MED437
KING SAUD UNIVERSITY

MICROBIOLOGY
437

Microbiology – Lecture 11
Diversity of Fungi and Fungal Infections

TEAM 437

Red: important
Green : doctor notes
Black : original slides
Grey: extra information

In this link, you will find any corrections or notes unmentioned in the team's work. Please check the link below frequently.

https://docs.google.com/presentation/d/1yIQt3G8UDFG6xYMRhXkTk-dS54NeTfhJaPe_y0M-kjk/edit?usp=sharing

Objectives

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1. To provide students with an overview of the common medically important yeasts and mold fungi.

2. To provide students with an overview of the major fungal diseases that threatens human health.

3. To give a fundamental knowledge about the antifungal agents, their mechanisms of action, and spectrum.

Mycotic Diseases

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Mycotic diseases

Hypersensitivity (Allergy)

- People exposed to fungi and develop allergies in skin, lungs, and sinuses… e.g. (Sinusitis)

Mycotoxicoses

- Some produce toxins, others are toxic e.g. (Mushrooms)

Infections

How the infection is acquired?

- Endogenous, colonization (overgrowth of Normal Flora)
- Inhalation (Airborne)
  - Like Spores.
  - Most common method
- Contact
- Trauma

Types of fungal infections (Mycoses)

Different Fungi in patient depending on the Immune system

- Immuno-Competent Host
  - Superficial Mycoses
  - Cutaneous Mycoses
  - Subcutaneous Mycoses
  - Systemic Mycoses
- Immuno-Compromised Host
  - Opportunistic Mycoses

Types of fungal infections (Mycoses)

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Superficial Mycoses (usually mild)

- Affect the outer layer of the skin or hair shaft.
  - Very common
- No immune response - No Inflammation e.g. (redness or itching)

Cutaneous Mycoses (May produce toxins)

- Also called Dermatophytosis
- Infection of the skin, hair or nails caused by a group of keratinophilic fungi, called dermatophytes
- Usually affect Keratinized tissue
  - Will cause inflammation (unlike superficial)

Subcutaneous Mycoses (Deep)

- **Fungal infections involving the dermis, subcutaneous tissues, muscle and may extend to bone**
- Usually they are initiated by trauma.
  - plant material (usually)
- -Usually affects farmers or gardeners

Primary Systemic Mycoses

- -Caused by primary pathogens
  - contracted by inhalation, start as respiratory disease
- -Geographically restricted (endemic) ,north and south America
- -In some cases diseases will spread

Opportunistic fungal infections mold

- -Diseases in immunocompromised host
  - Risk factor: it makes host more sensible to fungal disease
- -Examples: HIV/AIDS, Solid organs transplantation, Malignancies(cancer), Neutropenia, Diabetes
- And Hematopoietic stem cell transplant (HSCT)

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The Fungi

A- Opportunistic Fungi

Normal Flora	- Candida spp. - Other yeast
*Ubiquitous in our environment (Molds)	- Aspergillus spp. - Zygomycetes spp.
*Other Fungi	

B- Primary Pathogens

Dermatophytes

Endemic geographically restricted

- Histoplasma spp.
- Blastomyces spp.
- Coccidioides spp.
- Paracoccidioides spp.

Dimorphic

Diagnosis of Fungal Infection

Clinical features (clinical presentation)	Imaging	Lab Investigations
History, risk factors, etc.	Good value in diagnosis and therapy monitoring	-Histopathology (To see any cellular changes) -Microbiology (To see any Fungai grow)

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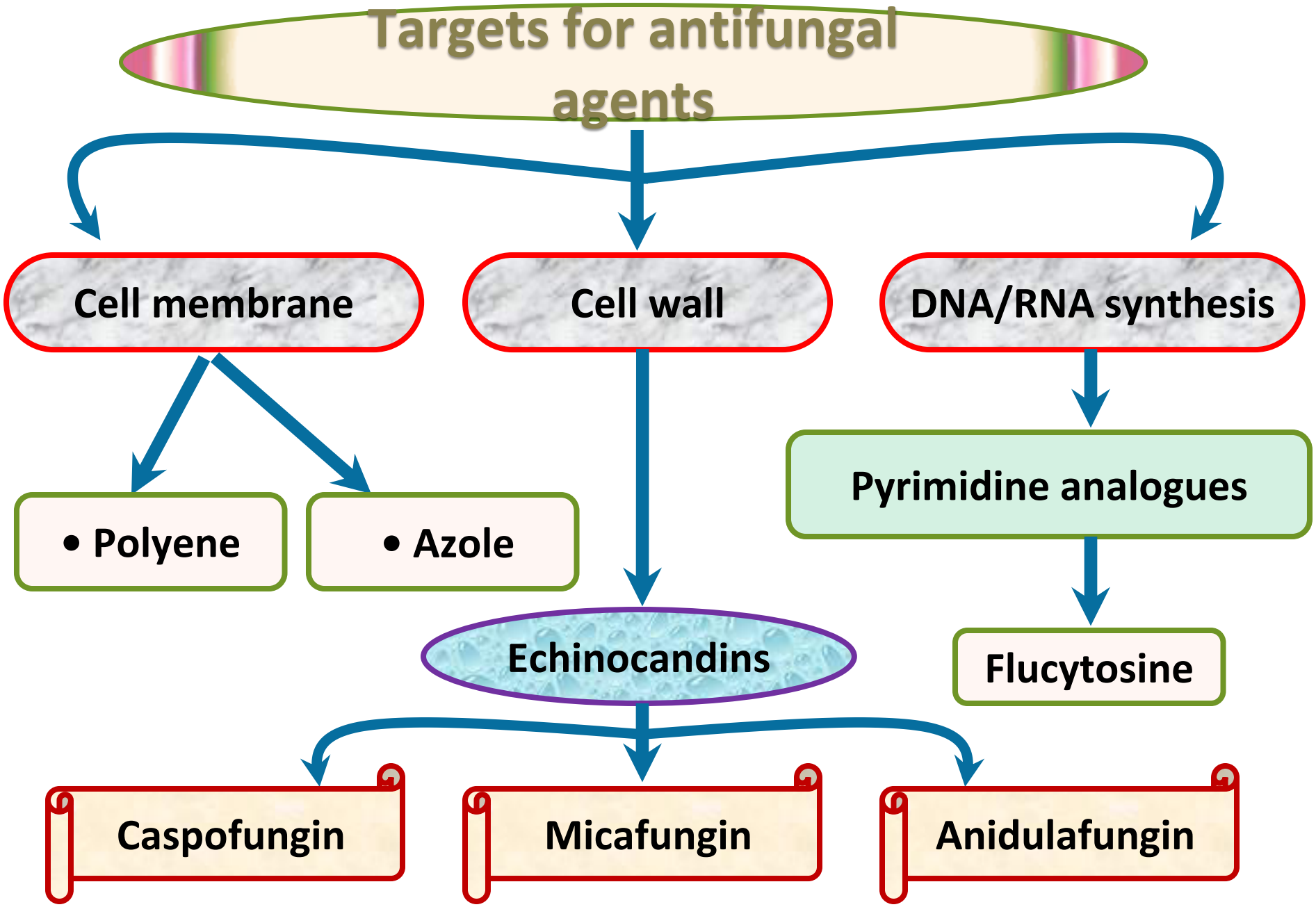
Targets for antifungal agents
Cell membrane
Cell wall
DNA/RNA synthesis
• Polyene
• Azole
Pyrimidine analogues
Echinocandins
Flucytosine
Caspofungin
Micafungin
Anidulafungin

polyenes (cell membrane)

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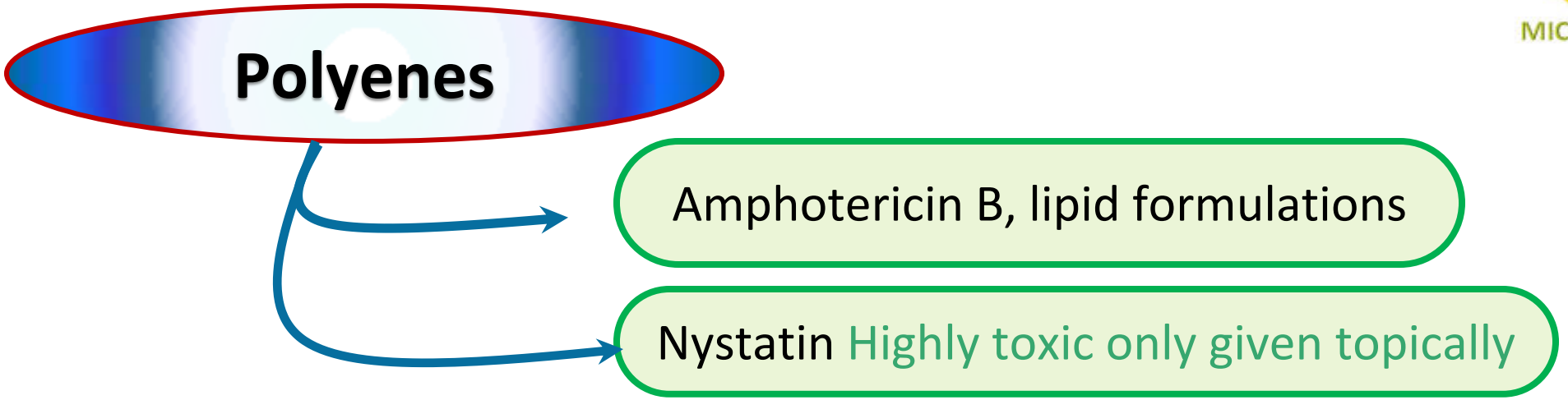

Mechanism of Action Amphotericin B (MOA):

- Binds to ergosterol within the fungal cell membrane resulting in formation of pores which permit leakage of intracellular contents, and lead to death .

- Amphotericin B (given systemically) has an broad antifungal spectrum which includes most fungi that cause human disease

Azoles (cell membrane)

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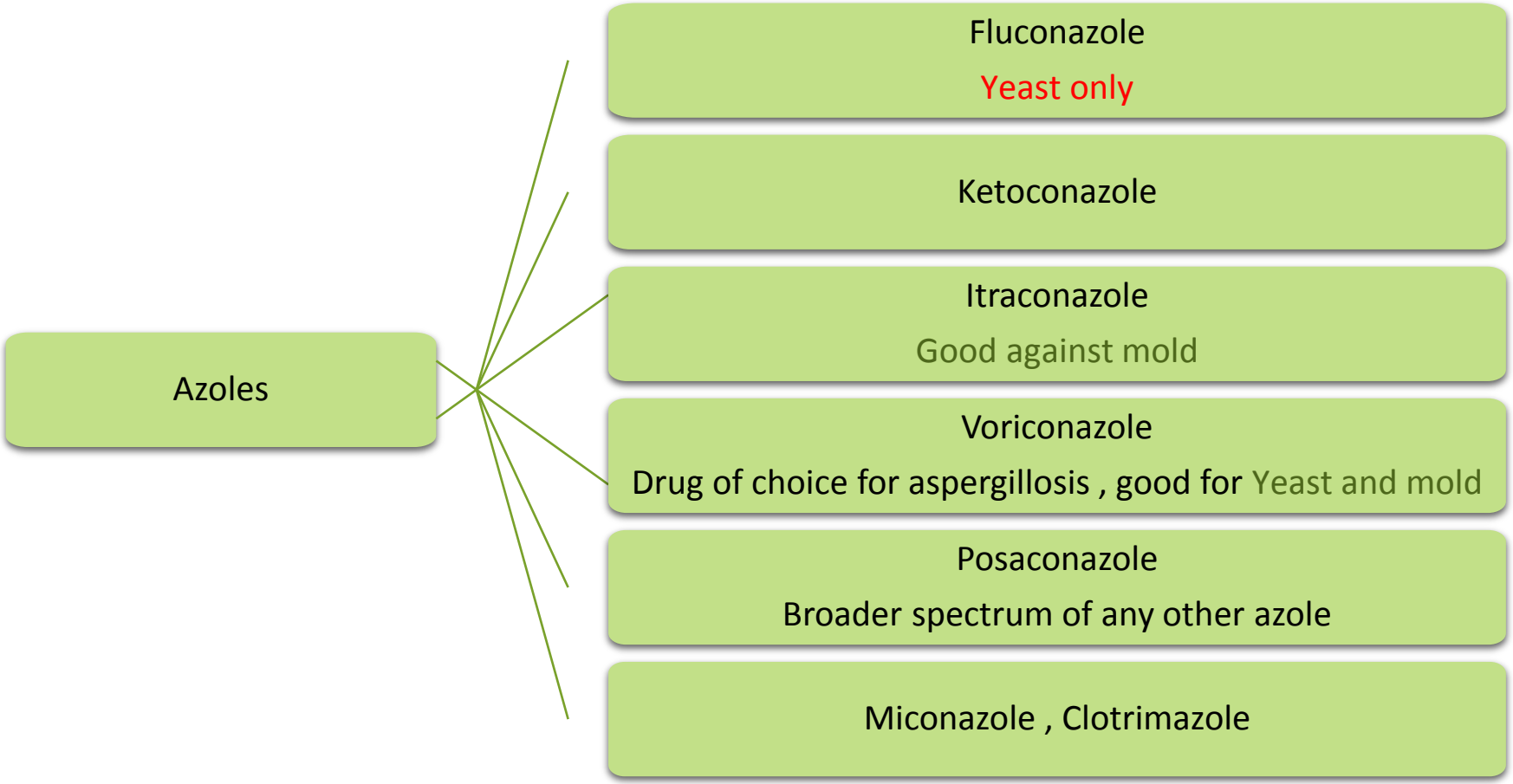
Mechanism of Action :

- They inhibit the synthesis of ergosterol , the major sterol of fungal cell membrane.
- They lead to fungistasis (the inhibition of the growth of the fungi).
- Azoles are not effective against non-septated fungal hyphae (Zygomycetes) and amphotericin B should be used instead.



Flucytosine (DNA/RNA synthesis)

✓ **Mechanism of Action :**

- Fungal RNA miscoding.
- Interfering with DNA synthesis.

✓ Spectrum of Activity (Restricted spectrum of activity)
Active against :

- Candida species
- Cryptococcus neoformans

Monotherapy : now limited (resistance)
Cannot be used alone because fungi develop resistance.
So its used in combination therapy because of it resistance and toxicity

Echinocandis (cell wall)

- Capsofungin
- Micafungin
- Anidulafungin

✓ **Mechanism of Action :**

- Inhibits B-1,3-D glucan synthase , the enzyme complex that forms glucan polymers in the fungal cell wall.
- Glucan polymers are responsible for providing rigidity to the cell wall.
- Without glucan the cells cannot grow and survive.

✓ **Good Activity Against** :

- *Candida* spp
- *Aspergillus* spp

Not effective against other types of fungi less toxicity & side effects than azoles & amphotericin B

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Target	Group	Mechanism of action	Antifungal Agents	Spectrum of activity	Comments
Cell membrane	Polyenes	Binds to ergosterol within cell membrane, formation of pores which lead to cell death	Amphotericin B, Nystatin	Broad antifungal spectrum which includes most fungi	Serious toxic side effects (nephrotoxicity) Toxic to kidney
	Azoles	Inhibit the synthesis of ergosterol	Fluconazole Itraconazole Voriconazole Miconazole clotrimazole	**Fluconazole** has a limited or no activity against mold fungi **Voriconazol** is the drug of choice for Aspergillosis	Not effective against zygomycosis (except posaconazole) Adverse Effects Drug Interactions Toxic to liver
Cell wall	Echinocandins	Inhibits glucan synthasis, (glucan polymers in the fungal cell wall)	Caspofungin Micafungin Anidulafungin	Good activity against *Candida spp ,Aspergillus spp* Limited or no activity against other fungi	Less toxicity and side effects compared to amphotericin B and azoles
DNA/RNA synthesis	Pyrimidine analogues	Fungal RNA miscoding Interfering with DNA synthesis	Flucytosine	Restricted spectrum of activity *Candida* species *Cryptococcus neoformans*	Monotherapy now limited (Resistance)

Questions

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1-How are mycotic diseases acquired?

Ans:……..

2- affect the outer layer of the skin:

A-systemic mycoses B-cutaneous mycoses C-superficial mycoses

3-fungal infection usually initiated by trauma:

A-subcutaneous mycoses B-opportunistic mycoses C-cutaneous mycoses

4-fungal infection that starts as a respiratory disease:

A-primary systemic mycoses B-opportunistic mycoses C-superficial mycoses

5-in what labs are fungal diseases diagnosed:

Ans:……

6- an anti fungal agent that target the cell membrane:

A-Echinocandins B-polyene C-flucytosine

7- has a broad antifungal spectrum which includes most fungi that cause human diseases:

Ans:…..

8- an antifungal that interferes with DNA synthesis:

A-Flucytosine B-Azoels C-polyenes

9- an antifungal the inhibits the synthesis of ergosterol:

A-pyrimidine analouges B-polyenes C-Azoles

10- name the types of fungal infections

Ans:……

Video and answers

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Useful video: https://www.youtube.com/watch?v=m4DUZhnNo4s

1-colonization,inhalation,contact,trauma

2- B-superficial mycoses

3-A-subcutaneous mycoses

4- A primary systemic mycoses

5- histopathology and microbiology

6- B-polyene

7- Amphotericin B

8-flucytosine

9- C-azoles

10- superficial mycoses ,cutaneous mycoses ,subcutaneous mycoses ,systemic mycoses ,opportunistic mycoses

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Team members:

محمد الدويغري	فهد الفايز	الهام العلامي
داود إسماعيل	سعد الهداب	رناد المقرن
عمر الفوزان	خالد الدوسري	هديل عورتاني
عبدالله الزهراني	خالد المطيري	اسراء النزاوي
معن شكر	أنس السيف	لمياء القويز
عبدالمجيد الوردي	عبدالجبار اليماني	شوق القحطاني
محمد إبراهيم	عبدالله السرجاني	نورة القاضي
عمر السحيباني	عبدالعزيز الدخيل	افنان المصطفى
سيف المشاري	عادل العريني	رهف الشمري
حسين علامي	سعد العقيلي	الهنوف الجلعود
	فهد الشغيرثي	

Team leaders:

غادة الحيدري ، علي شحادة

For any corrections, suggestions or any useful information please contact us at:
Micro.437@hotmail.com