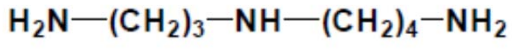
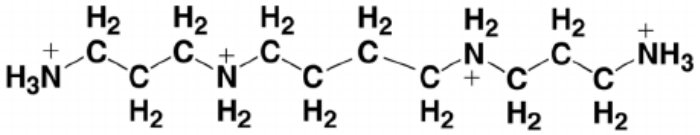
Polyamines

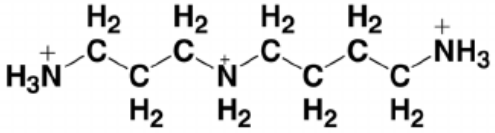
- *Nature*
- are a group of aliphatic amines
- derived from the decarboxylation of the amino acids arginine or ornithine.
- The conversion of the diamine **putrescine** to the triamine **spermidine** and the quaternaryamine **spermine** involves the decarboxylation of S-adenosylmethionine.



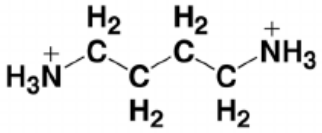
SPERMIDINE



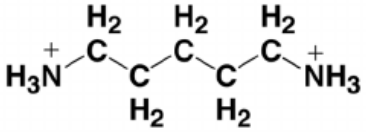
spermine



spermidine



putrescine



cadaverine

- *Sites of biosynthesis*

It appears that polyamines are present in all cells rather than having a specific site of synthesis

- *Transport*

- *Effects*
- *Polyamines have a wide range of effects on plants and appear to be essential for plant growth, particularly cell division and normal morphologies*

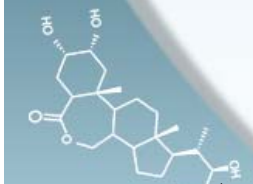
براسینو استروئیدها (Brassinosteroids)

Mitchell et al (دهه ۱۹۶۰)

- ✓کار روی دانه گرده
- ✓عصاره دانه گرده حدود ۳۰ گونه گیاهی باعث افزایش رشد دومین میانگره لوبیا شد.
- ✓عصاره گرده توسکا قشلاقی (*Alnus glutinosa*) و شلغم روغنی یا کلزا (*Brassica napus*) منجر به شکافته شدن دومین میانگره لوبیا شد.
- ✓آن عصاره را brassins نام نهادند: عصاره خام لیپیدی از دانه گرده شلغم
- ✓برای جداسازی ماده موثره brassins، ۵۰۰ پوند دانه گرده شلغم جمع آوری و ۱۰ میلی گرم ماده فعال کریستاله بدست آمد.

Grove et al (1979)

- ✓Brassinolide را بعنوان ماده فعال brassins شناسائی کردند.
- ✓براسینولید اولین PGs است که ساختمان استروئیدی دارد (دارای ۴ حلقه و ۲۷ کربن)
- ✓**براسینولید در گیاهان دیگر به مرور کشف شد.**

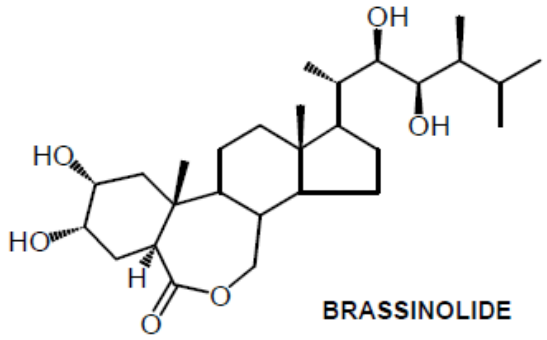


brassinolide

Cutler et al (1991)

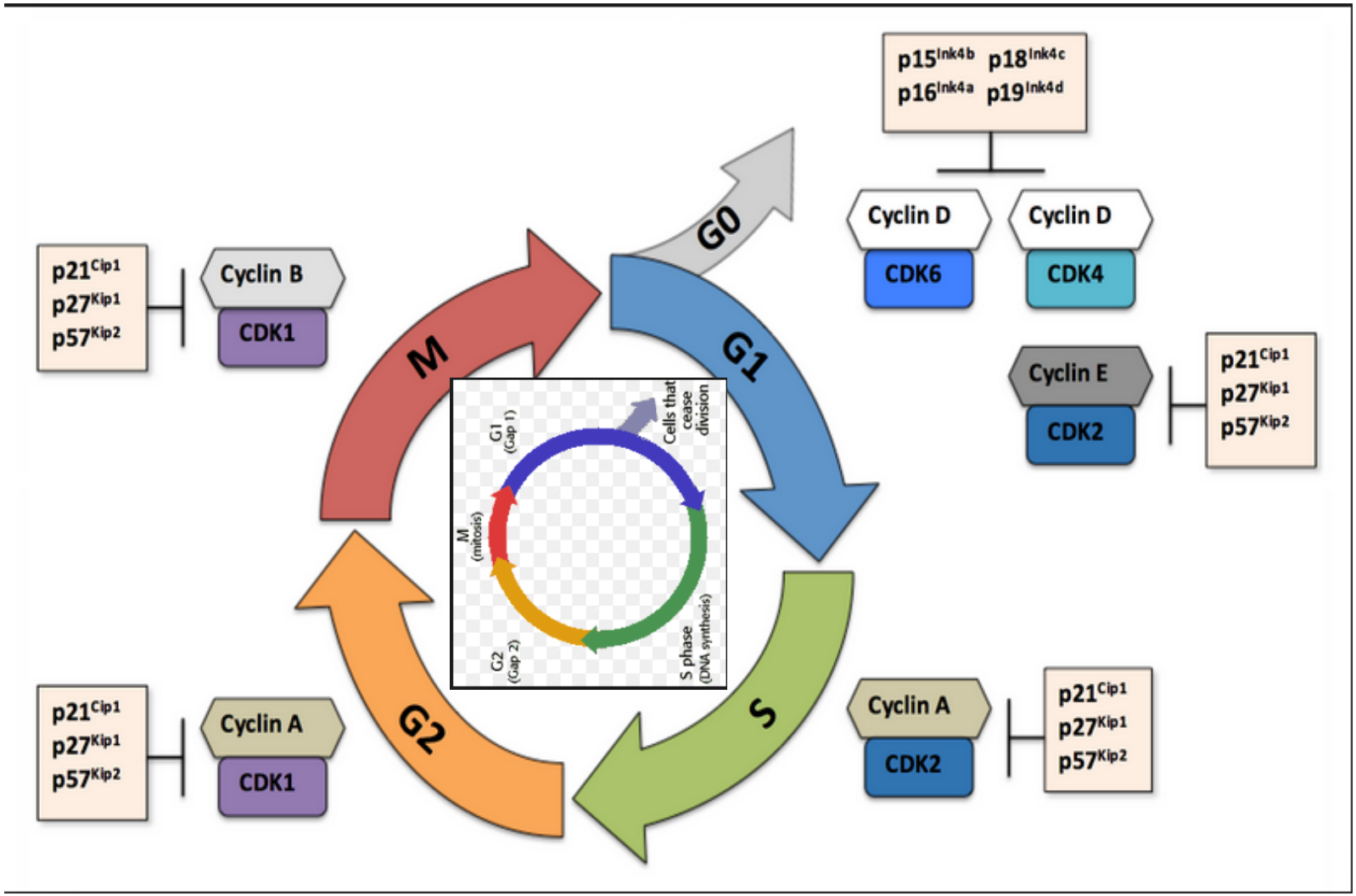
- ✓براسینواستروئیدها یک گروه از ترکیبات استروئیدی هستند که اثراتی مشابه براسینولید روی دومین میانگره لوبیا داشته و بطور وسیعی در گیاهان وجود دارند و اثرات متعددی روی رشد و نمو دارند.

Brassinosteroids



BRASSINOLIDE

- *Effects*
- *Cell Division.*
- *Cell elongation.*
- *Vascular differentiation.*
- *Fertility.*
- *Inhibition of root growth and development.*
- *Promotion of ethylene biosynthesis and epinasty.*

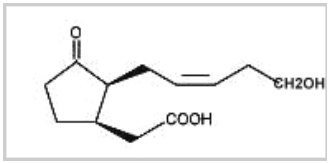

p15Ink4b p18Ink4c
p16Ink4a p19Ink4d
G0
Cyclin D
CDK6
Cyclin D
CDK4
G1
Cyclin E
CDK2
p21Cip1
p27Kip1
p57Kip2
S
Cyclin A
CDK2
p21Cip1
p27Kip1
p57Kip2
G2
Cyclin A
CDK1
p21Cip1
p27Kip1
p57Kip2
M
Cyclin B
CDK1
p21Cip1
p27Kip1
p57Kip2
G1 (Gap 1)
Cells that cease division
S phase (DNA synthesis)
G2 (Gap 2)
M (mitosis)

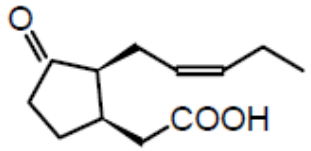
- Expansins comprise a large gene super-family which codes for small (225–300 amino acid residues) cell wall proteins (Fukuda 2014; Sampedro and Cosgrove 2005).
- Expansins have the ability to non-enzymatically trigger a pH dependent relaxation of the cell wall which loosens and softens it thus enabling cell expansion. It has been noted that due to the action of expansins, growing plant cell walls extend faster at low pH (4.5), a phenomenon which Rayle and Cleland (1992) preferred to call acid growth.
- besides pH, the action of expansins can also be influenced by several other factors including environmental factors (Brummell et al. 1999) such as flooding (Vreeburg et al. 2005) or submergence (Lee and Kende 2001) and hormones like abscisic acid, indole-3-acetic acid (Zhao et al. 2012), auxins (McQueen-Mason et al. 1992), brassinosteroids (Park et al. 2010), cytokinins (Downes and Crowell 1998) and ethylene (Belfield et al. 2005).

- Xyloglucan is intimately associated with cellulose microfibrils by hydrogen bonding, thus protects the cell wall from collapsing due to osmotic stress. In addition to this structural function, xyloglucan also has a role in the regulation of cell enlargement during plant growth. Auxin, a hormone coordinating plant development, induces the degradation of xyloglucan into smaller oligosaccharides, which results in the loosening of the cellulose-xyloglucan network and allows the turgor driven expansion of the cell wall.
- The strong hydrogen bonding between cellulose and xyloglucan makes the extraction of xyloglucan from the cell wall difficult.
- Enzymatic degradation of the xyloglucan by xyloglucanases could potentially improve the overall hydrolysis of lignocellulosic substrates by enabling cellulases to hydrolyze the cellulose polymer more efficiently.

Jasmonates

- *Nature*
- are represented by jasmonic acid (JA) and its methyl ester.
- They are named after the jasmine plant.
- There is also a related hydroxylated compound that has been named tuberonic acid.





JASMONIC ACID

- *Biosynthesis*
- Jasmonic acid is synthesized from linolenic acid
- jasmonic acid is most likely the precursor of tuberonic acid

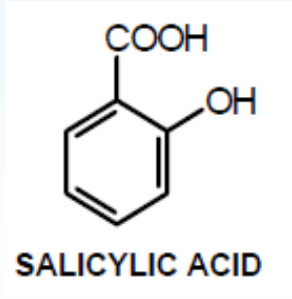
- *Effects*
- Jasminates play an important role in plant defense.
- Jamonates inhibit many plant processes.
- They promote senescence, abscission, tuber formation, fruit ripening, pigment formation and tendril coiling.
- JA is essential for male reproductive development of *Arabidopsis*.

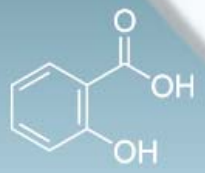
سالیسیلات ها (Salicylates)

- ✓ **یونانیان قدیم و سرخپوستان آمریکائی متوجه شده بودند که برگ و پوست درخت بید دردهای جزئی و تب را معالجه می کند.**

Johann Buchner (1828)

- ✓اولین کسی بود که مقدار جزئی salicin را استخراج کرد که گلوکزاید سالیسیل الکل بود و بعداً معلوم شد سالیسیلات اصلی در پوست بید می باشد.





salicylic acid

Raffaele Piria (1838)

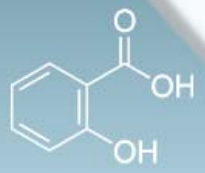
✓ماده موثره در پوست بید را سالیسیلیک اسید Salicylic acid (SA) نامید.

✓نام لاتین درخت بید (Willow tree) ، Salix می باشد.

(1878) – اولین تولید تجاری SA در آلمان شروع شد.

(1898)– شرکت بایر آسپرین aspirin که نام تجاری Acetylsalycylic acid (ASA) است را ساخت.

– استفاده از آسپرین به جای SA



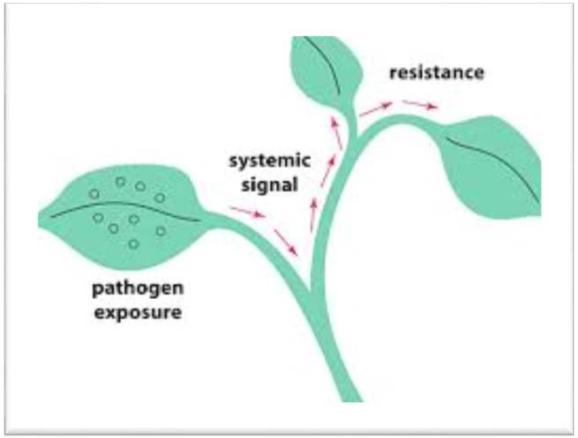
salicylic acid

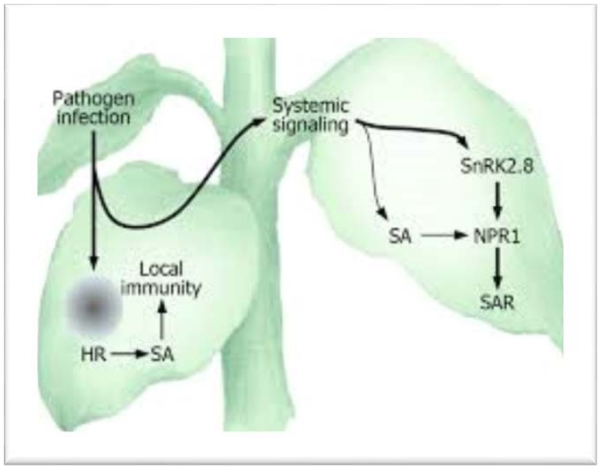
Salicylates

- *Biosynthesis*
- *biosynthesized from the amino acid phenylalanine*

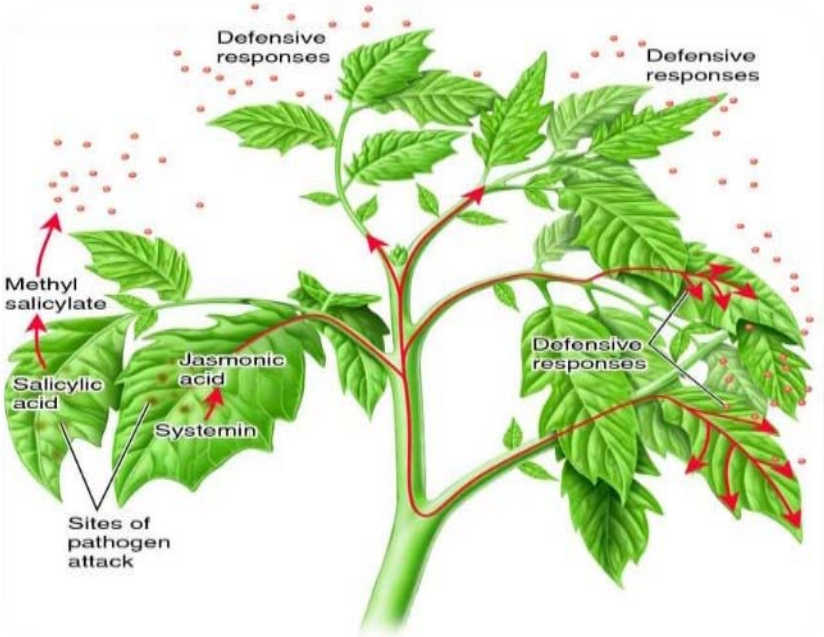
- *Effects*
- plays a main role in the resistance to pathogens.
- SA is the calorigenic substance.
- enhances flower longevity, inhibits ethylene biosynthesis and seed germination, blocks the wound response, and reverses the effects of ABA.

The term “pathogenesis-related proteins” means a group of proteins induced in a plant in response to fungal, bacterial, viral, and viroid diseases, as well as to some chemicals.





SYSTEMIC ACQUIRED RESISTANCE

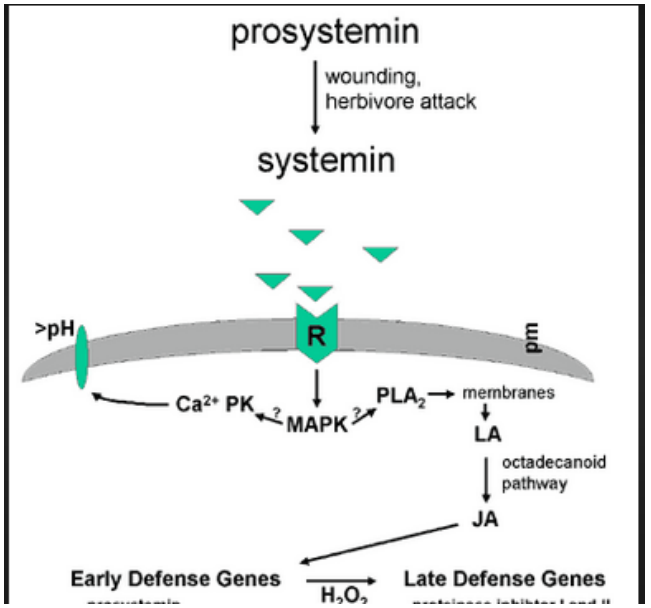


Submitted to : Dr. KP Singh
Department of Plant Pathology

Sudha Nandini Sharma
Ph.D (Plant Pathology)
Id : 43970

Signal Peptides

- *Nature*
- started with the discovery of systemin.
- Since then, over a dozen peptide hormones that regulate various processes involved in defense, cell division, growth and development and reproduction have been isolated from plants, or identified by genetic approaches



- *Effects*
- The activation of defense responses.
- The promotion of cell proliferation of suspension cultured plant cells.
- The determination of cell fate during development of the shoot apical meristem.
- The modulation of root growth and leaf patterning in the presence of auxin and cytokinin.
- Peptide signals for self-incompatability.
- Nodule formation in response to bacterial signals involved in nodulation in legumes.