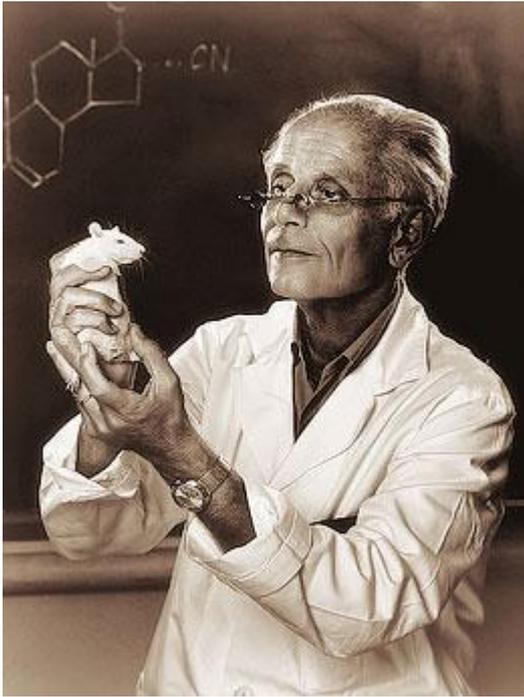


Стресс и стресс-реакции клетки



**Ганс Селье
(1907-1982)**

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STRESS AND THE GENERAL ADAPTATION SYNDROME*

BY

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1936 г. Стресс (от напряжения) ответ организма на поразжающего 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 physique, chimique ou biologique, ou à 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-

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. We 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" and "regenerative action" of foreign proteins, and the "non-specific therapeutic agents"; the "nephrotoxic sera" of Masugi; and to the "Goldblatt clamp" for the renal hypertensive rat. 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. Much work has been done in this field, but the connection between these and many additional facts, since they were thought to be interconnected in nature. Through the comprehension of their significance we are enabled to learn how to use 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 many of our conclusions 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 synthesis is necessary, and we shall therefore make so much promise (to all who suffer from stress. I hope that these pioneers in uncharted territories will accept my promise, distorted as it is, in the twilight which it is offered to them) that we shall be able to do so. It is in this sense that I should like the reader to consider the following synopsis of what I think I see.

Principal findings 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 function of their ability or "adaptability" to resist a limited number of stressors. The magnitude appears to depend largely on genetic factors.

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

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

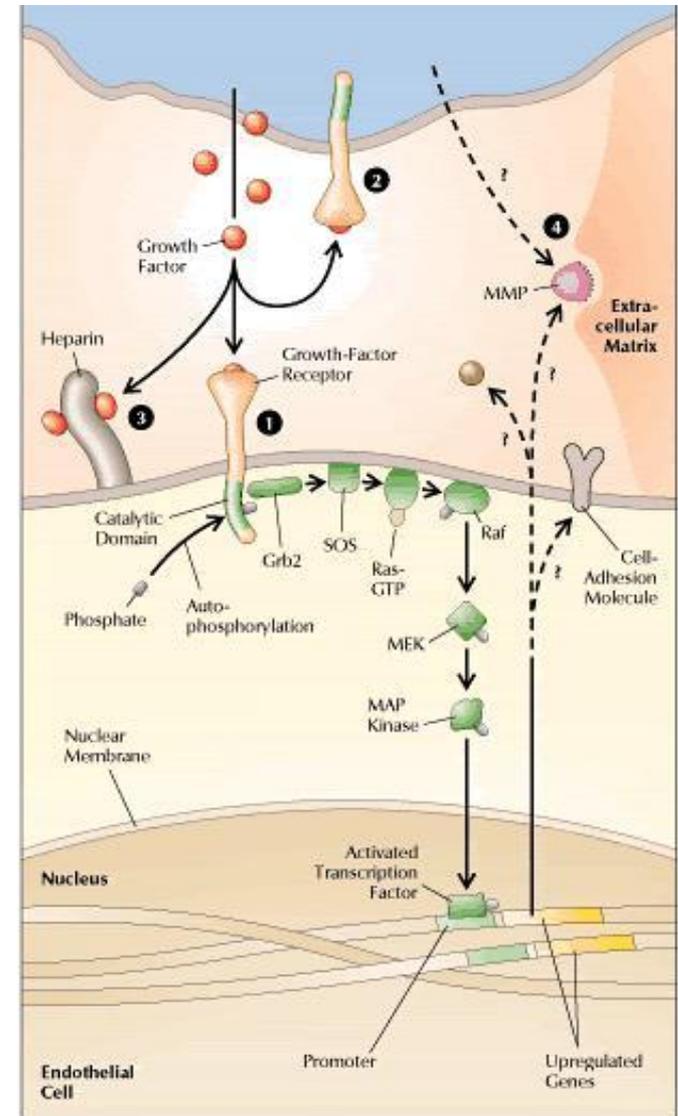
Стресс-фактор

Сенсор

Трансдуктор

Транскрипционный фактор

Эффектор



Функции механизмов стресс-ответа клетки

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1

Предотвращение

②

Репарация

③

Удаление

④

Замещение

- Детоксикация свободных радикалов и ксенобиотиков

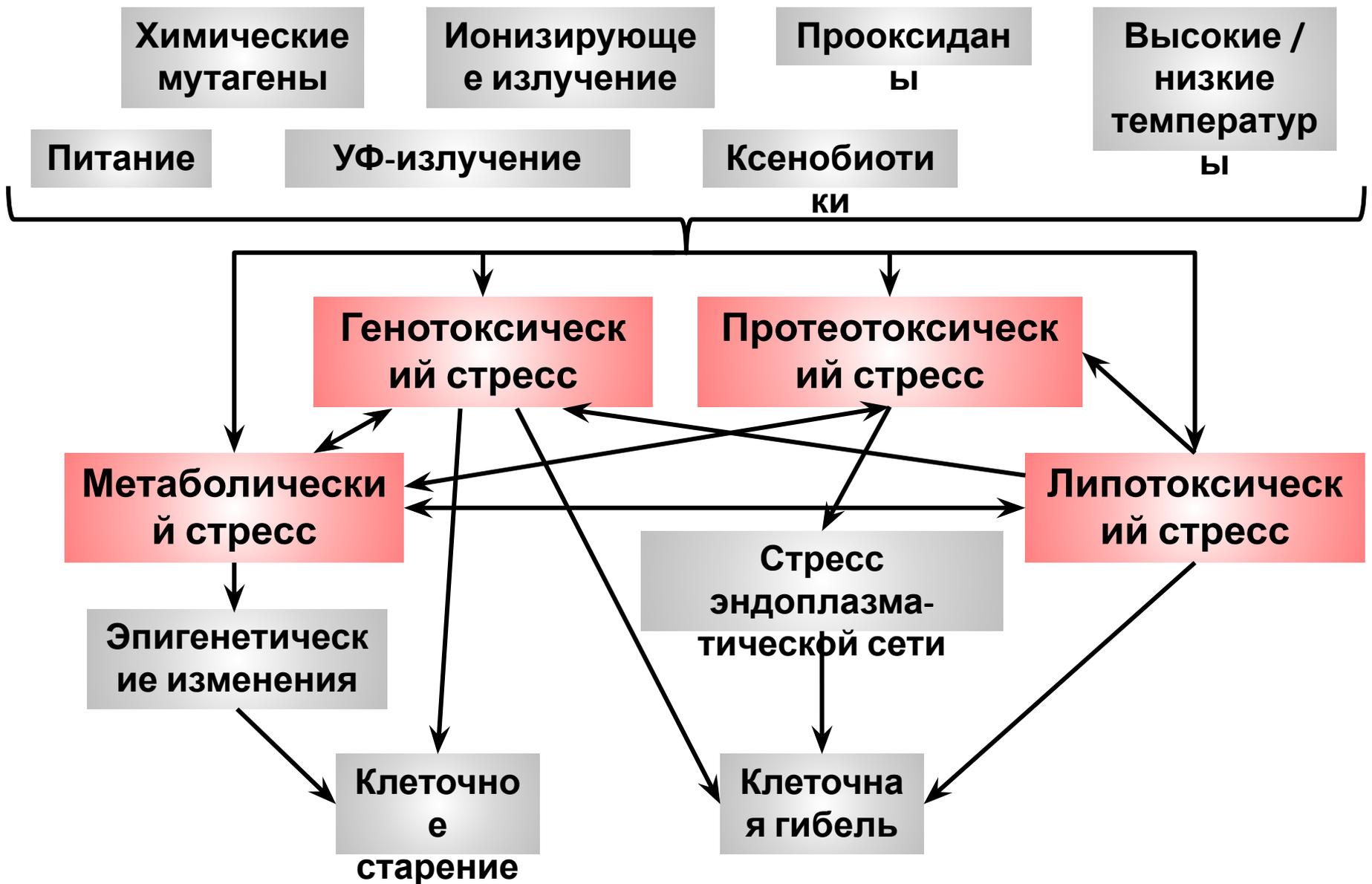
- Репарация ДНК
- Восстановление нативной структуры белков

- Протеолиз
- Автофагия
- Апоптоз

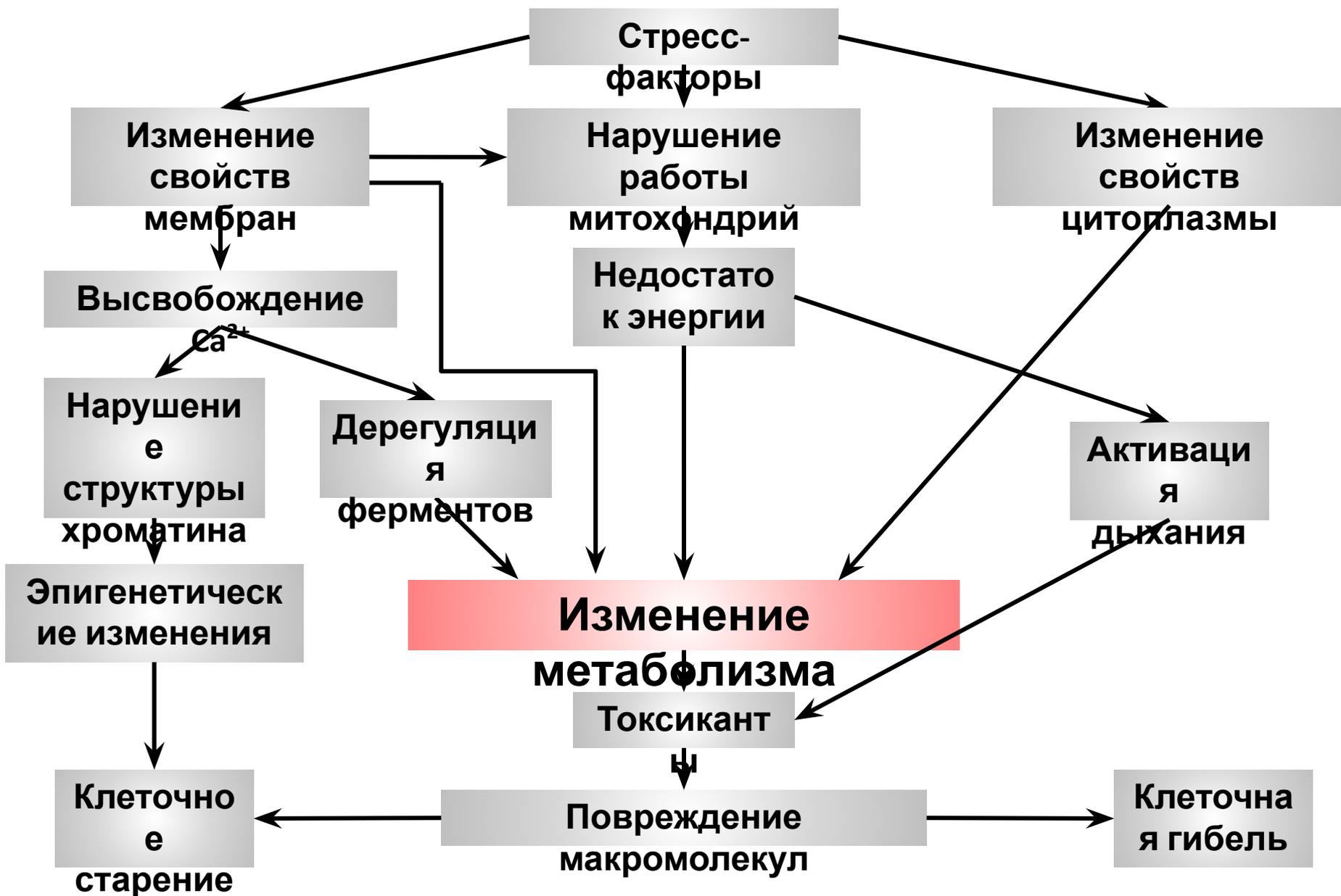
- Синтез макромолекул *de novo*

- Пролиферация клеток
- Дифференцировка стволовых клеток

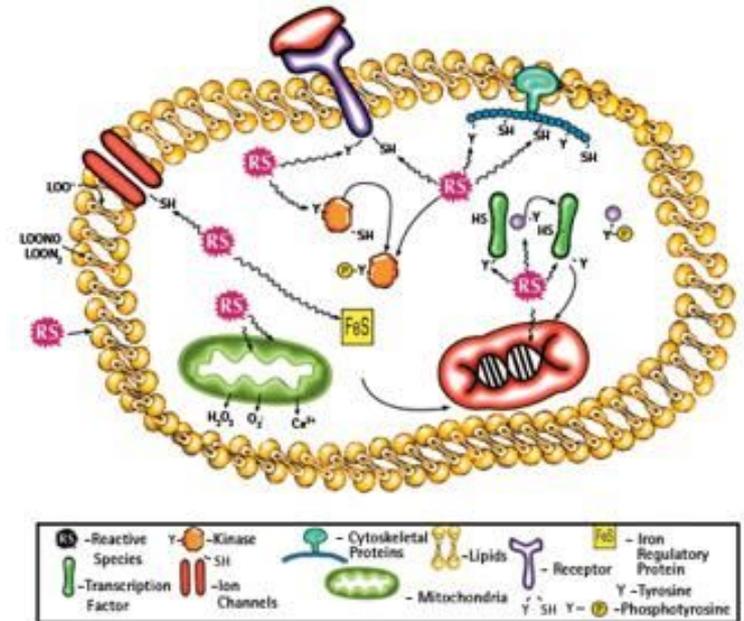
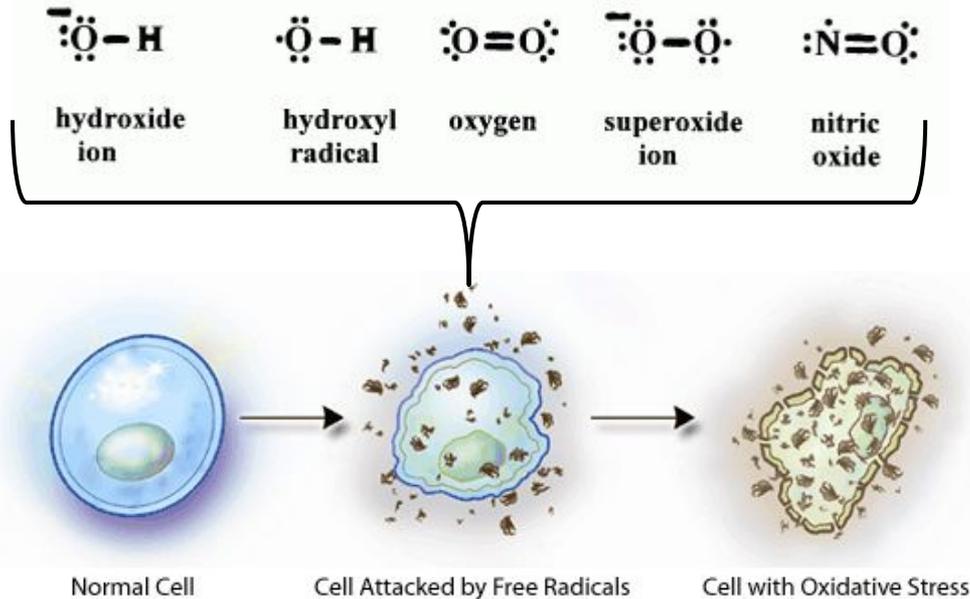
**Изменения в клетке при
стрессе.
Образование и
предотвращение
повреждений макромолекул**



Метаболический стресс

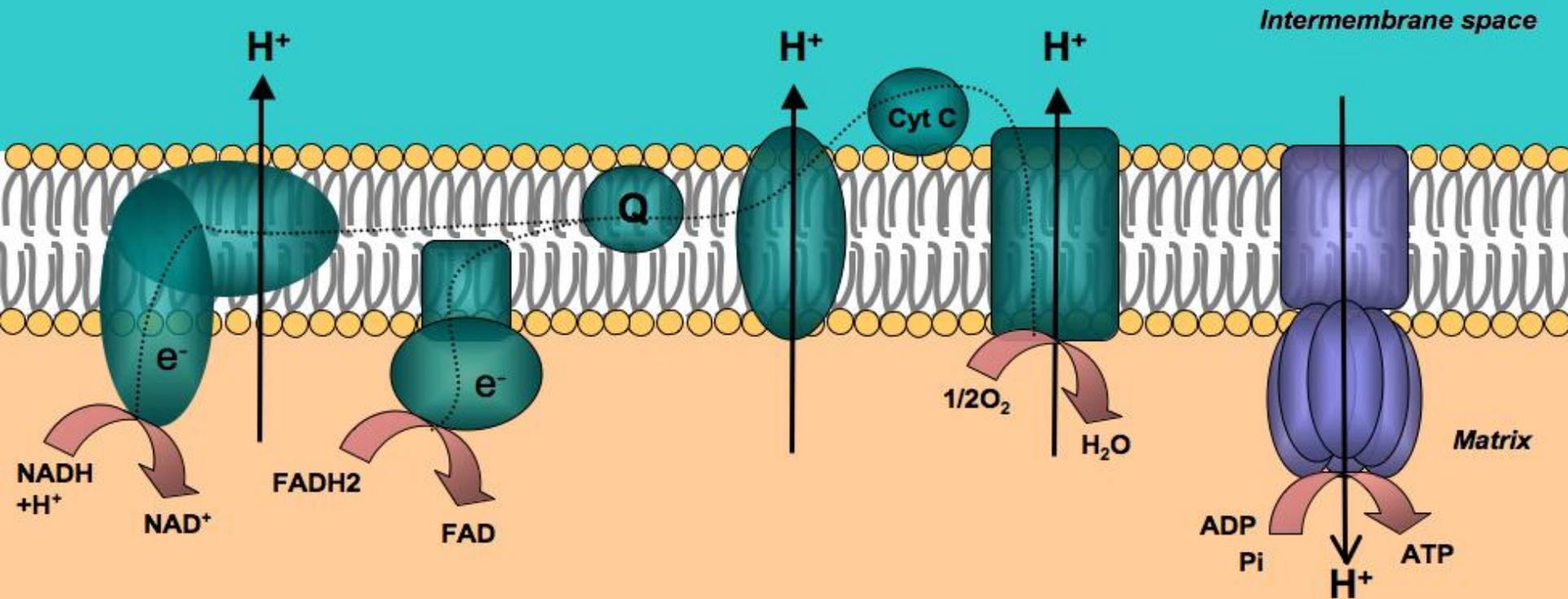


Свободные радикалы



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

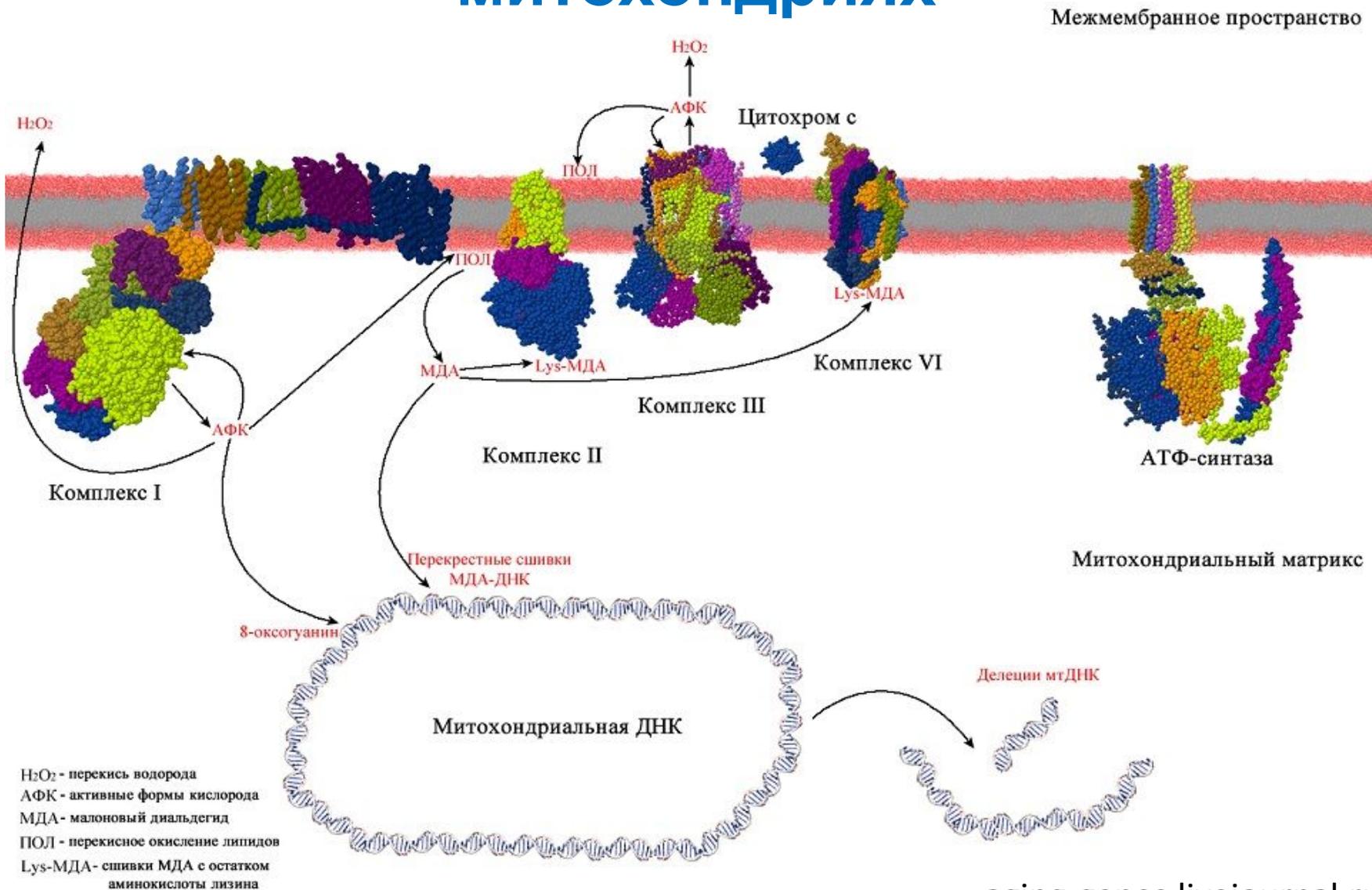
Complex IV
Cytochrome C
oxidase

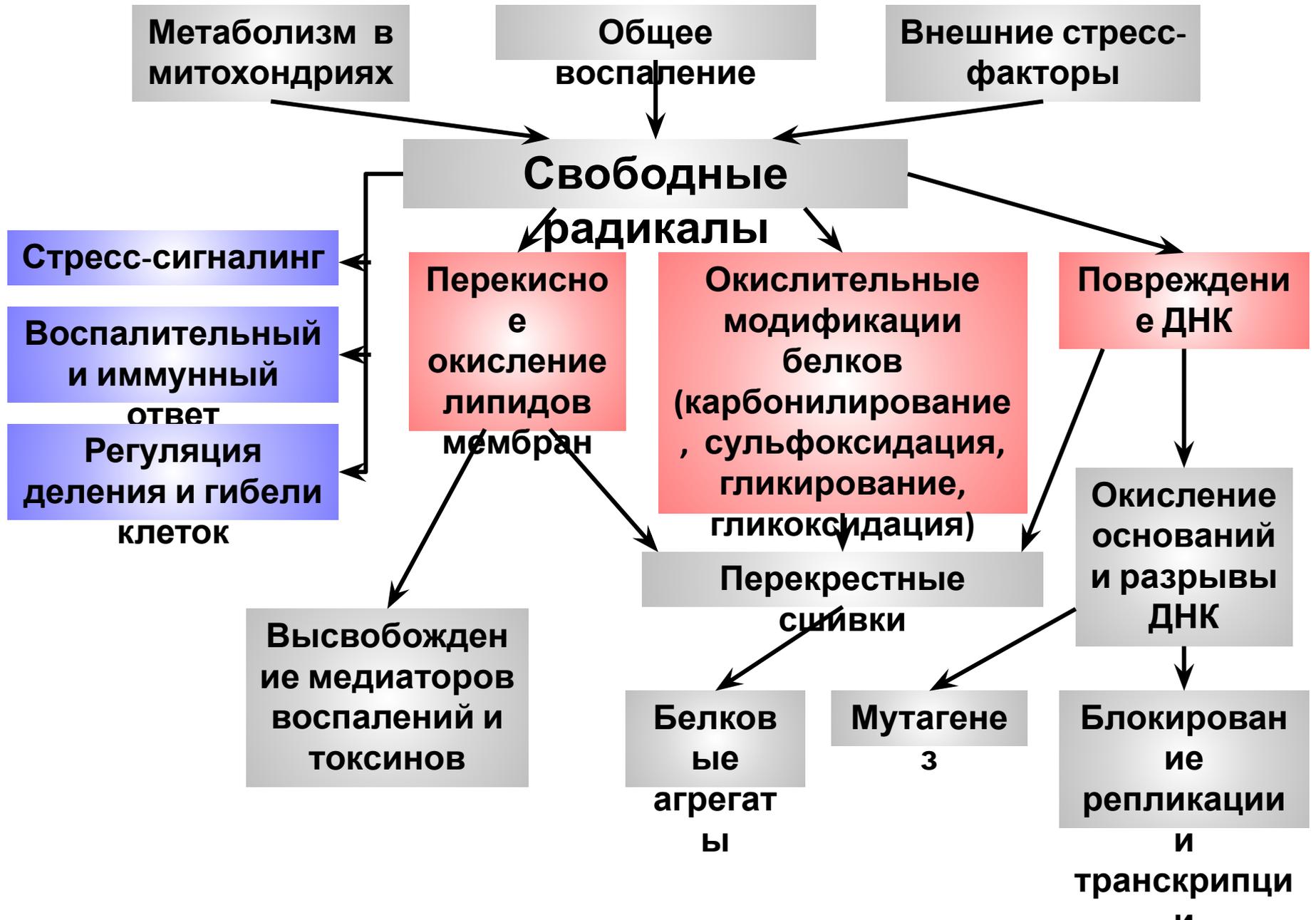
13 Subunits
3 mtDNA/10 nDNA

Complex V
ATP synthase

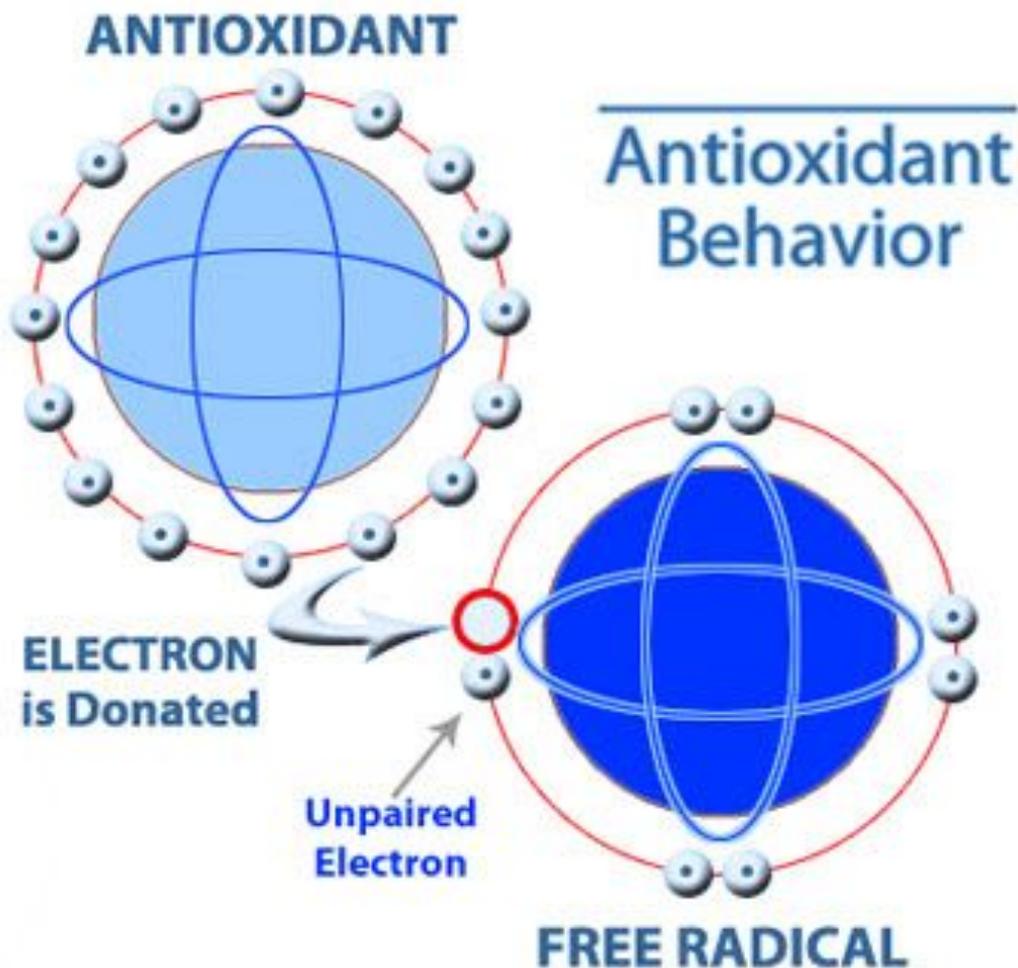
17 Subunits
2mtDNA/15 nDNA

Свободнорадикальные процессы в МИТОХОНДРИЯХ





Антиоксиданты



astiro-medtext.blogspot.com

Ферменты:

- Супероксиддисмутаза
- Каталаза
- Глутатион пероксидаза
- Тиоредоксин пероксидаза

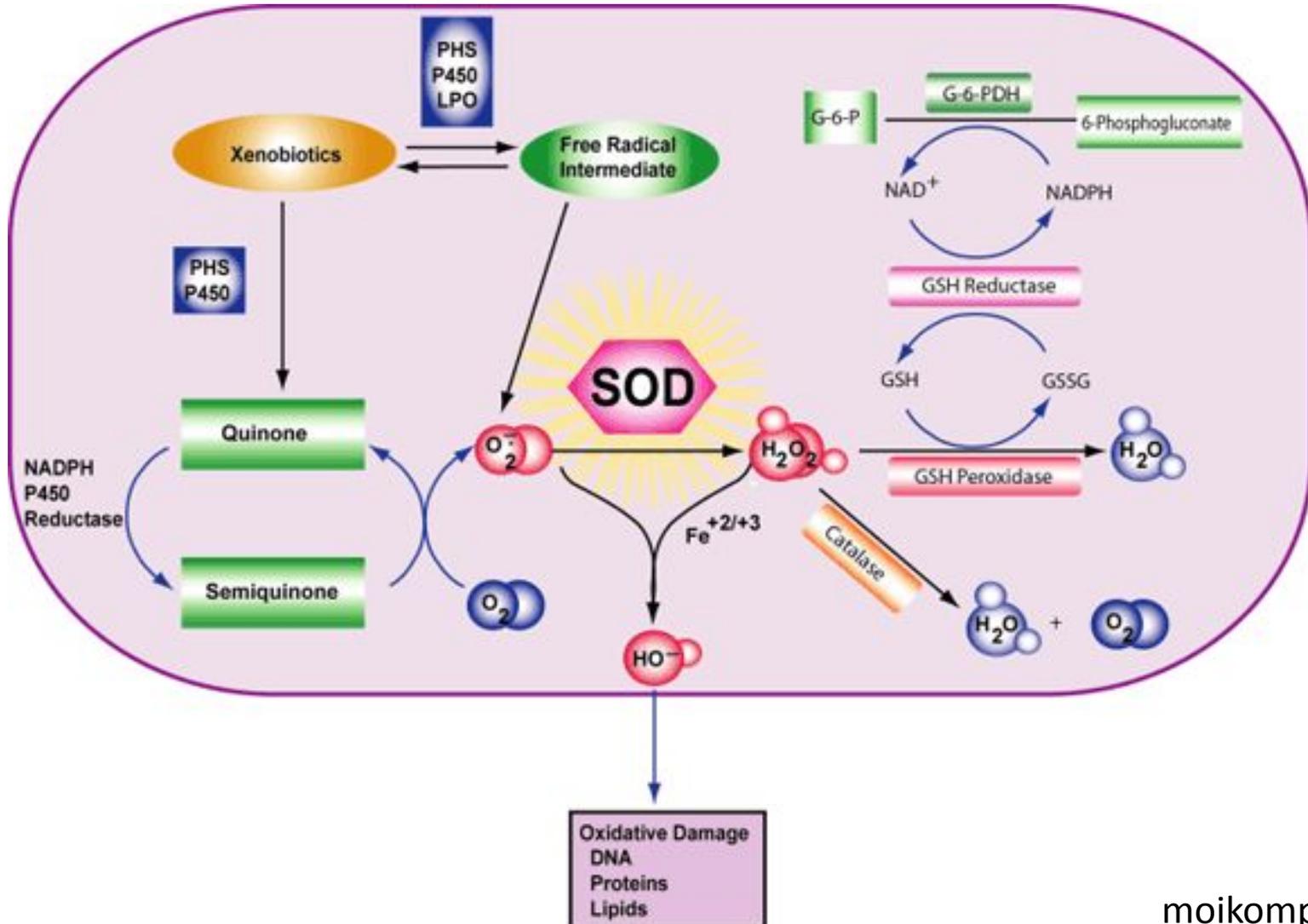
Витамины:

- β -каротин
- α -токоферол
- Аскорбиновая кислота

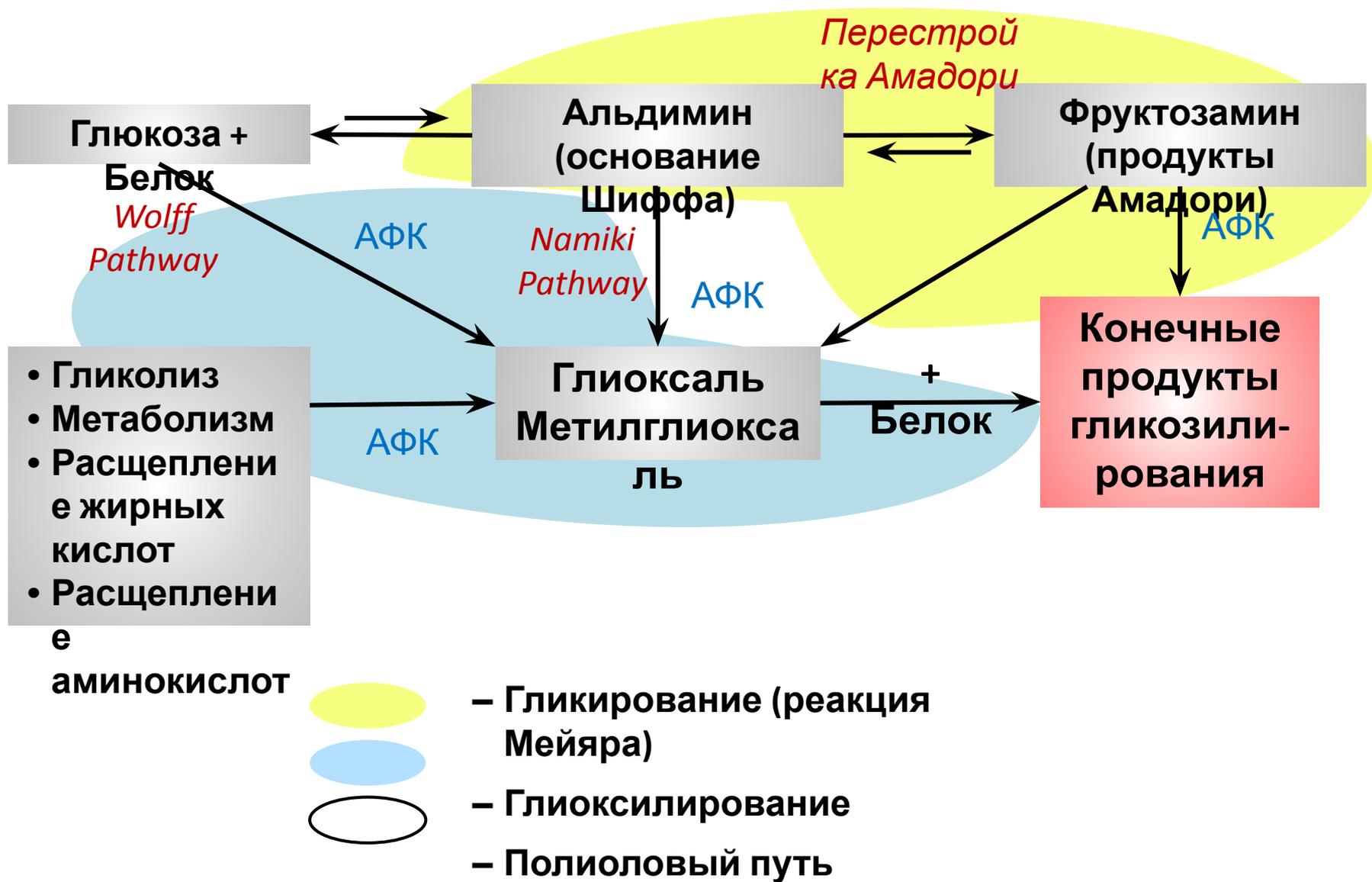
Другие вещества:

- Мелатонин
- Карнозин
- Карцинин
- Хелатные агенты

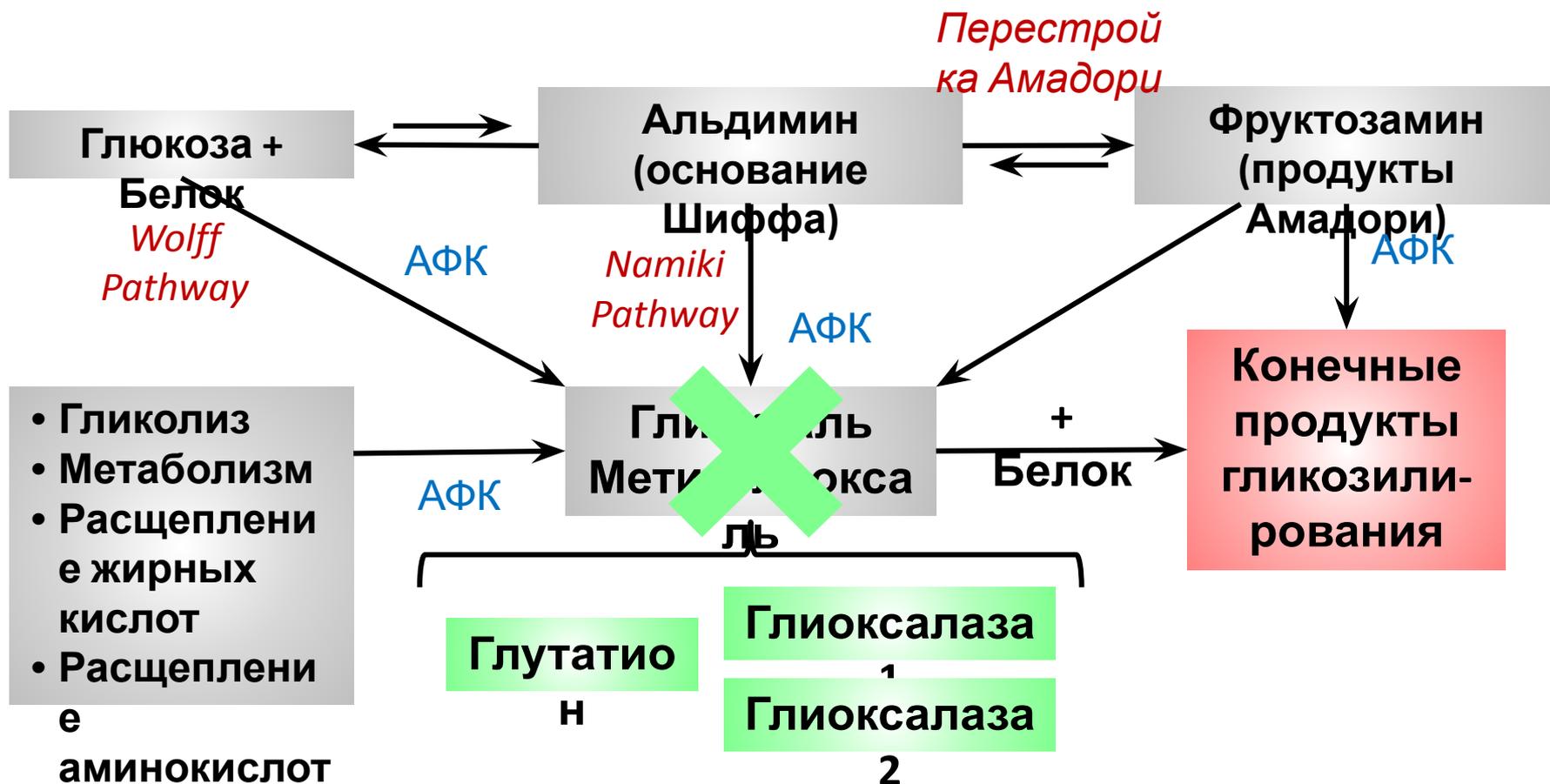
Детоксикация свободных радикалов и ксенобиотиков



Продукты гликозилирования



Продукты гликозилирования



Дектоксикация токсинов



Стресс-сигналинг

