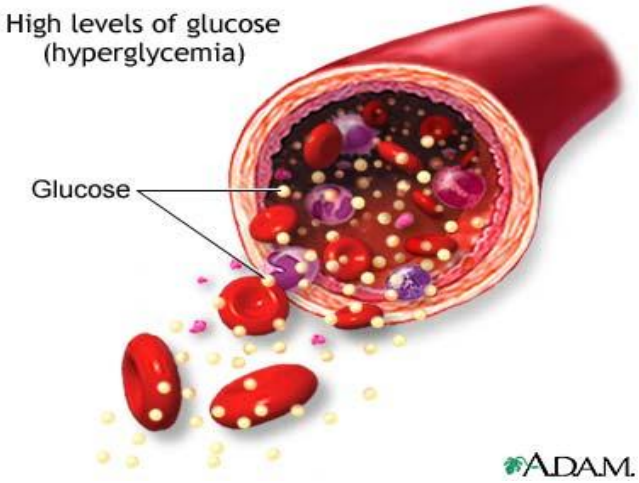
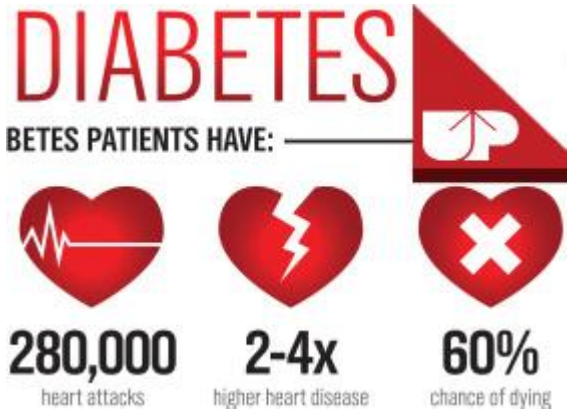
Reverse Diabetes: Dangers of high blood sugar





Glucose converts to sorbitol in eyes and nerves;

Glucose is sticky, high blood sugar leads to high blood viscosity;

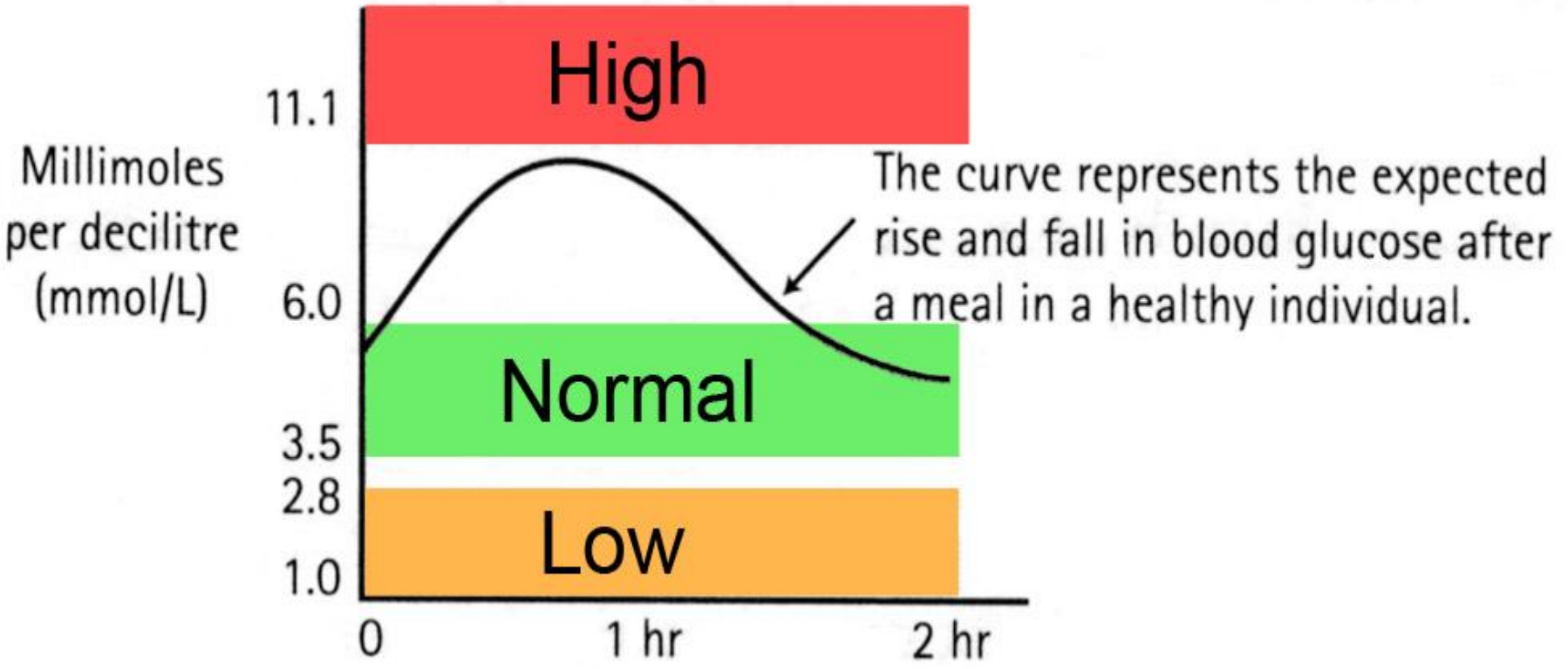
Glucose tangles with protein results in glycation and AGES (glycotoxins):

AGES is a main cause of aging;

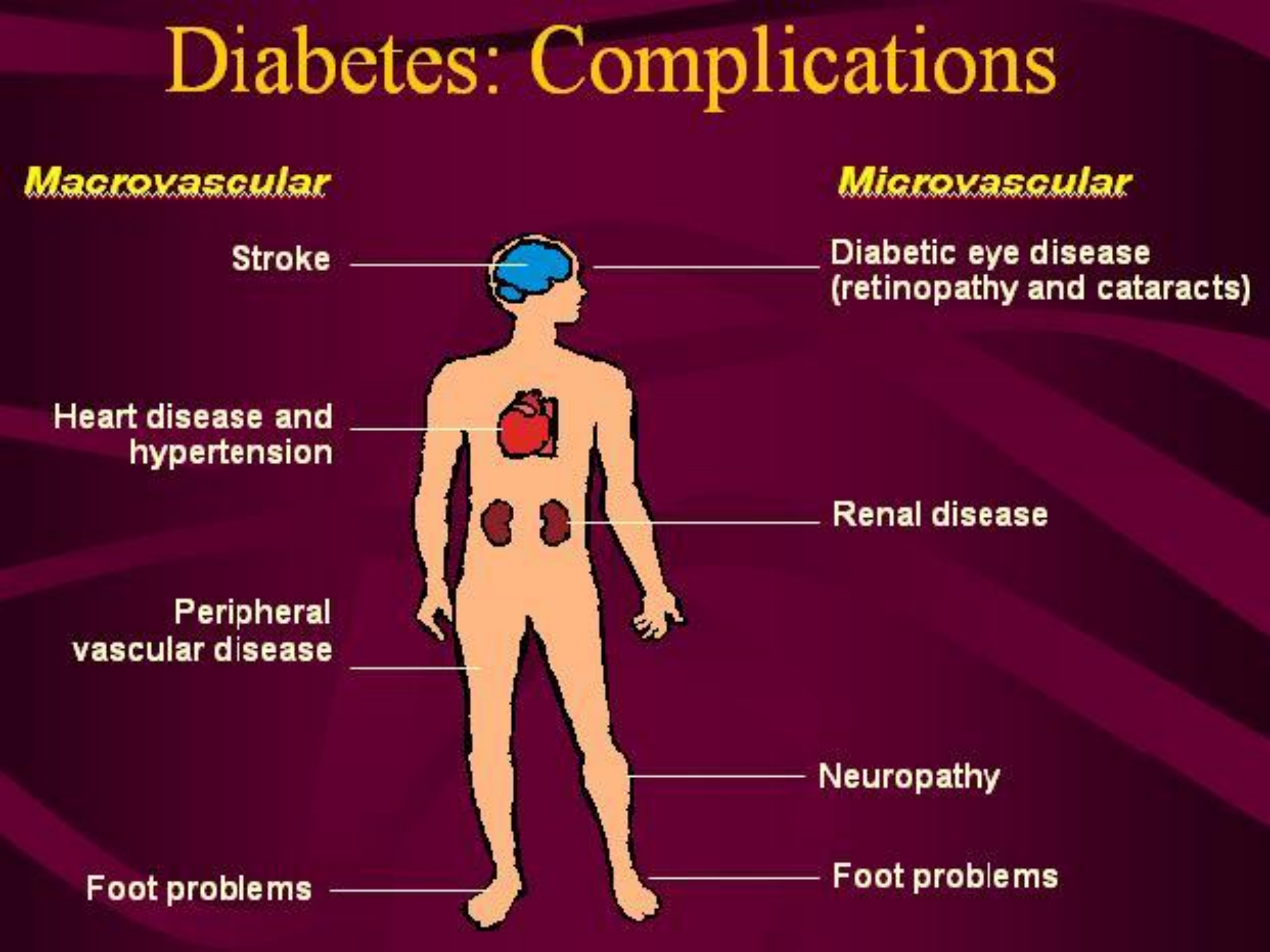
AGES promotes hardening of arteries, result in dementia, strokes, heart disease, kidney disease, cataract…

AGES promote inflammation….

Normal and Abnormal blood sugar level



Diabetes: Complications



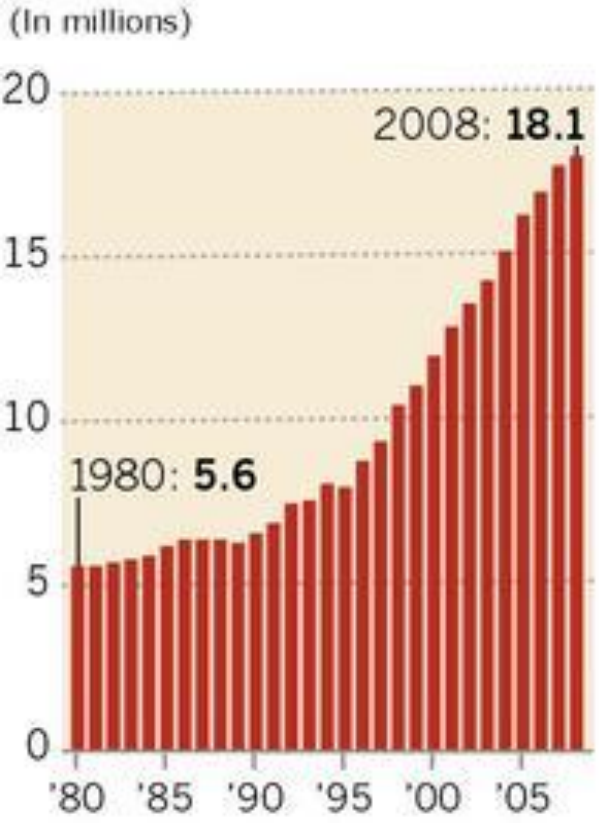
New cases of diagnosed diabetes

Rank-ing	2000		2030	
	Country	People with diabetes (millions)	Country	People with diabetes (millions)
1	India	31.7	India	79.4
2	China	20.8	China	42.3
3	USA	17.7	USA	30.3
4	Indonesia	8.4	Indonesia	21.3
5	Japan	6.8	Pakistan	13.9
6	Pakistan	5.2	Brazil	11.3
7	Russian Federation	4.6	Bangladesh	11.1
8	Brazil	4.6	Japan	8.9
9	Italy	4.3	Philippines	7.8
10	Bangladesh	3.2	Egypt	6.7

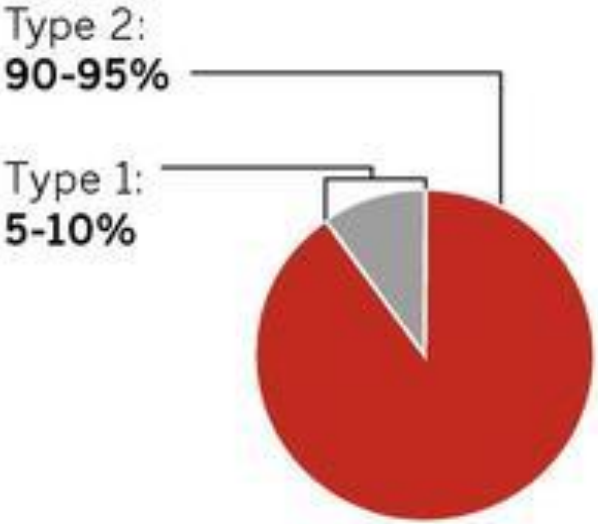
Type 2 diabetes in the United States

One in three adults could have diabetes by 2050, compared with today's 1 in 10, according to the Centers for Disease Control and Prevention. Type 2, the most common form of diabetes, can usually be controlled with diet, execise, weight loss and oral medication.

Number of people with diabetes in the U.S.



Percentage of all cases that are Type 1 or Type 2



Some diabetes-related complications

Number of diabetics who have visual impairment — **3.7 million** (in 2008)

Number of diabetics with cardiovascular disease — **5.9 million** (in 2007)

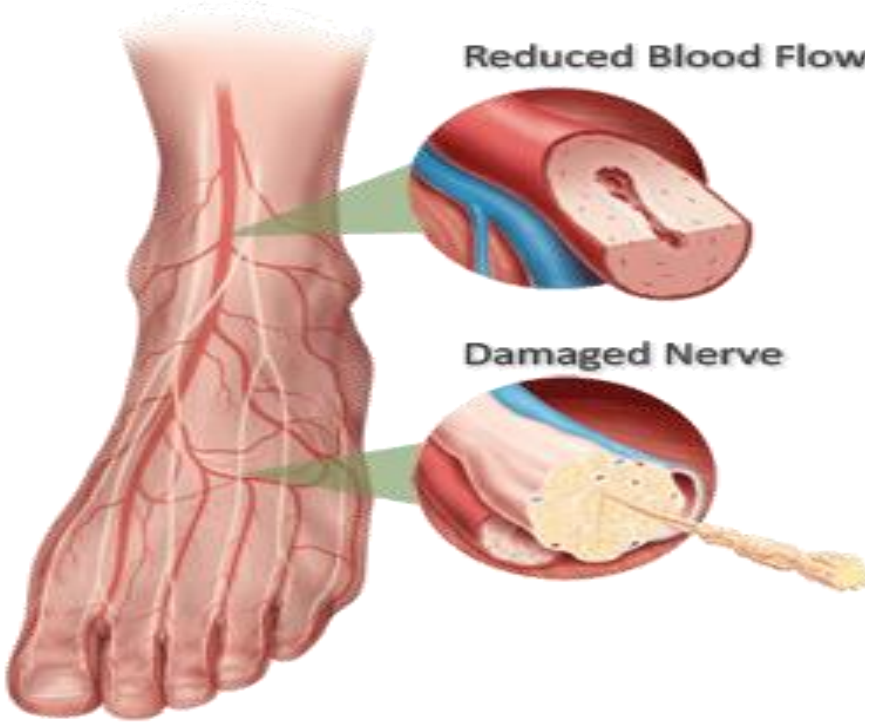
Number of diabetics who had non-traumatic lower limb amputations — **71,000** (in 2005)

Note: Figures shown are for the most recent year available.

Sources: National Institute of Diabetes and Digestive and Kidney Diseases, Centers for Disease Control and Prevention

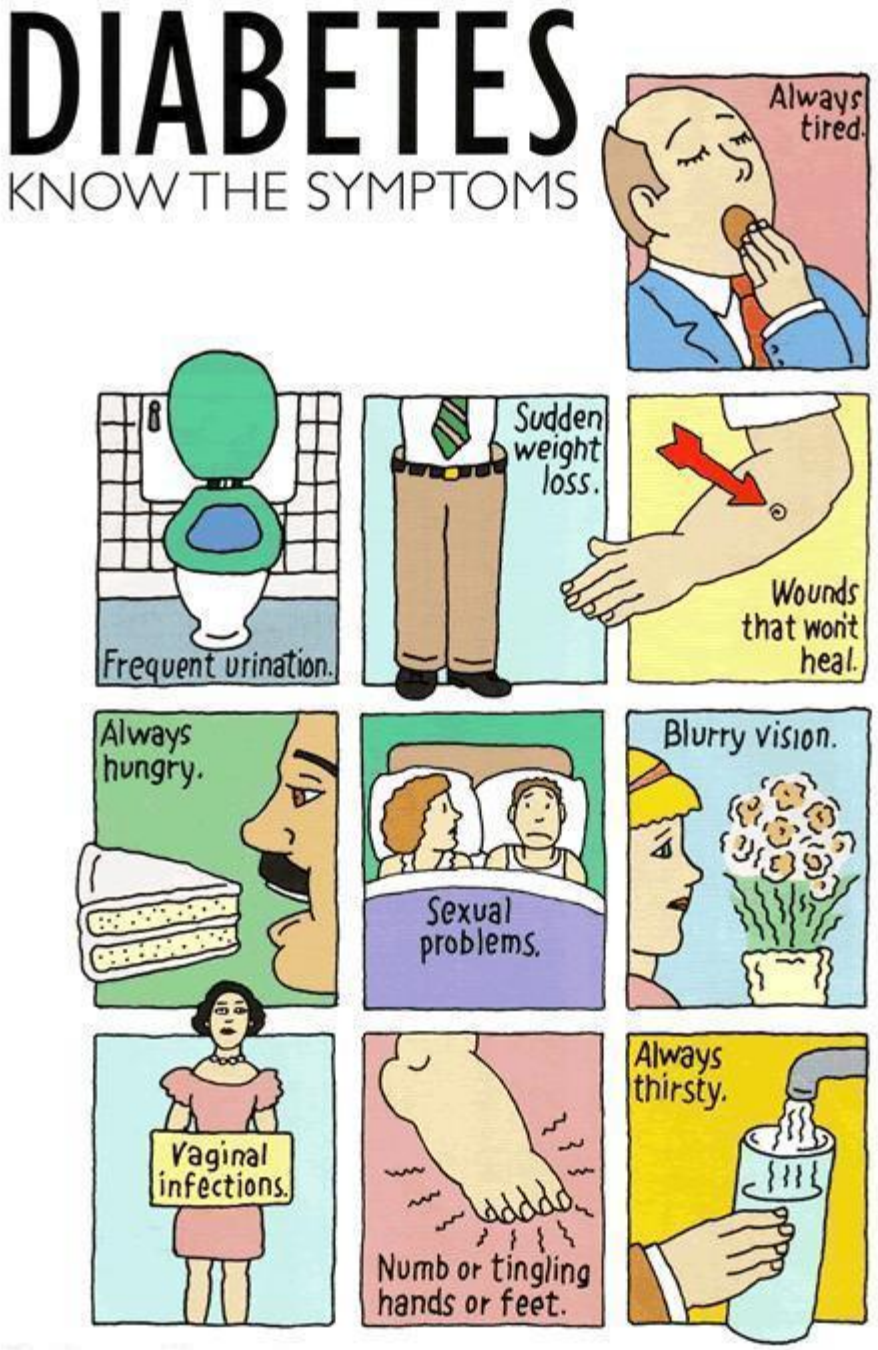
Graphics reporting by TIA LAI

Los Angeles Times



Diabetic Foot

Common symptoms



Stage 1: Preclinical[2]

Numbers on glucometer may be blurry.

Stage 2: Nonproliferative[2]

Numbers on the glucometer become hard to distinguish such as 6 & 8.

Normal Vision[2]

Stage 3: Proliferative[2]

Numbers on the glucometer will be obscured and assistance may be needed to read results.

Stage 4: Late Proliferative[2]

Numbers on glucometer are no longer distinguishable and assistance is required to read results.

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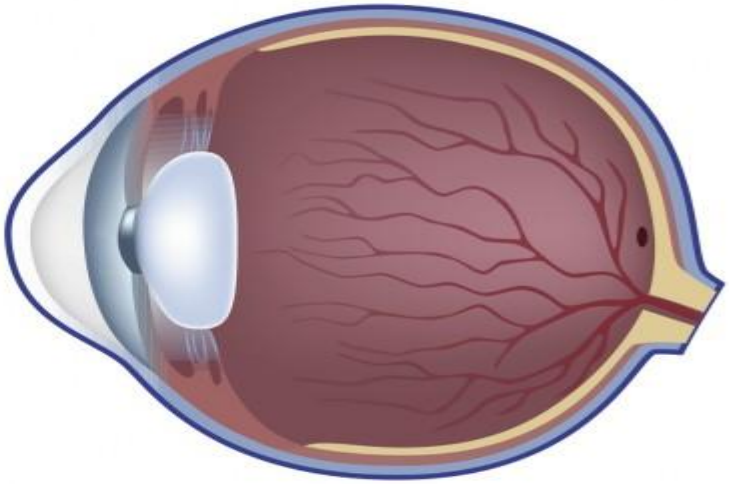
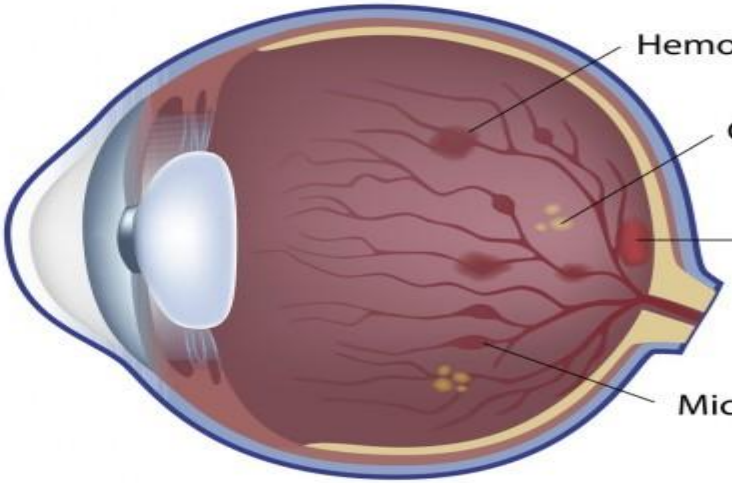
Normal

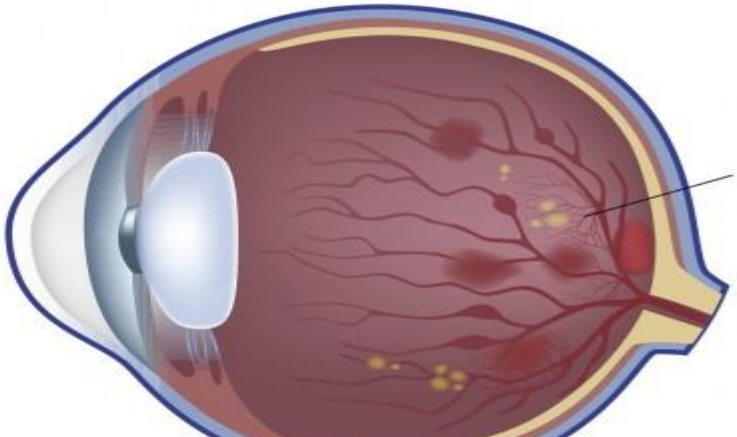


Diabetic Retinopathy

Nonproliferative Retinopathy



Proliferative Retinopathy



Diabetes is a form of accelerated Aging

- Cardiovascular ailments, such as heart attack, poor circulation in the legs, and atherosclerosis (a general term for several diseases characterized by thickening and hardening of the arteries), and stroke.
- Increased prevalence of certain types of cancer (pancreas, colon, and liver).
- Vision problems, including cataracts,
- glaucoma, and retinal degeneration.
- Impotence.
- Hearing loss.
- Memory loss or other cognitive impairment.
- Skin conditions, such as rashes, infections, thin skin, and discoloration.
- Loss of elasticity and flexibility of skin and other tissues.

Blindness

- Diabetes is the leading cause of new cases of blindness among adults aged 20–74 years.
- In 2005-2008,

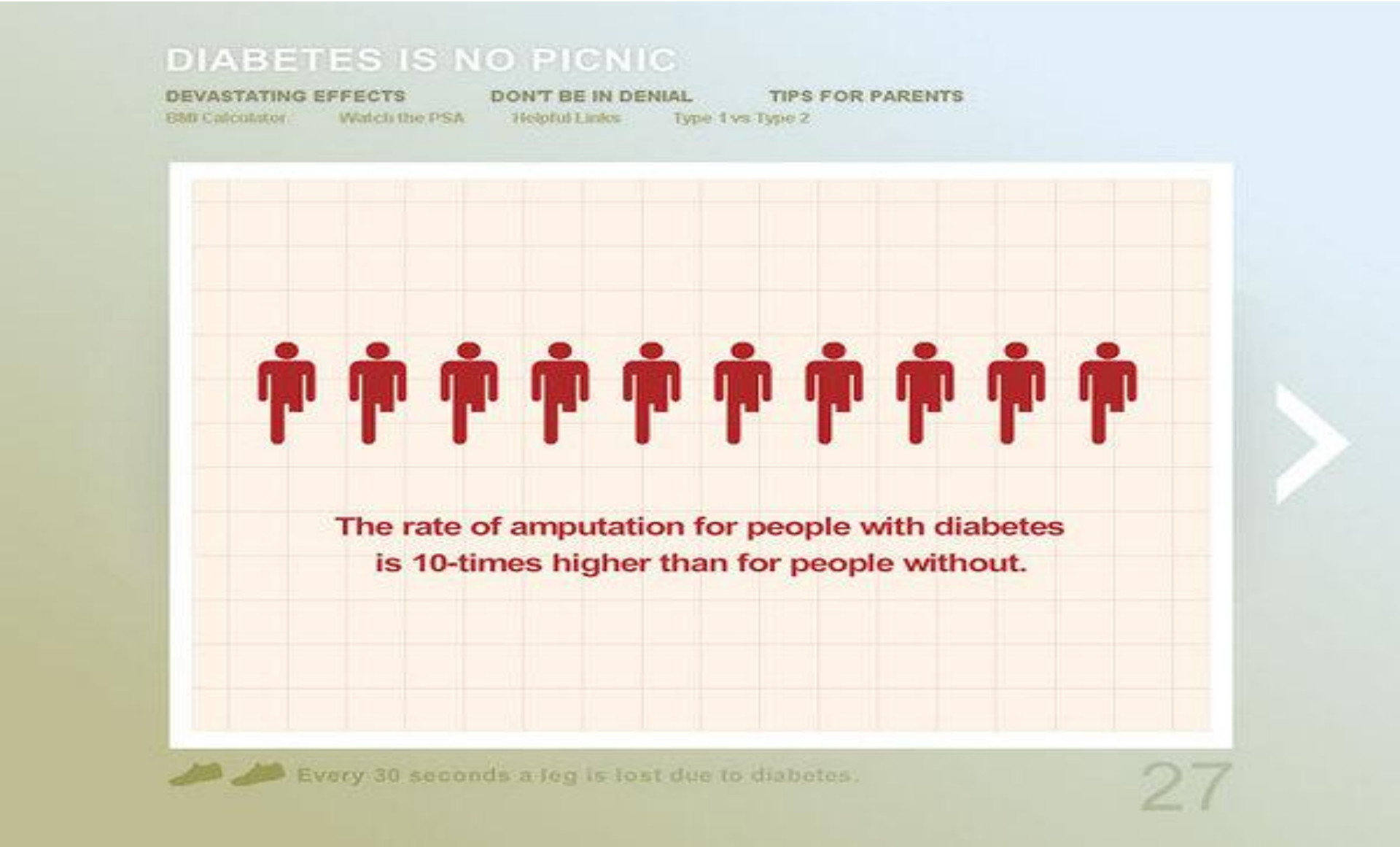
4.2 million (28.5%)

people with diabetes

aged 40 years or older

had diabetic retinopathy, and of these, almost 0.7 million (4.4% of those with diabetes) had advanced diabetic retinopathy that could lead to severe vision loss.

Amputation caused by diabetic foot



Just the Facts

Diabetes and Kidney Disease: The Stats

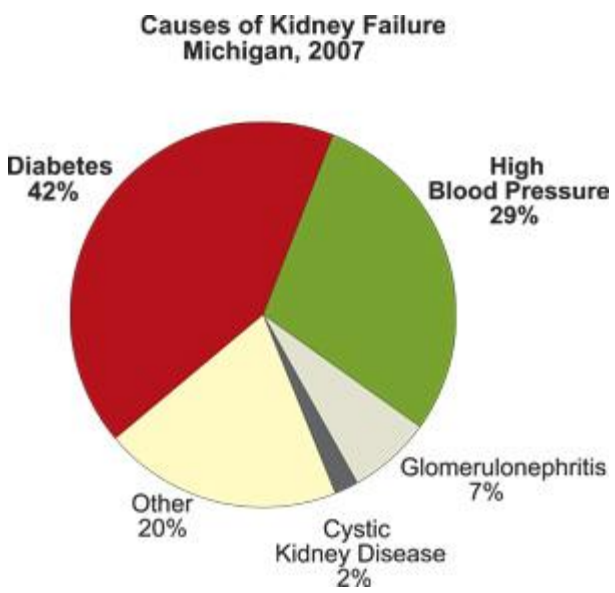
Diabetes is the leading cause of kidney failure, accounting for 44% of new cases in 2008.

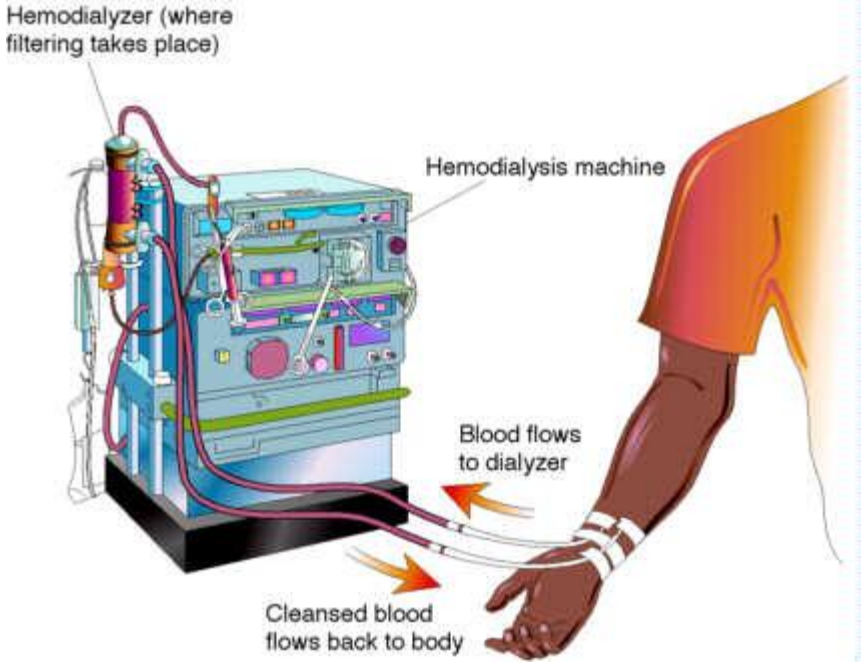
In 2008, almost 50,000 people with diabetes began treatment for end-stage kidney disease in the US.

In 2008, over 200,000 people with end-stage kidney disease due to diabetes were living on chronic dialysis or with a kidney transplant in the US.

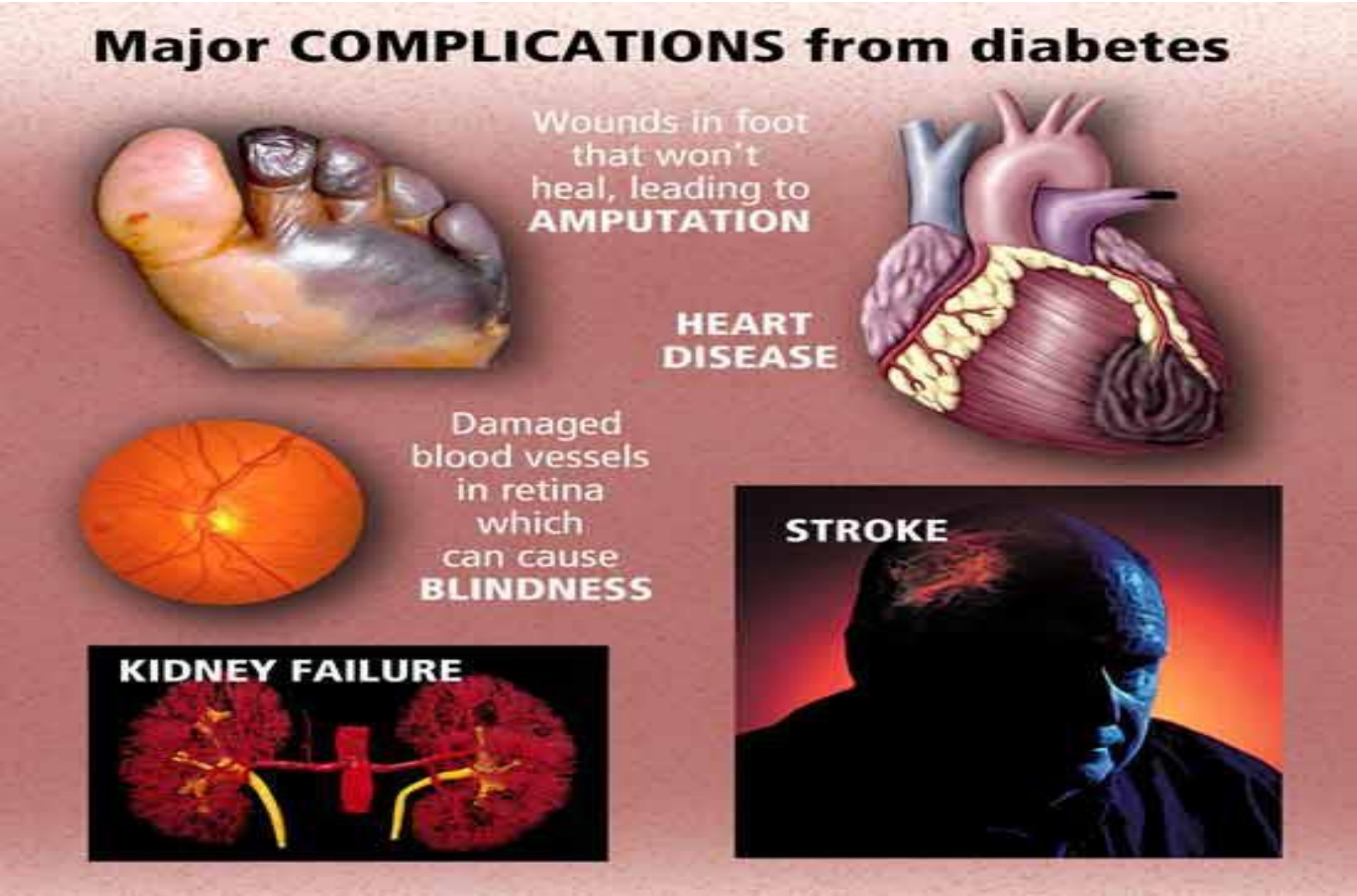
The main cause of Kidney Failure

- More than 200,000 diabetic patients lives on dialysis for life



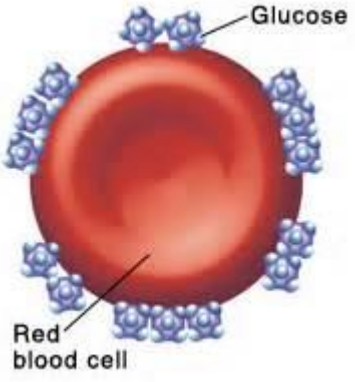


Dangers of high blood sugar



Sugar sticks to cell and converse to sorbitol

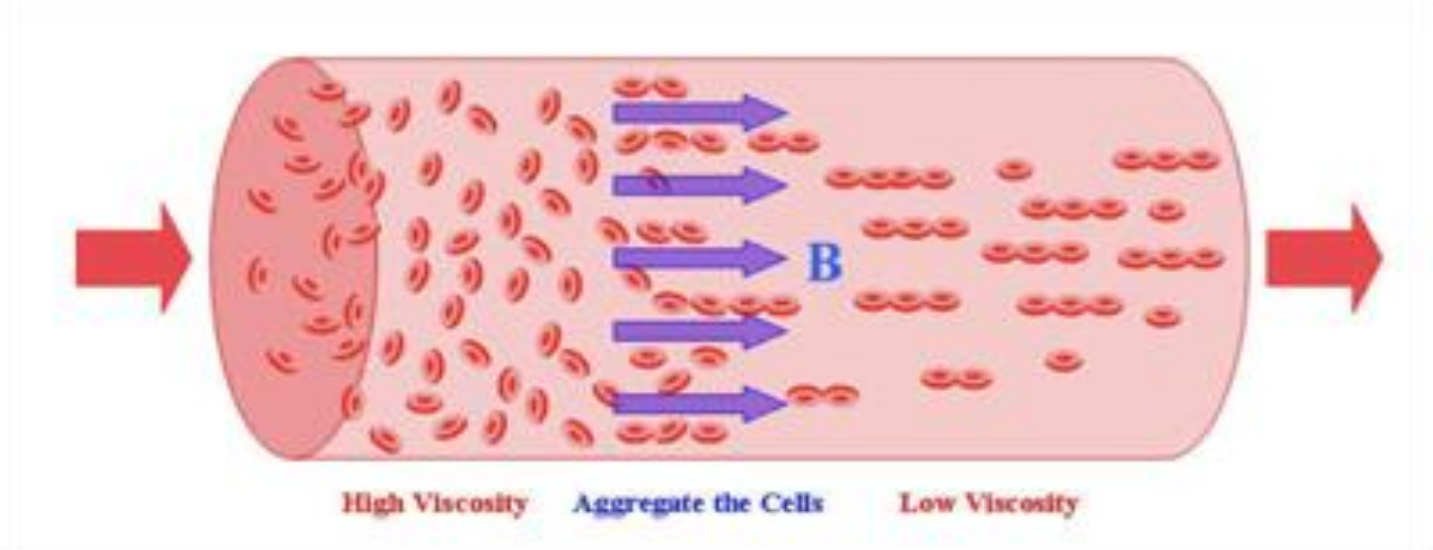
- A high rise in blood sugar levels causes sugar to stick on the surface of cells.
- Once stuck on the cells, sugar is converted to sorbitol, a sugar alcohol and cause dangerous complications over time.
- Since sorbitol can't exit from your cells very fast, and is not used in the body, it accumulates and attracts water.

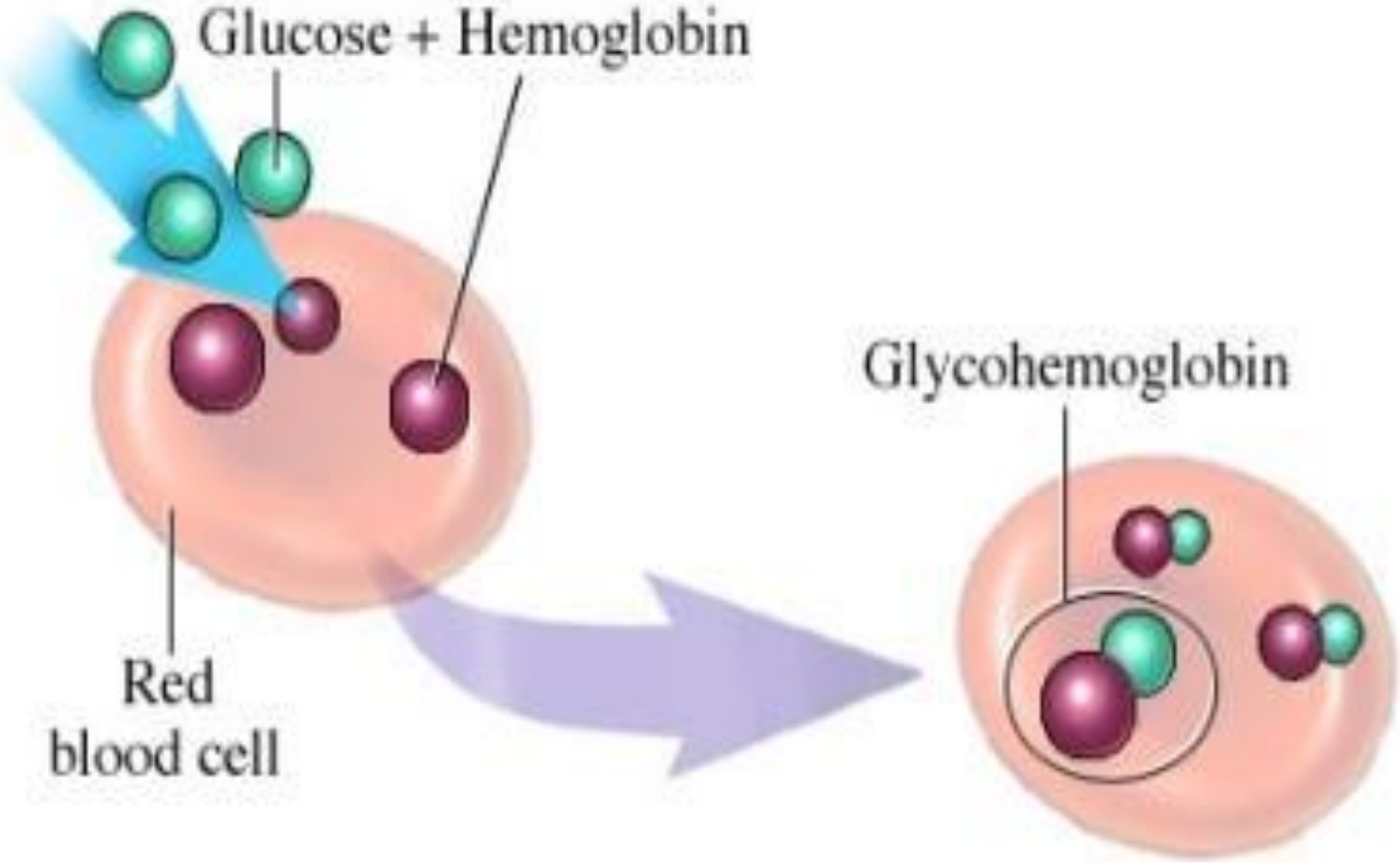


- This causes the cells to swell, which can result in nerve, eye, kidney and blood vessel damage, as well as development of cataracts.

Sticky blood

Excess sugar and fat in circulation increases blood viscosity, resist flowing movement. Heightened blood thickness and stickiness reduce oxygen delivery to body tissues, increase blood pressure and place extra burden to the heart.




Glucose + Hemoglobin
Red
blood cell
Glycohemoglobin

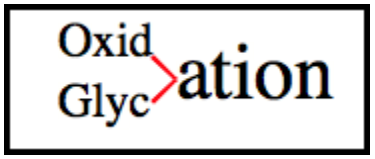
Glycation is aging and foundation of diabetic complications

- Glycation is a process by which proteins, certain fats, and glucose tangle together. It affects all body tissues, and tends to make them stiff and inflexible. In normal people, 5 percent of the total hemoglobin is glycosylated, or glycated, hemoglobin.
- When you have sugar molecules in your system, they bombard the body's cells like a meteor -shower—glomming onto fats and proteins in a process known as glycation. This forms advanced glycation end products (commonly shortened, appropriately, to AGEs), which cause protein fibers to become stiff and malformed.
- Once it has become glycated, the tissues start to produce ‘glycotoxins’, such as Advanced Glycation End-products – or AGEs, which are damaging to our cells. AGEs do this in two ways, both of which promote aging: they produce free radicals, and increase inflammation.

- To an extent, glycation is a fact of life. It's happening right now, to all of us. but high blood sugar accelerates this process;

Glycated proteins are debilitated

- Glycation is as detrimental for any molecules as its oxidation by free radicals.

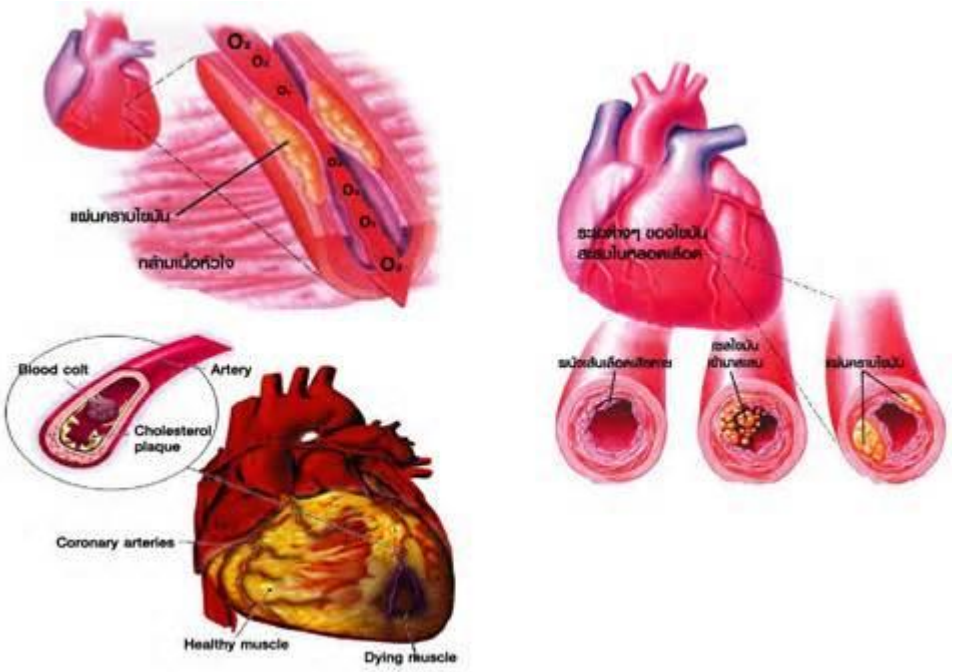


- Figure 1: Oxidation and glycation cause the same damage.
- Glycation triggers a cascade of chemical reactions that culminate in the formation, and eventual accumulation, of irreversible cross-links, the glycotoxins.
- Sugar “sticks” and molecules linked by random carbohydrate links lose their mobility, and their functions.

Glycation causes inflammation

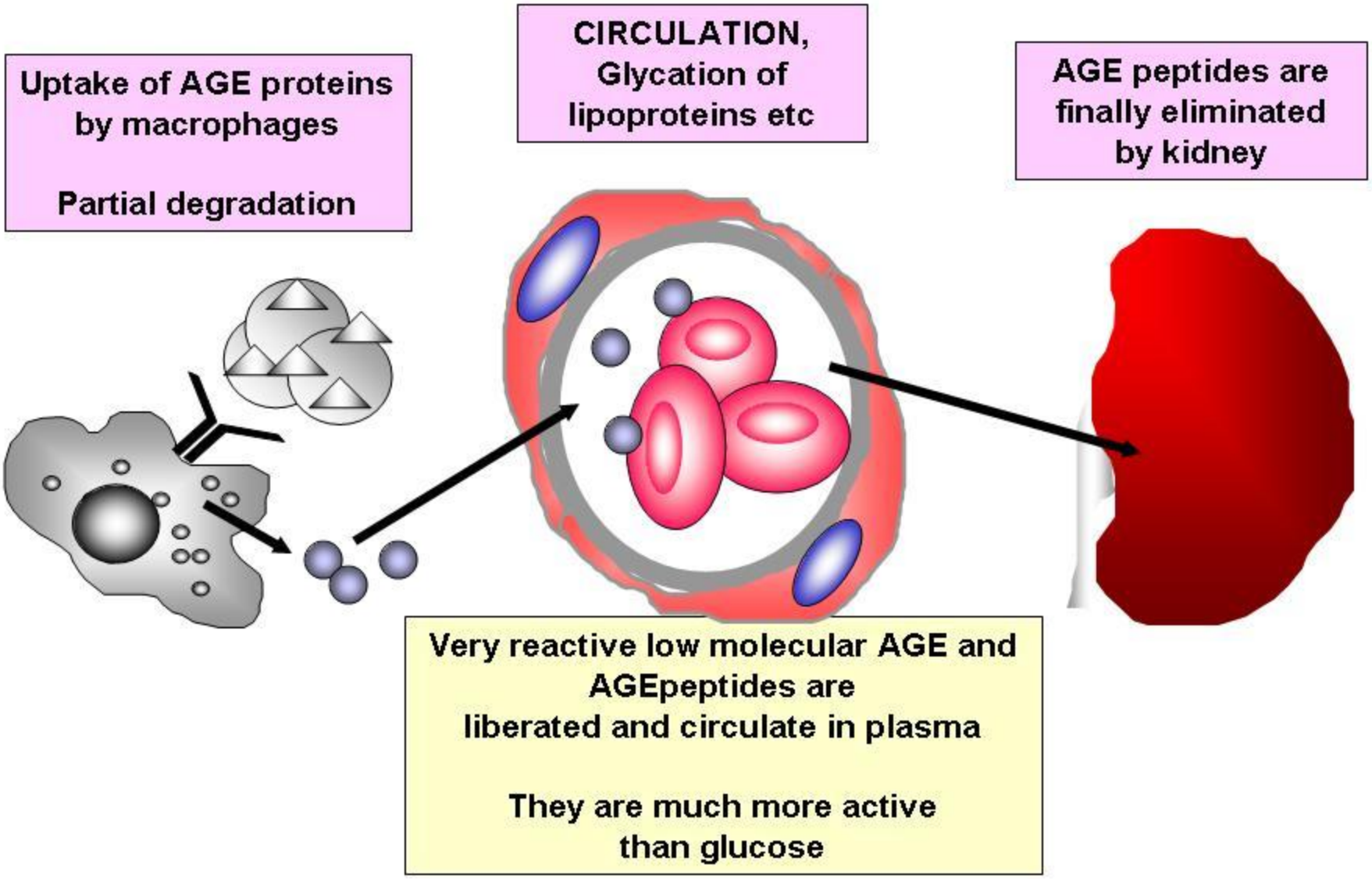
- Glycated molecules attract scavenger white blood cells.

  This initiates an inflammatory process to eliminate the damaged and useless molecules;



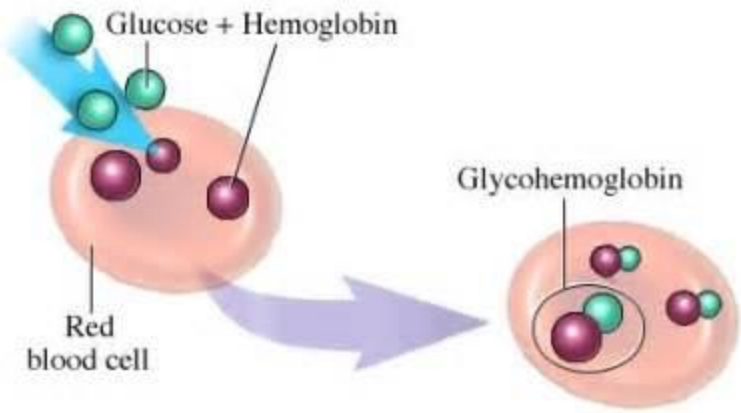
- <u>The glycation explains why people with hyperglycemia have more problems with chronic inflammation processes.</u>

Fig 7


Uptake of AGE proteins by macrophages
Partial degradation
CIRCULATION, Glycation of lipoproteins etc
AGE peptides are finally eliminated by kidney
Very reactive low molecular AGE and AGEpeptides are liberated and circulate in plasma
They are much more active than glucose

Damage to red blood cells

- Red blood cells exposed to hyperglycemia have their hemoglobin (L) altered by glycation (Hb A1c). Hb A1c is an irreversible stable product.The higher the plasma glucose, the higher the HbA1c.
- The function of hemoglobin in red blood cells is to carry oxygen. Glycated hemoglobin carries less oxygen;
- Glycated hemoglobin is wasted hemoglobin. The tissue and organs of people with high levels of glycated hemoglobin lack oxygen.



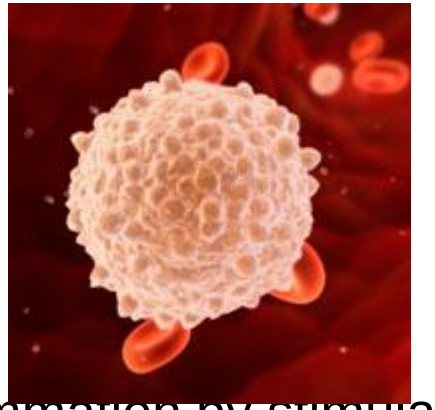
Damage by fructose

- Until recently it was believed that dietary fructose—as opposed to the glucose from starch and from sugar, may produce a lesser rise in plasma glucose. Based on the prevalent opinion that fructose was less detrimental, diabetics were encouraged to use fructose.
- However, demonstrated that in healthy volunteers, as well as in people with diabetes, fructose has a higher chemical affinity for proteins than the glucose molecule. Consequently, the random attachment of fructose to other molecules causes more damage than the random attachment of glucose.
- Aside from this fructose can not be used for energy unless is changed into glucose, which is a three step energy-driven reaction.

- Meanwhile fructose is easily changed into fat and stored as such in the liver.

Damage to white blood cells

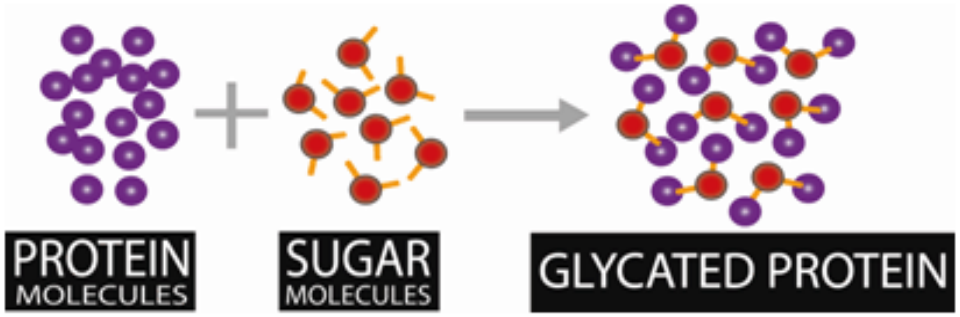
- Several experiments demonstrate the delirious effect of hyperglycemia on the number and the function of circulating white blood cells. Hyperglycemia disrupts the communications of white blood cells, reducing their functions. Glycation—induced by hyperglycemia, triggers inflammation by attracting scavengers cells.



- Hyperglycemia contributes further to inflammation by stimulating the production of pro-inflammatory prostaglandins (L), critical in the progressive development of heart disease, diabetes and obesity.

Glycation of collagen and elastin

- The proteins in skin most prone to glycation are the same ones that make a youthful complexion so plump and springy—collagen and elastin.

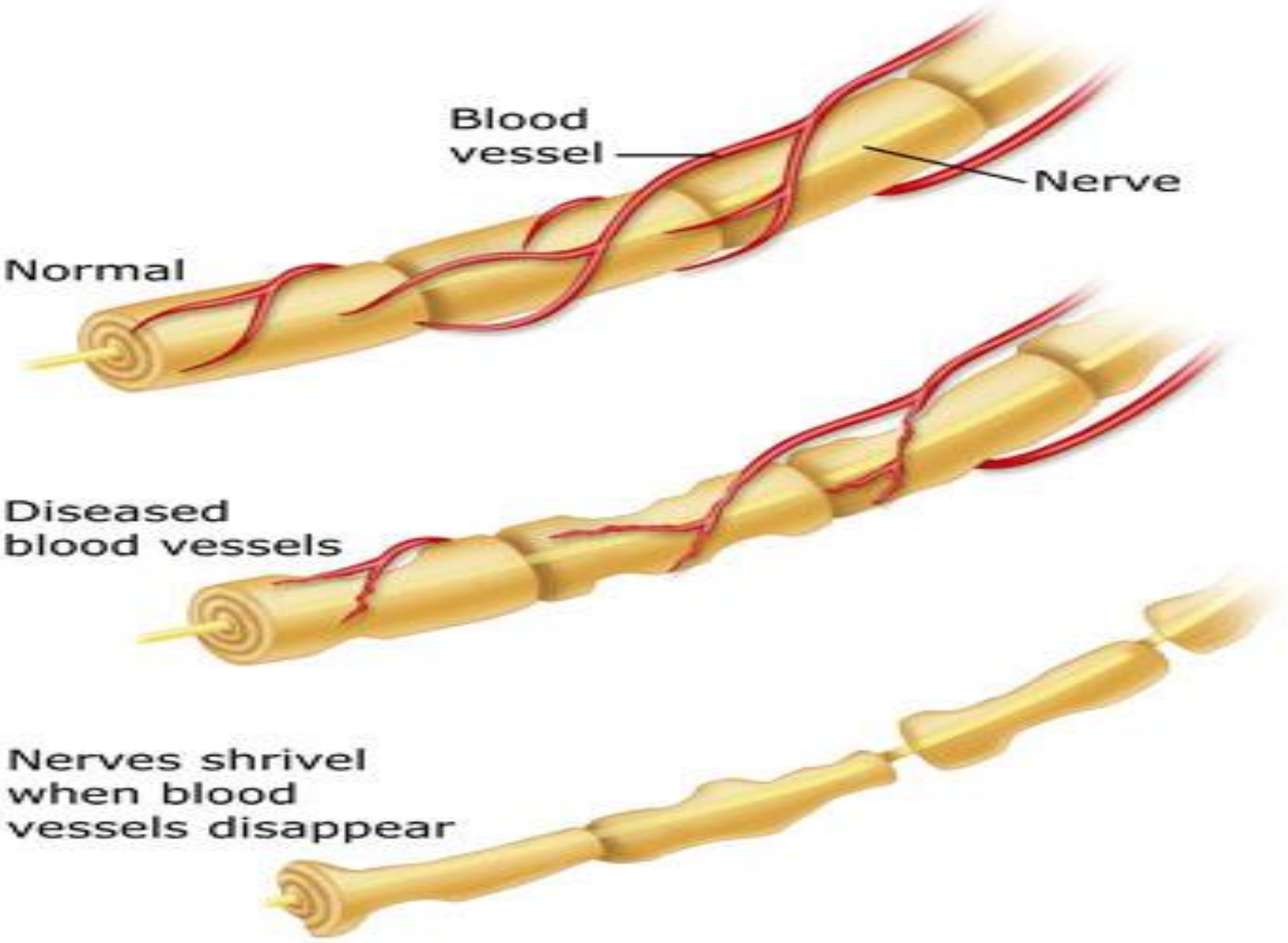


- When those proteins hook up with renegade sugars, they become discolored, weak, and less supple; this shows up on the skin's surface as wrinkles, sagginess, and a loss of radiance.

Glycation and glycotoxins lead to horrible diabetic complications

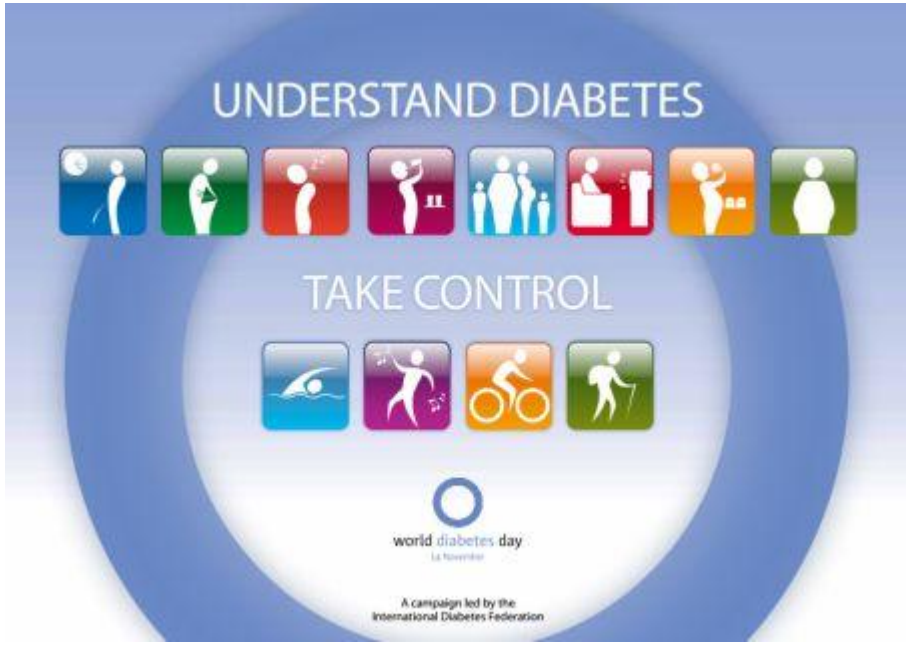
- Glycation, and the glycotoxins caused by it, are a major cause of the horrible side-effects of being diabetic- The connective-tissue damage and chronic inflammation resulting from diabetics' sustained high blood sugar can lead to debilitating conditions, such as cataracts, Alzheimer's, vascular tightening, and diseases of the kidneys and circulatory systems.

Diabetes Affects the Nerves



Affects babies

Act on Diabetes Now-protect our future



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