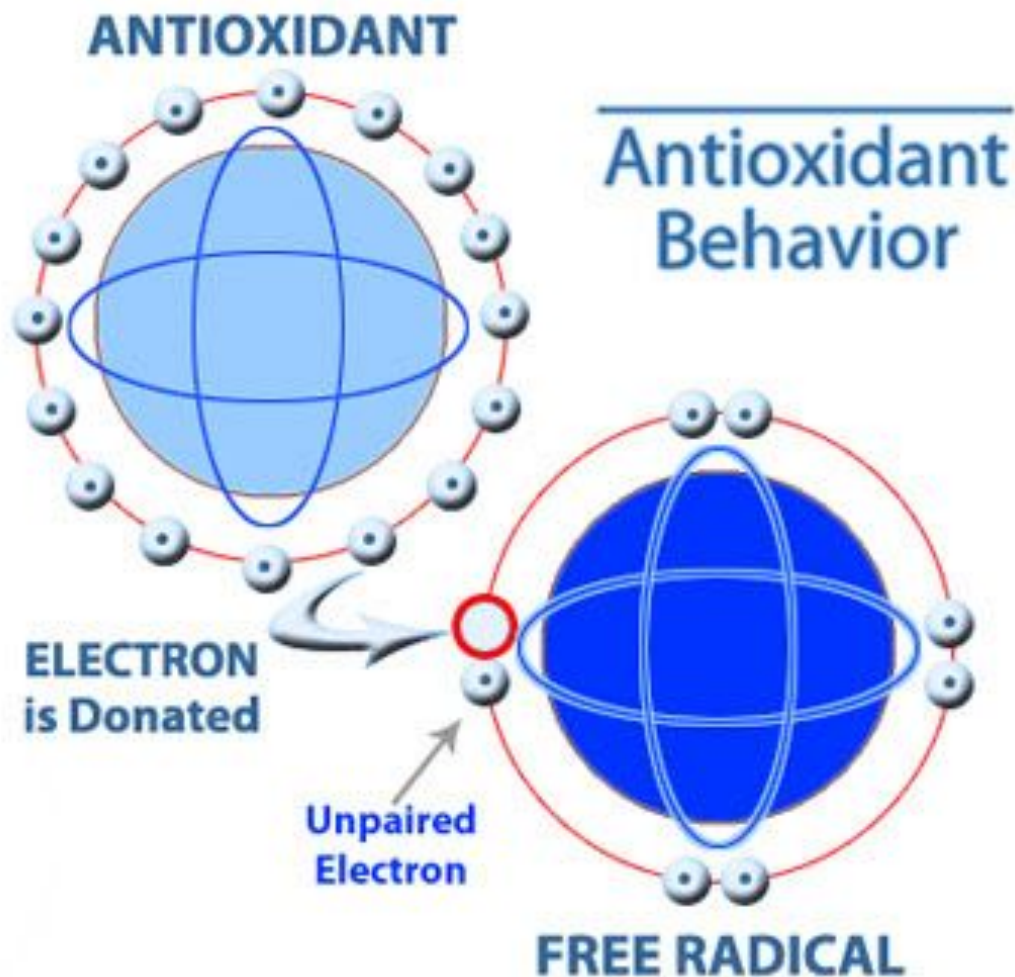
Свободнорадикальные процессы в МИТОХОНДРИЯХ



H₂O₂ - перекись водорода
АФК - активные формы кислорода
МДА - малоновый диальдегид
ПОЛ - перекисное окисление липидов
Lys-МДА - сшивки МДА с остатком аминокислоты лизина



Антиоксиданты



astiro-medtext.blogspot.com

Ферменты:

- Супероксиддисмутаза
- Каталаза
- Глутатион пероксидаза
- Тиоредоксин пероксидаза

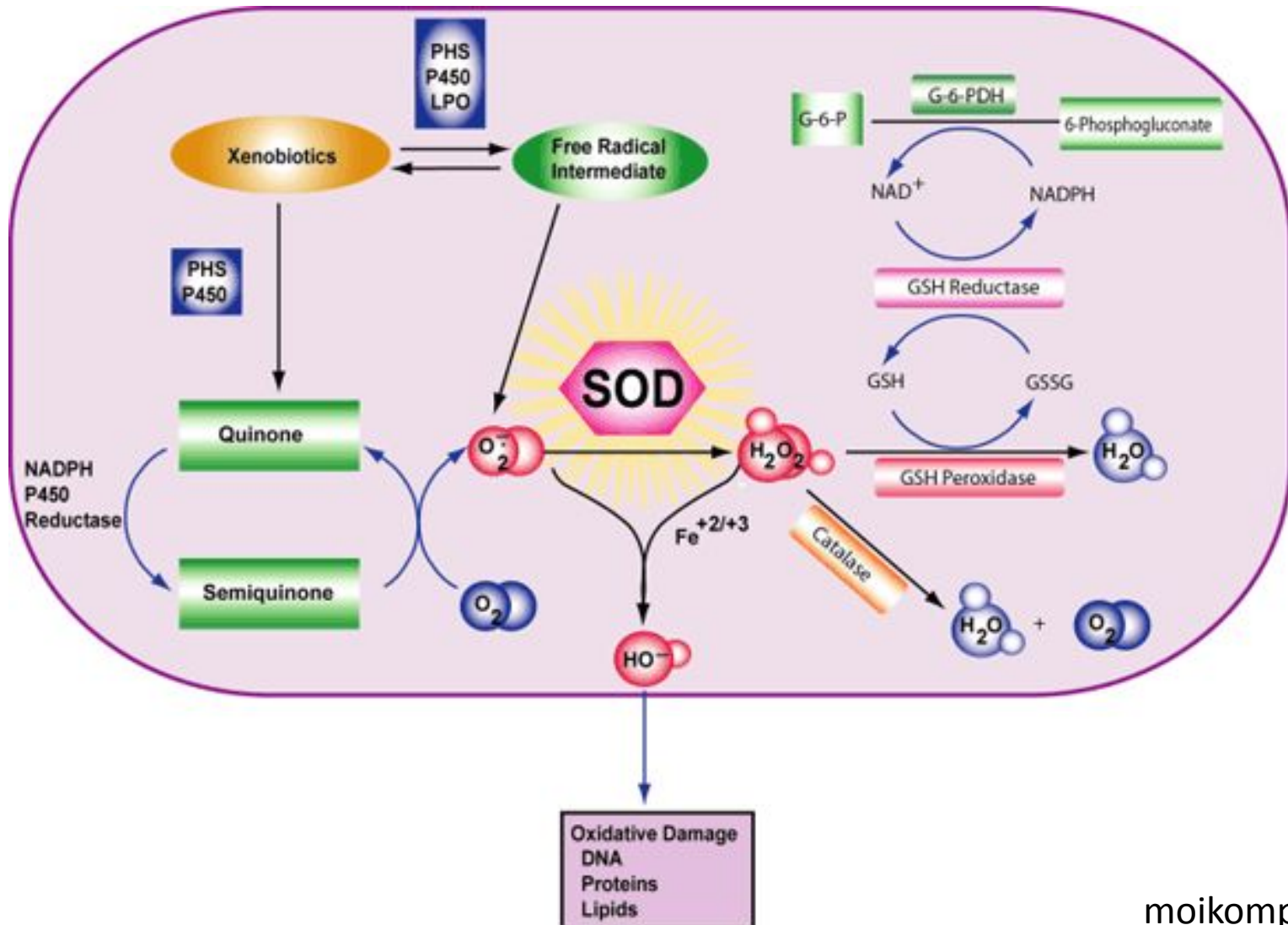
Витамины:

- β -каротин
- α -токоферол
- Аскорбиновая кислота

Другие вещества:

- Мелатонин
- Карнозин
- Карцинин
- Хелатные агенты

Детоксикация свободных радикалов и ксенобиотиков



Дектоксикация токсинов



Стресс-сигналинг

