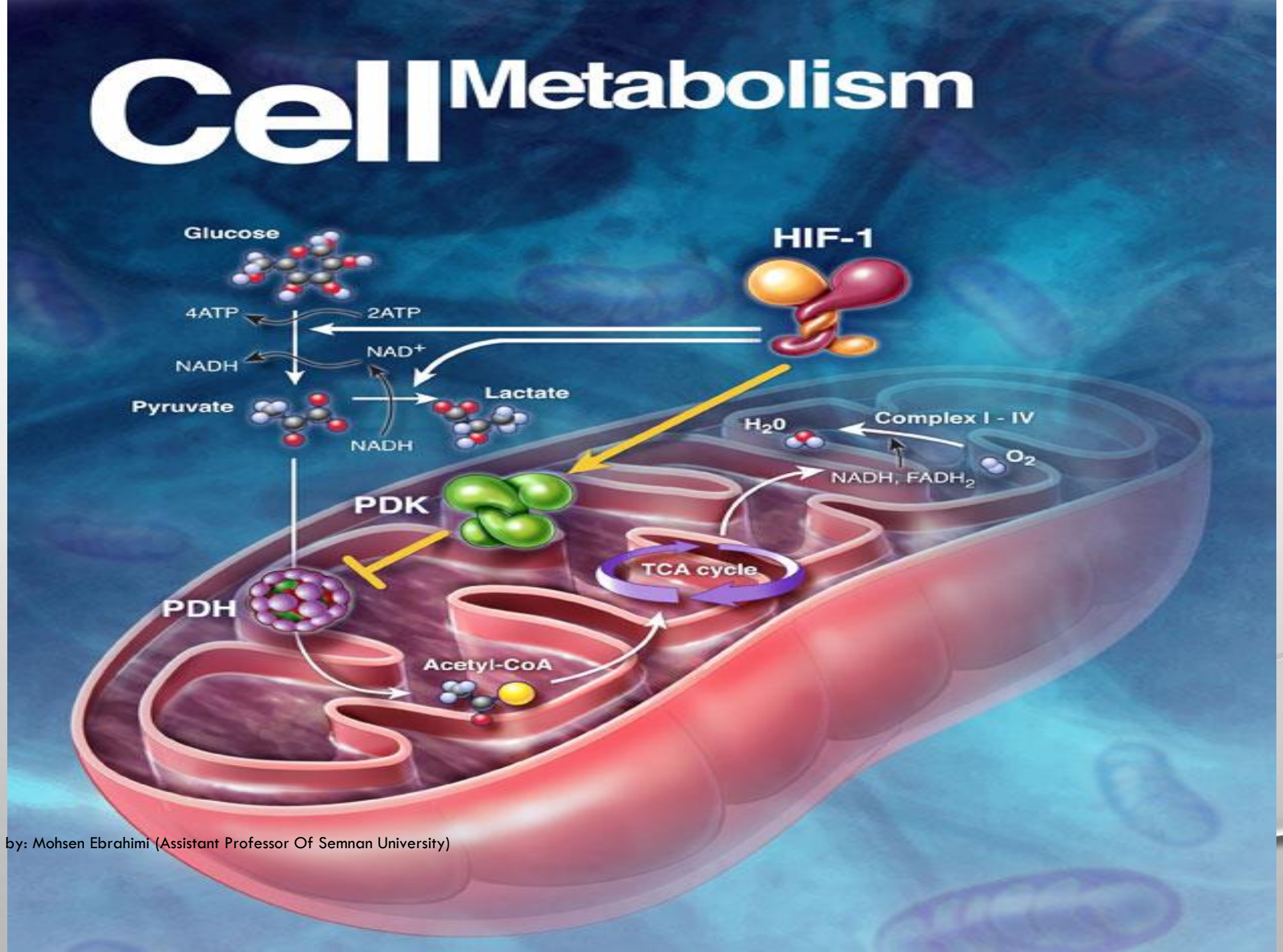
ENERGY SYSTEMS

Designed by: Mohsen Ebrahimi (Assistant Professor Of Semnan University)



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METABOLISM

- **METABOLISM:** REFERS TO THE ENTIRE NETWORK OF CHEMICAL PROCESSES INVOLVED IN MAINTAINING LIFE.

- **ENERGY METABOLISM:** THE WAYS THAT THE BODY OBTAINS AND SPENDS ENERGY FROM FOOD.

- **ANABOLISM: THE BUILDING OF COMPOUNDS FROM SMALL MOLECULES INTO LARGER ONES. ENERGY IS USED FOR THIS PROCESS TO TAKE PLACE.**

- **CATABOLISM: THE BREAKDOWN OF MOLECULES INTO SMALLER UNITS. ENERGY IS RELEASED IN THIS PROCESS.**
  - **EX: GLUCOSE CATABOLISM RESULTS IN THE RELEASE OF CO_2 AND H_2O**

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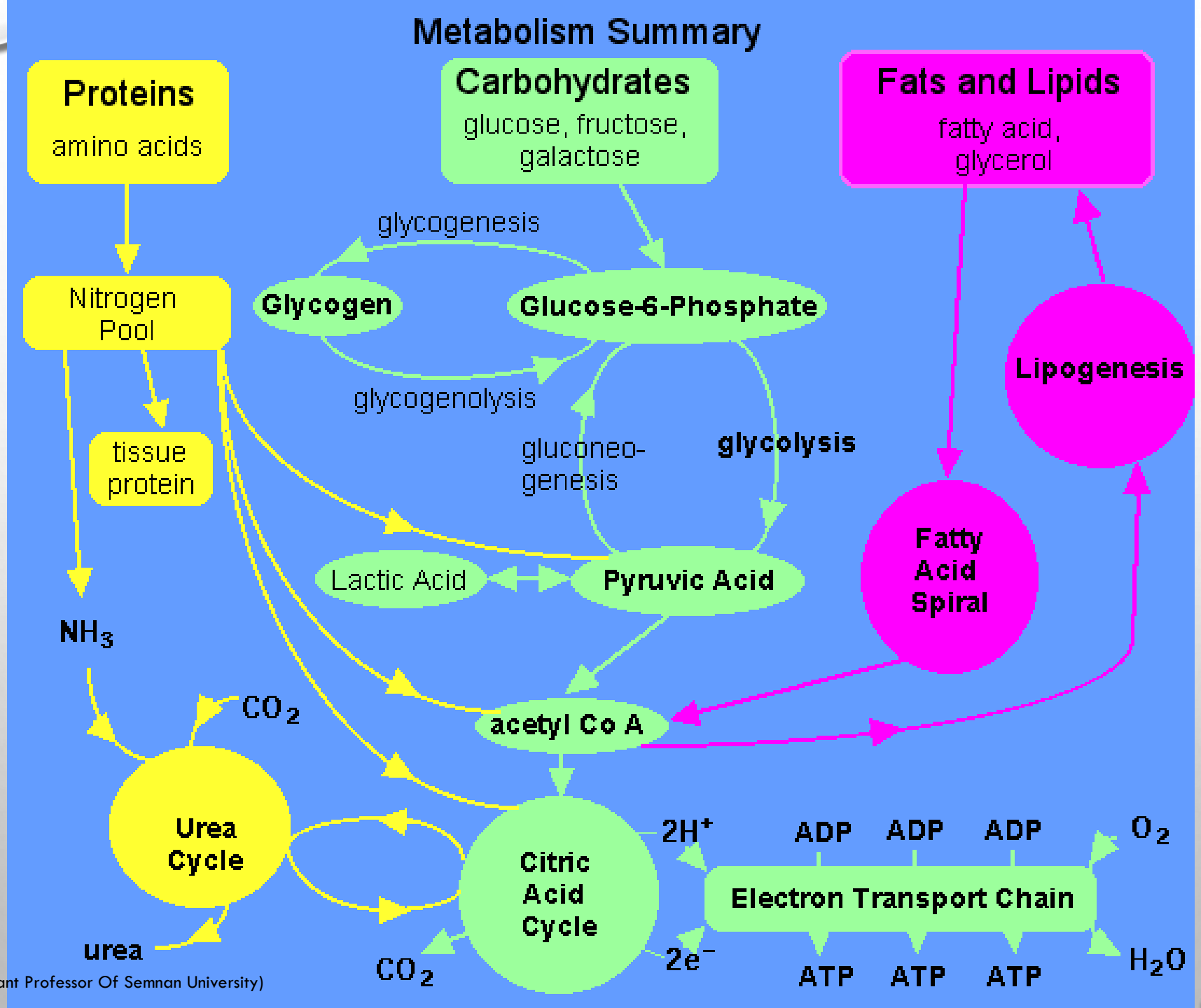
METABOLIC EFFICIENCY

- FOOD ENERGY IS CONVERTED TO ATP WITH APPROXIMATELY 50% EFFICIENCY.
- THE OTHER 50% IS RELEASED AS HEAT.
- WHEN ATP IS NEEDED FOR ENERGY, ~50% ARE USED.

- OVERALL: 25% OF FOOD BECOMES ENERGY

75% IS RELEASED AS HEAT.



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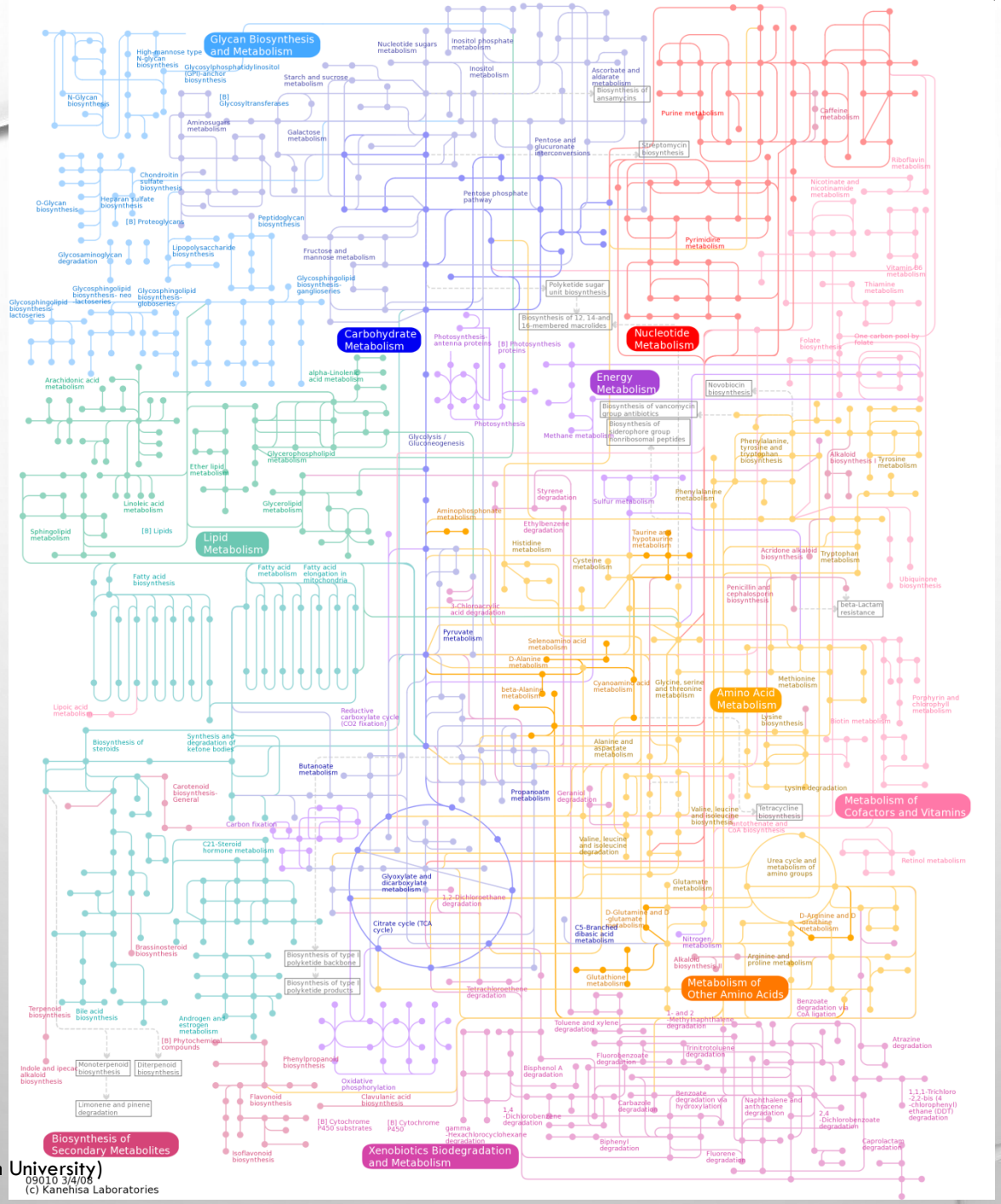

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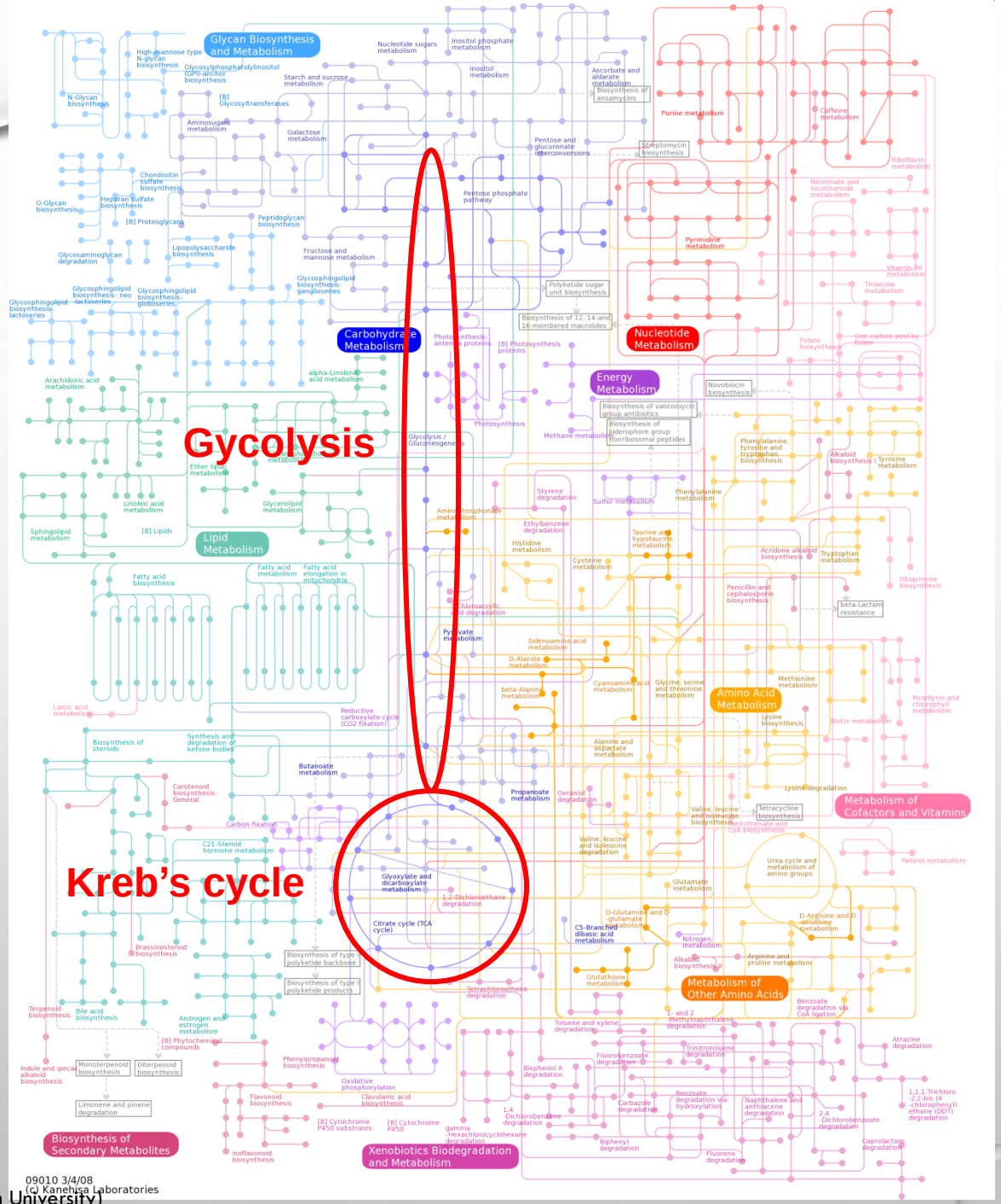

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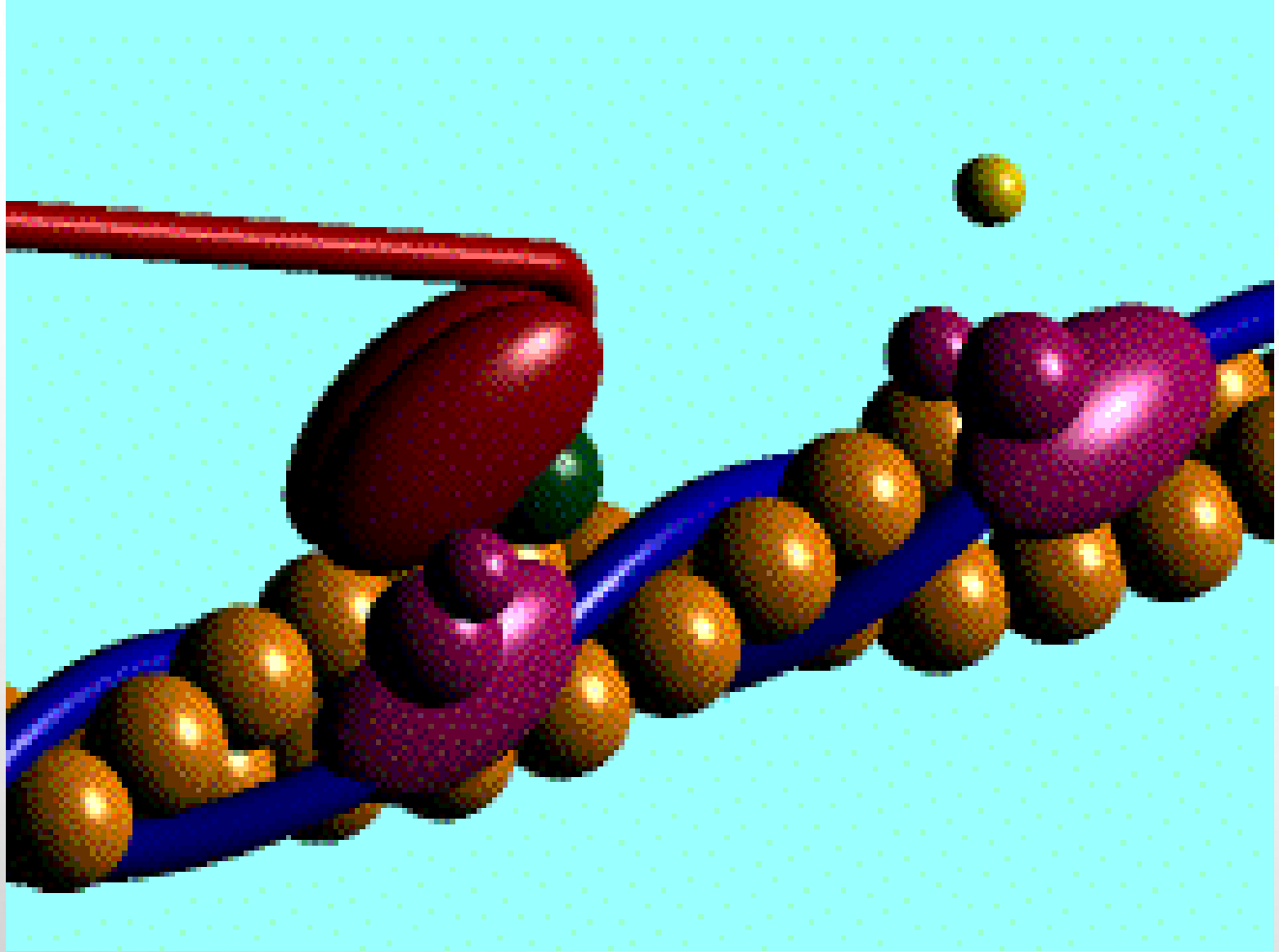
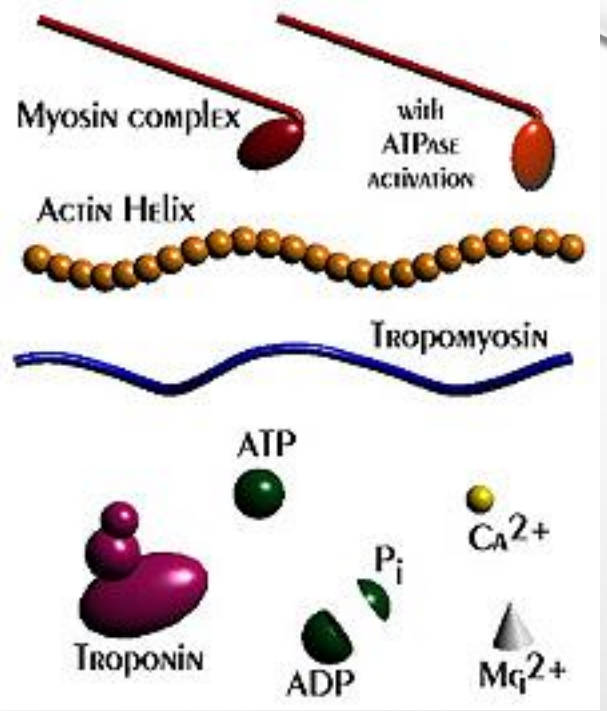
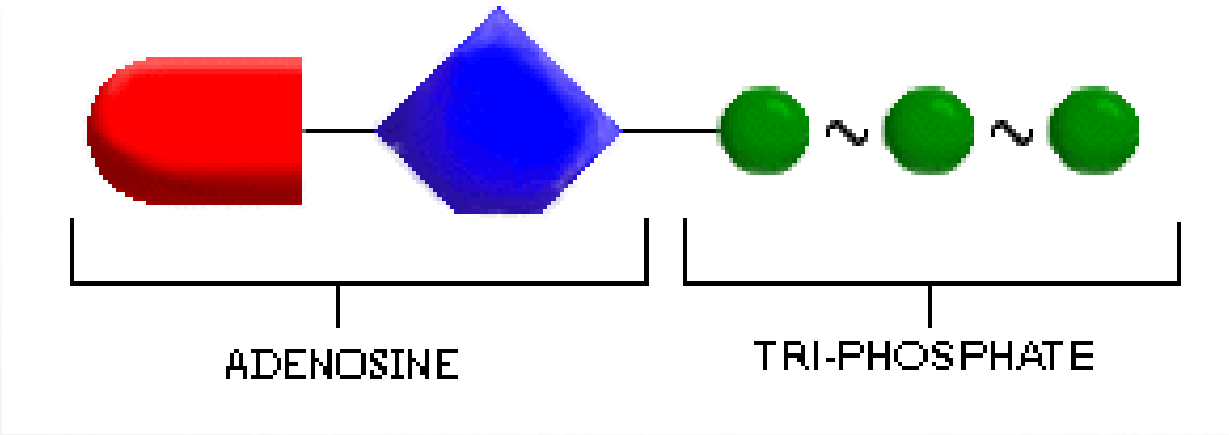



Myosin complex
with
ATPase
activation
Actin Helix
Tropomyosin
ATP
Troponin
ADP
Pi
Ca2+
Mg2+

پول رایج سلول ها

- ATP
- ADP

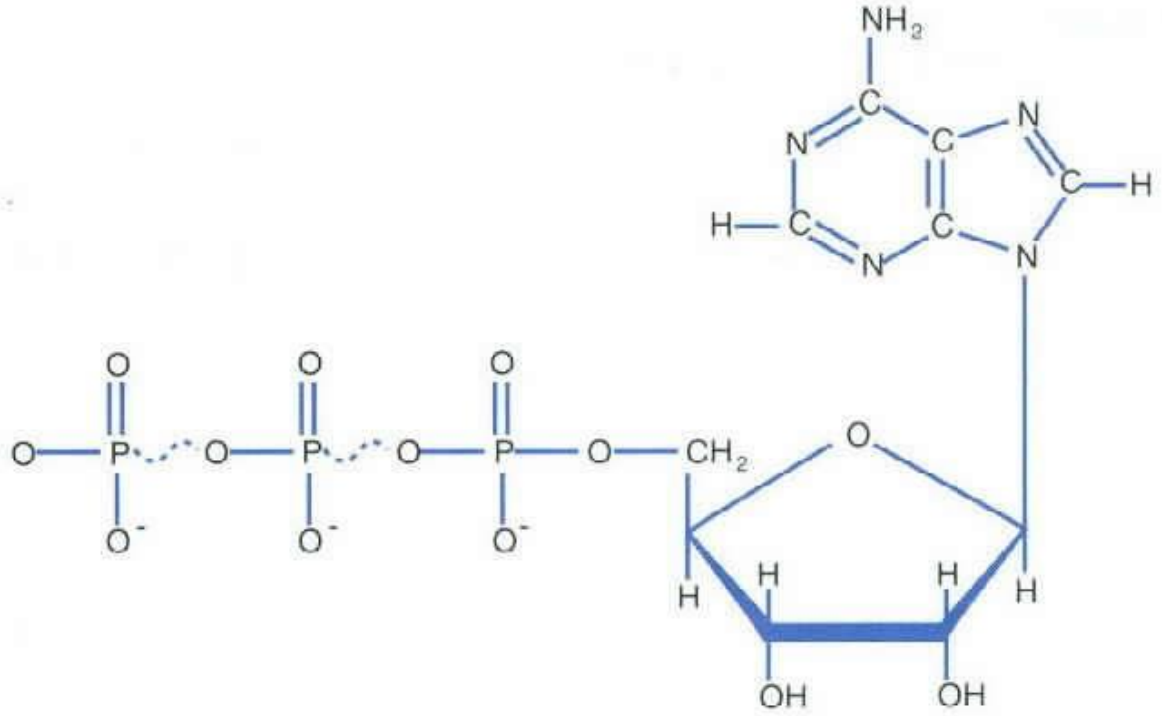
ATP

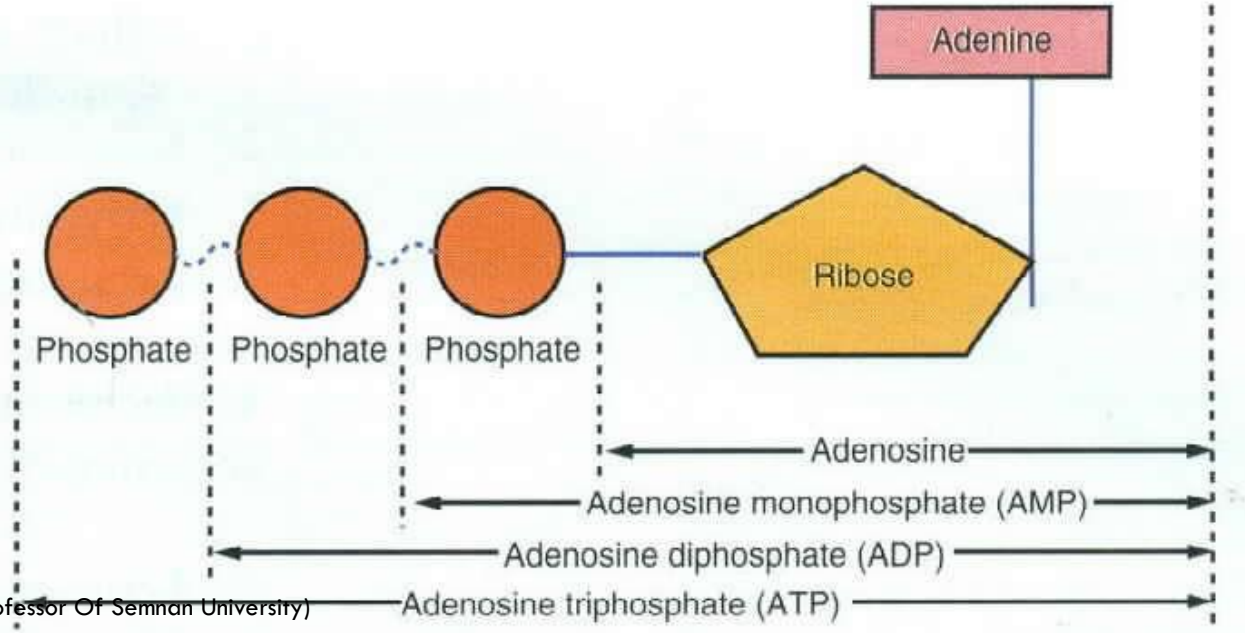


ATP consists of:

- The sugar ribose
- The adenine
- And 3 phosphate groups

- About 40kg of ATP is made in cells every day.
- You may make up to 0.5kg a minute
- At any one time you probably have only about 5g in your body.


NH2
C
N
C
N
C
H
H
C
C
N
N
O
O
O
P
P
P
O
O
O
O
O
O
O
CH2
O
H
H
H
H
OH
OH


Adenine
Ribose
Phosphate
Phosphate
Phosphate
Adenosine
Adenosine monophosphate (AMP)
Adenosine diphosphate (ADP)
Adenosine triphosphate (ATP)

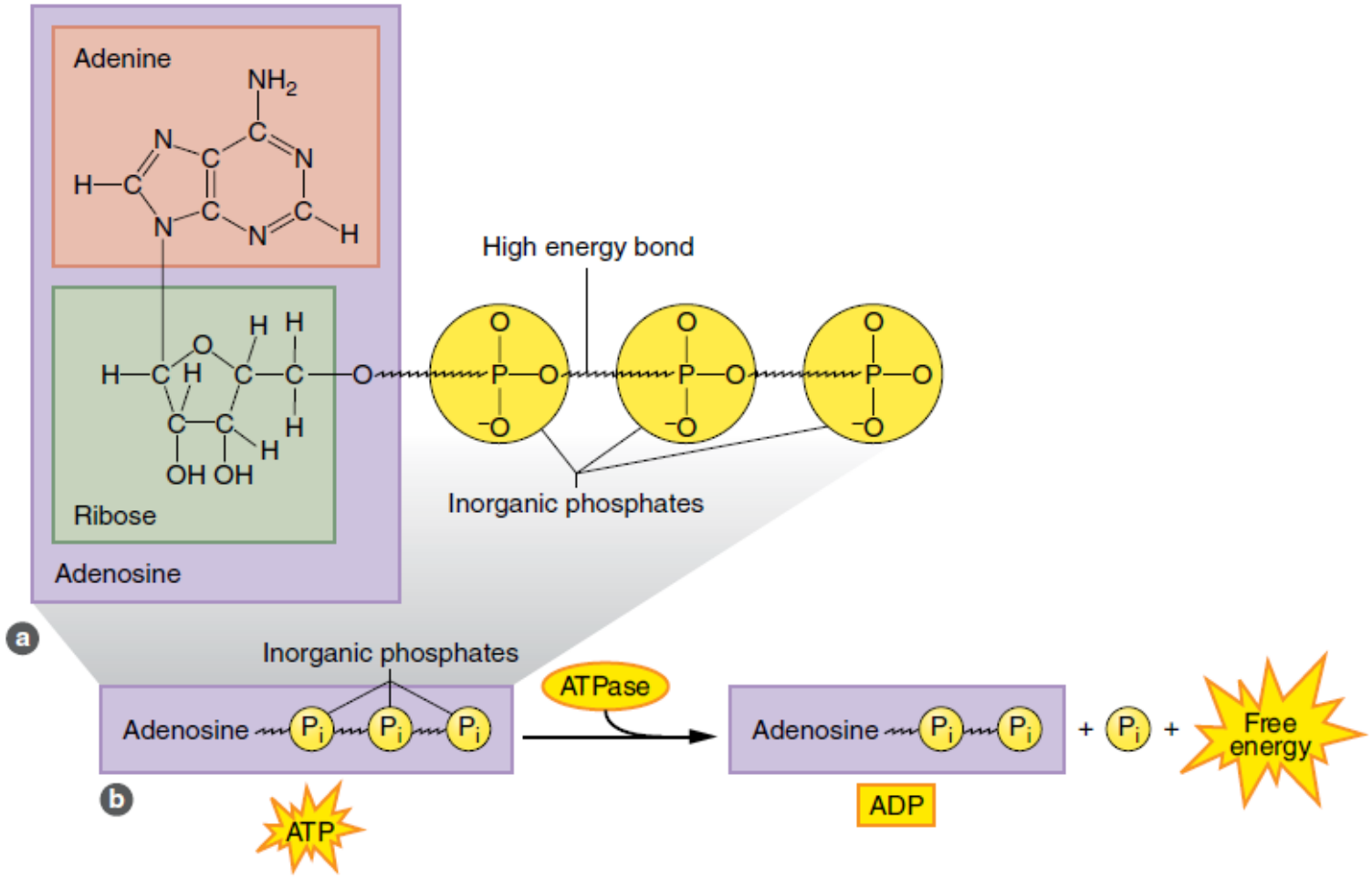
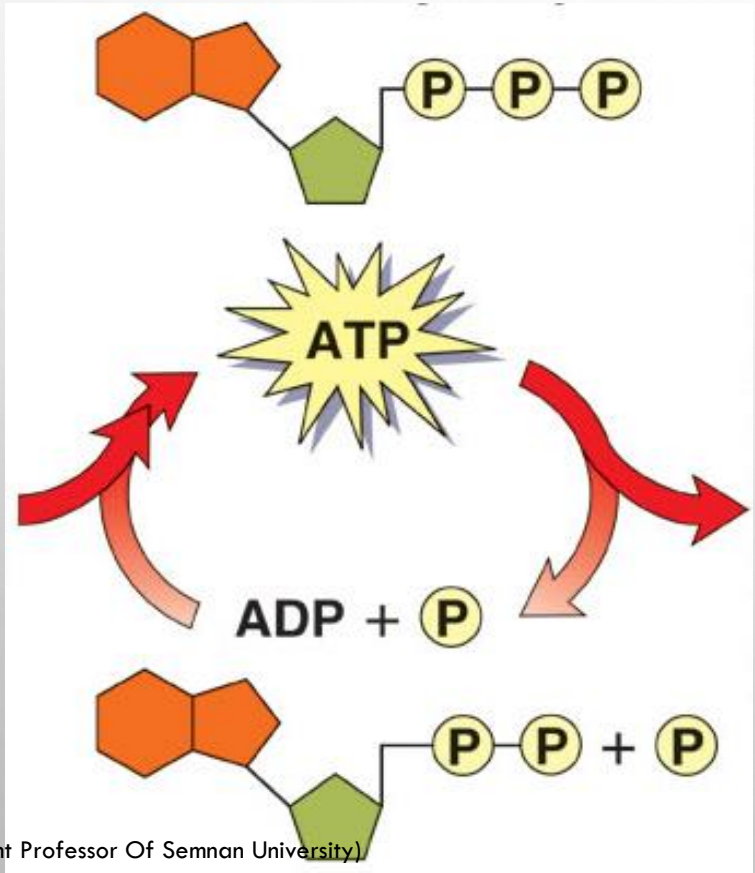


FIGURE 2.4 (*a*) The structure of an adenosine triphosphate (ATP) molecule, showing the high-energy phosphate bonds. (*b*) When the third phosphate on the ATP molecule is separated from adenosine by the action of adenosine triphosphatase (ATPase), energy is released.

چرخه ATP–ADP

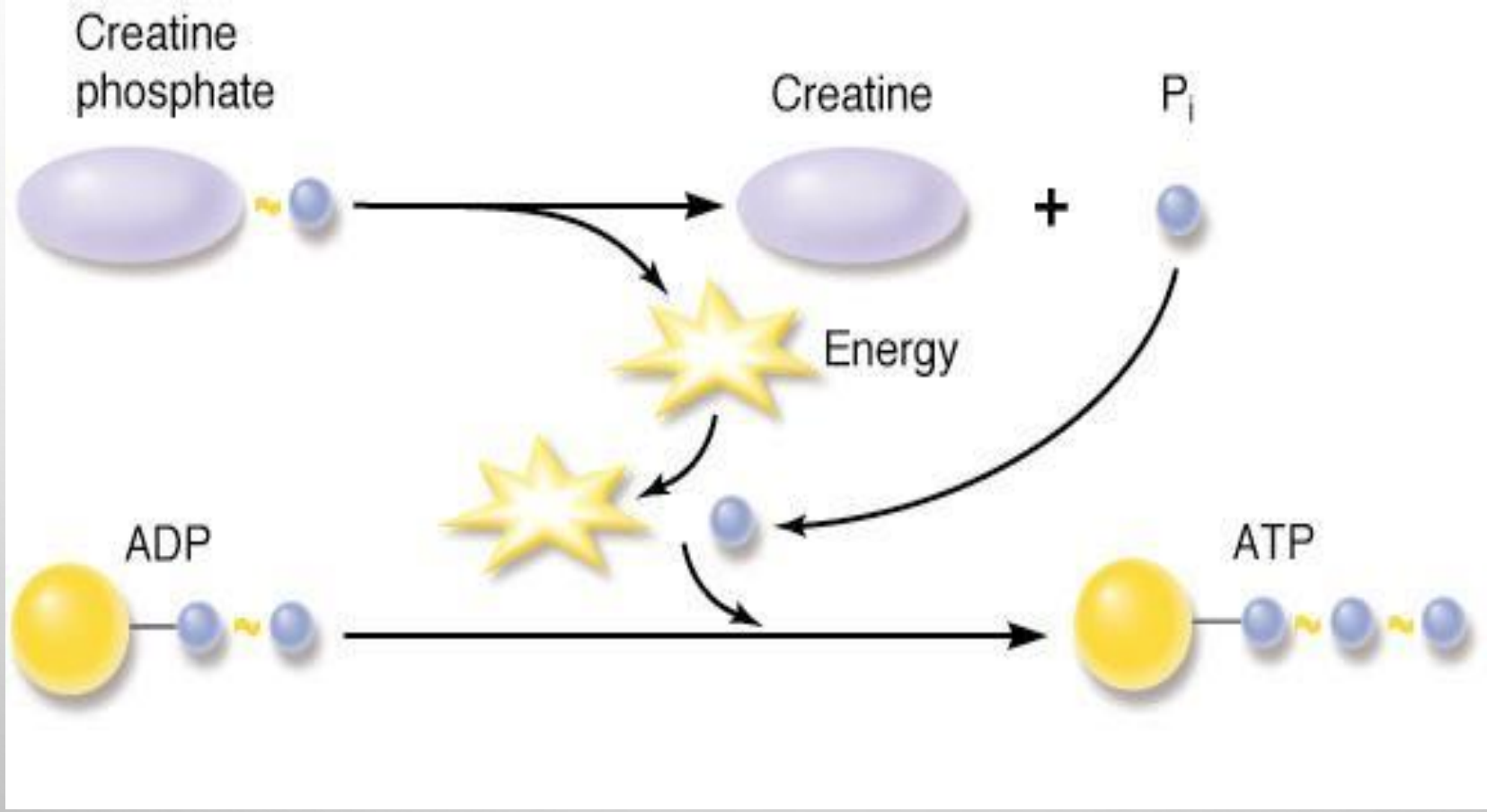
- مقدار ATP در عضله=۶ میلی مول در هر کیلوگرم
- اتمام در ۳ ثانیه فعالیت



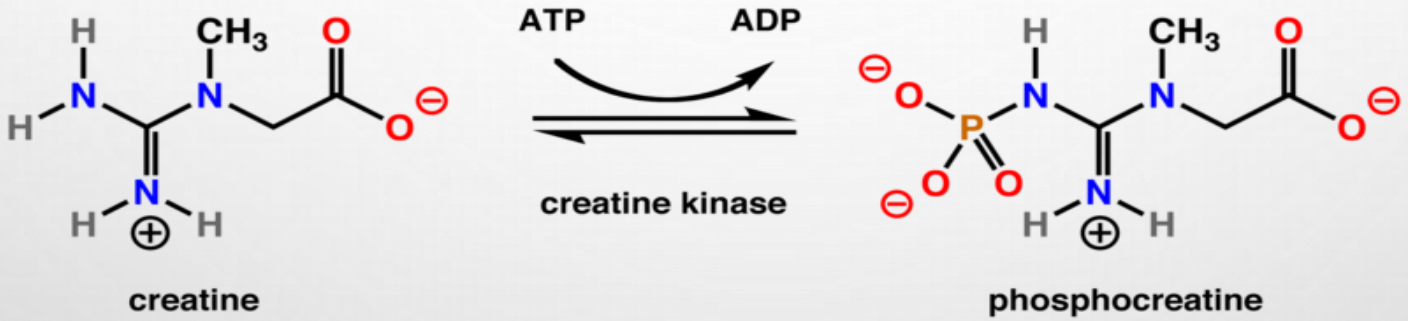
منابع تامین انرژی برای بازسازی ATP

- PCR (بی هوازی)
- کربوهیدرات (بی هوازی و هوازی)
- چربی (هوازی)
- پروتئین (هوازی)

کراتین فسفات



- کراتین یک پروتئین (پپتید) است (گلایسین + آرژنین + متیونین)
- در هر کیلوگرم عضله =۱۲ میلی مول کراتین +۲۰ میلی مول PC
- این ترکیب به مدت ۱۰ تا ۱۵ ثانیه در طول فعالیت شدید به اتمام می رسد.



- CK-BB در مغز و عضلات صاف
- CK-MB در قلب
- CK-MM در عضله اسکلتی

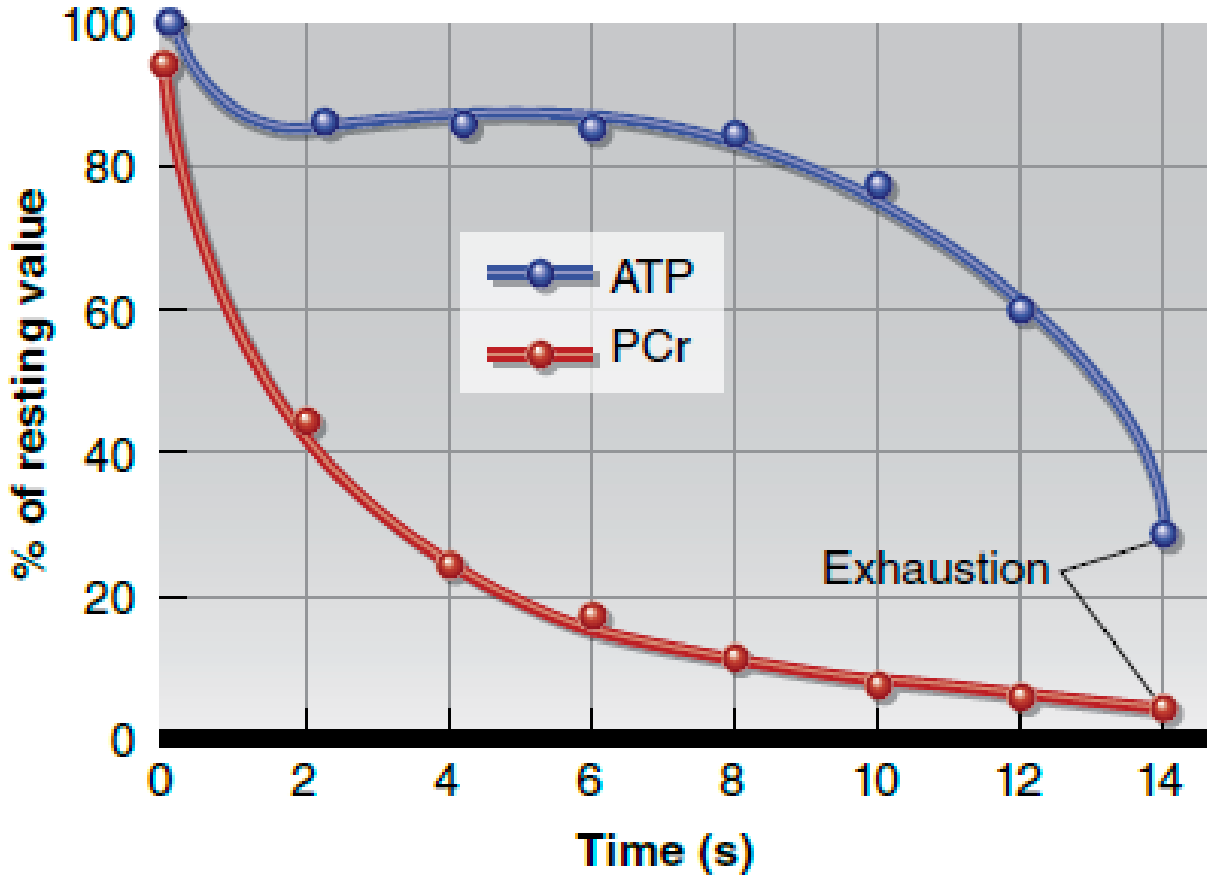


FIGURE 2.6 Changes in type II (fast-twitch) skeletal muscle adenosine triphosphate (ATP) and phosphocreatine (PCr) during 14 s of maximal muscular effort (sprinting). Although ATP is being used at a very high rate, the energy from PCr is used to synthesize ATP, preventing the ATP level from decreasing. However, at exhaustion, both ATP and PCr levels are low.