

FRCPath Part 2—Revision Notes on *Aspergillus* spp.

(Oxford Textbook of Medical Mycology, Ch 10)

1. Genus at a glance

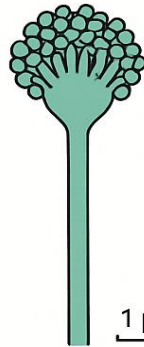
- **> 200 species; > 30 human pathogens**—among the most ubiquitous environmental moulds; conidia inhaled daily.
- Characteristic **aspergillum** (asexual conidial head); despite known teleomorphs, the 2012 “one-fungus-one-name” rule retains *Aspergillus* nomenclature .
- **Commercial uses:** *A. niger* → citric-acid & enzyme production; *A. oryzae* → sake/soy fermentation .

2. Key species, temperatures, toxins & clinical points

Species (complex)	Opt. Temp / Range (°C)	Colony / Microscopy	Major toxin	Salient clinical facts
<i>A. fumigatus</i>	37 / 12-65	Green-blue; columnar uniseriate heads	—	Commonest invasive isolate ; ABPA, CPA
<i>A. flavus</i>	37 / 12-48	Green-yellow; radiate uni/bi-seriate	Aflatoxin	Sinusitis, keratitis, aflatoxicosis risk
<i>A. niger</i>	37	Black biseriate heads	—	Otomycosis, onychomycosis
<i>A. terreus</i>	25-40	Beige; biseriate + accessory conidia	Ochratoxin	Intrinsic AmB-R
<i>A. nidulans</i>	37 / 2-48	Green with red-brown cleistothecia	—	CGD infections; AmB-R
<i>A. versicolor</i>	22-26 (opt); ≤40	White→yellow/green; penicillium-like	Sterigmatocystin	Onychomycosis; grows best at room-temp
<i>A. clavatus</i>	37	Long club-shaped vesicle	—	Extrinsic allergic alveolitis (“malt-worker’s lung”)

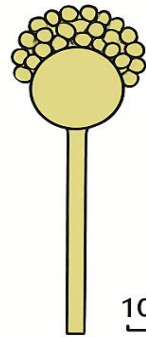
Memory hook: *A. fumigatus* thermotolerant to 65 °C; *A. versicolor* prefers ~25 °C—good MCQ bait .

Aspergillus species



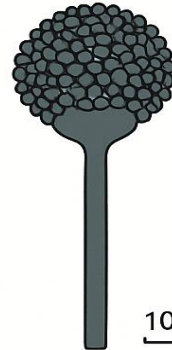
A. fumigatus

- Uniseriate
- Dome-shaped vesicle
- Green conidia



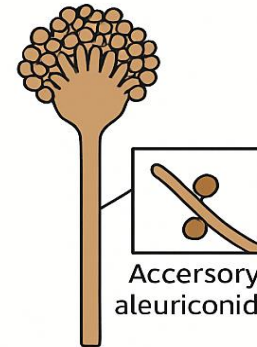
A. flavus

- Uni- and biseriate
- Spherical vesicle
- Yellow-green conidia



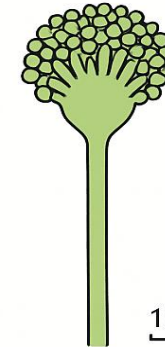
A. niger

- Biseriate
- Globose vesicle
- Black



A. terreus

- Biseriate
- Columnar head
- Cinnamon-brown conidia



A. versicolor

- Biseriate
- Small vesicle
- Light green conidia

Fig. 1 *Aspergillus clavatus*
clavate or “club-shaped”
vesicle with a single layer of
phialides

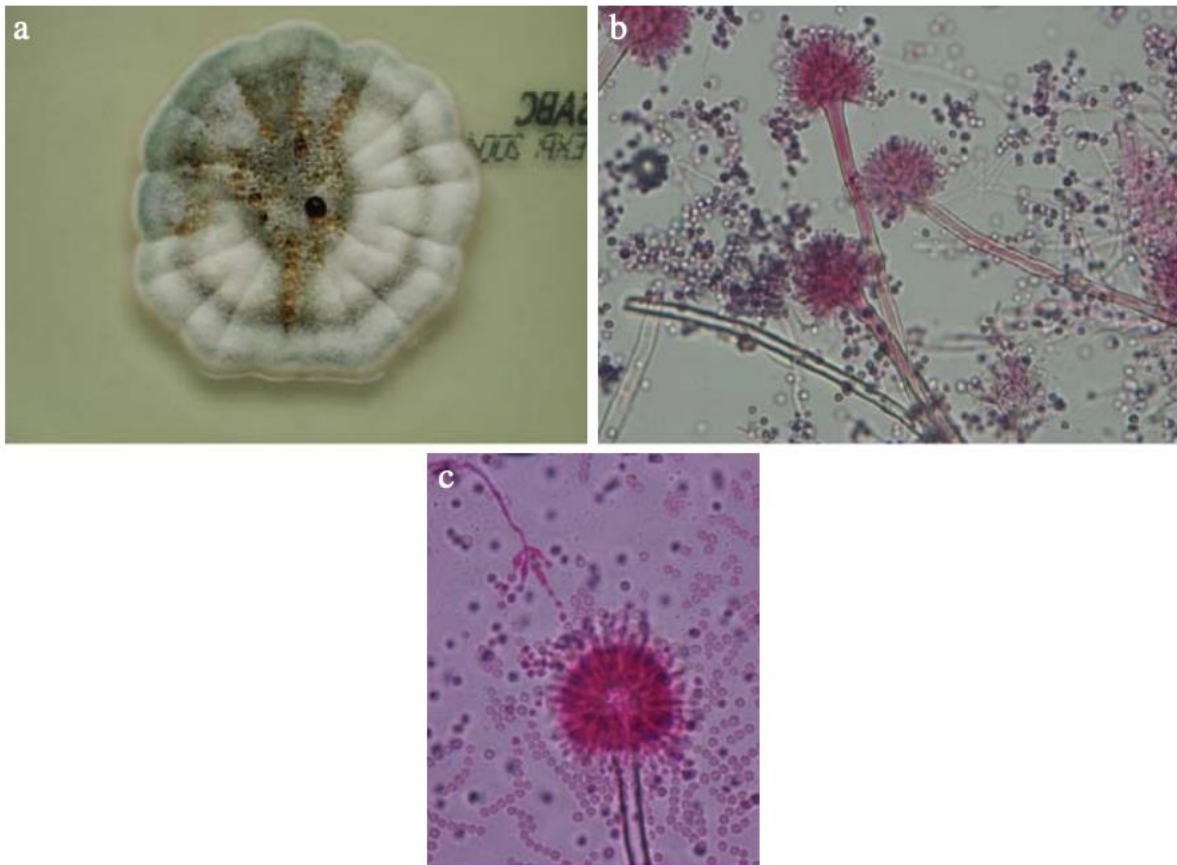


Fig. 2 *Aspergillus versicolor* (a) colonial form; (b) “spoon-shaped” vesicle; (c) reduced or *Penicillium*-type heads

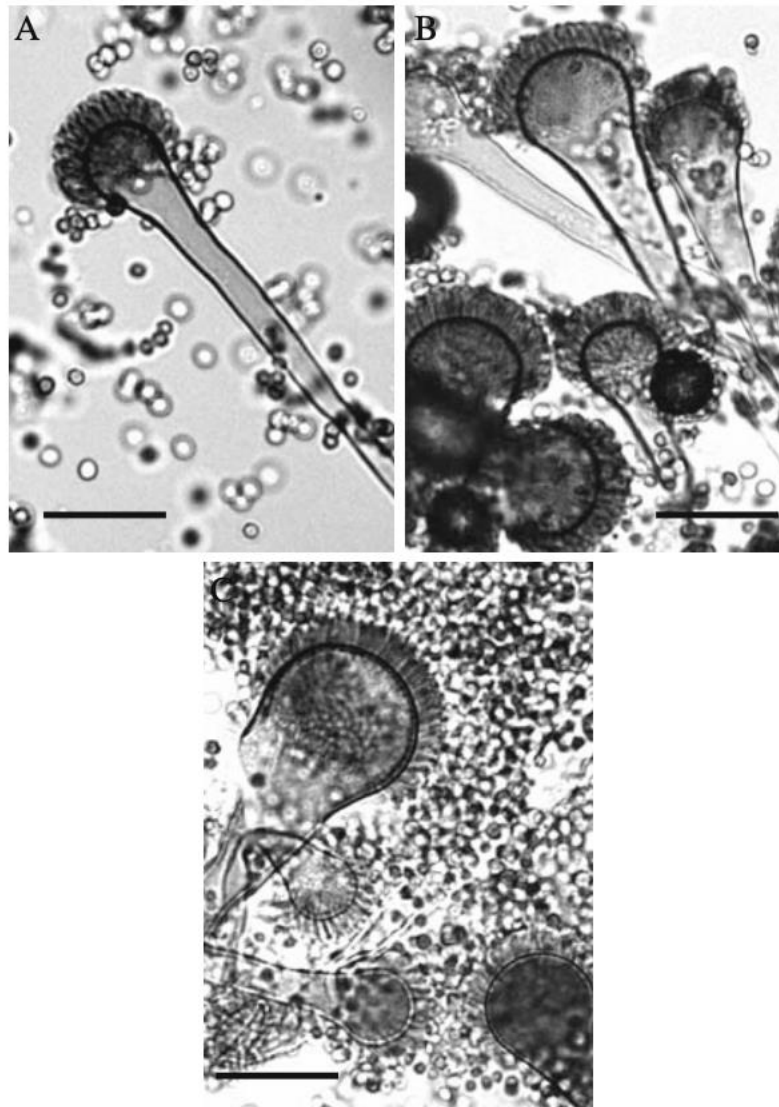


Fig. 6 Conidiophores and conidia of *Aspergillus fumigatus* sensu stricto. (a) a single typical conidiophore terminating in a *flask-shaped* vesicle bearing uniseriate phialides. Panels (b) and (c): highly variable vesicle sizes and conidiophore colorations observed with different isolates of *A. fumigatus*. Bar = 25 μ m

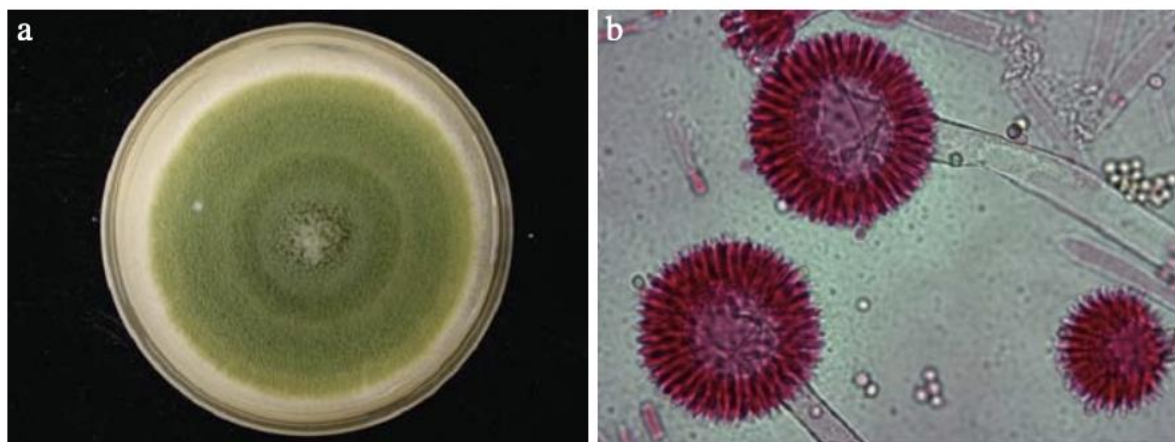
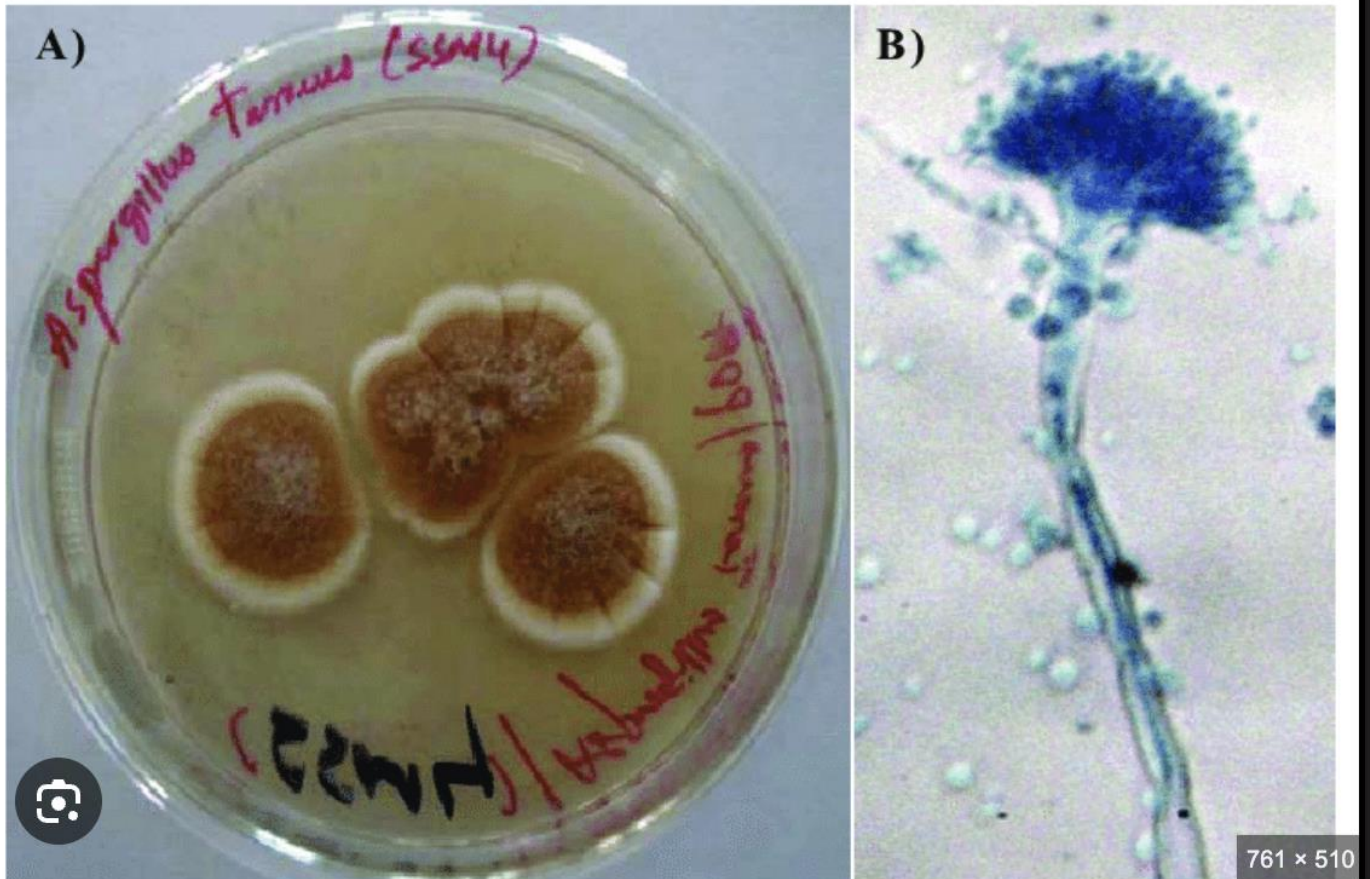


Fig. 7 *Aspergillus flavus* (a) colonial form; (b) conidial head showing the presence of metulae and phialides

Green-yellow radiate, compare to *A. fumigatus*



Characterization of *Aspergillus terreus*. A. *Aspergillus terreus*... | Download Scientific Diagram

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Cinnamon colored, columnar

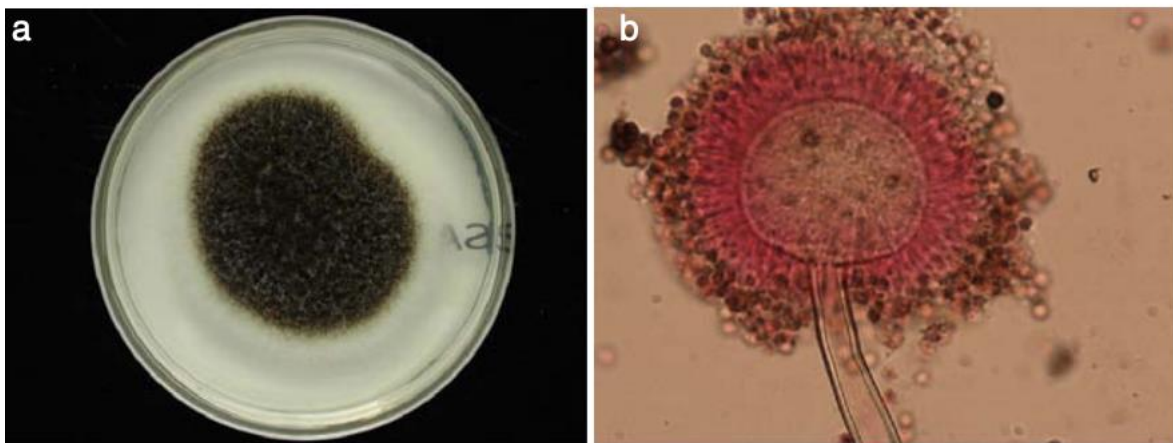


Fig. 8 *Aspergillus niger* (a) colonial form; (b) conidial head showing the presence of metulae and phialides over the entire surface of the vesicle and darkly pigmented, roughened spores

3. Epidemiology & reservoirs

- Conidia in **soil, rotting vegetation, damp building materials (wallpaper, concrete, pipe-lagging, carpets, HVAC)**; hospital construction dust → outbreaks .
- **High-risk hosts:** prolonged neutropenia, allogeneic-HSCT (~12 %), heart-lung Tx (11 %), CGD, high-dose steroids .
- **CPA** rising after TB, COPD, sarcoidosis .

4. Pathogenesis (4-step mnemonic I-G-A-T)

- 1 Inhalation & alveolar deposition
- 2 Germination when innate immunity fails
- 3 Angio-invasion → thrombosis, infarction
- 4 Toxins & hypersensitivity drive allergic / chronic disease

5. Clinical spectrum

Category	Typical entities / notes
Non-invasive	Otomycosis (<i>A. niger</i>), onychomycosis (<i>A. versicolor</i>), allergic fungal rhinosinusitis
Allergic	ABPA (≈16 % asthmatics); EAA by <i>A. clavatus</i> ; SAFS
Chronic	CPA continuum: simple aspergilloma → chronic cavitary → fibrosing disease
Invasive	Acute pulmonary IA ± CNS, eye, skin; sinusitis; mortality 50–85 %

6. Diagnosis workflow

1. **Direct / culture:** septate 45° branching hyphae; Sabouraud agar 48-90 h.
2. **Serology & biomarkers:**
 - a. **Aspergillus precipitins (IgG)**—best single test for CPA/ABPA support .
 - b. Galactomannan ELISA / LFD (false-pos with β-lactams) .
 - c. (1→3) β-D-glucan (pan-fungal) .
 - d. PCR on blood/BAL; combine with GM for ↑ sensitivity .
3. **Imaging:** HR-CT halo sign → air-crescent; MRI for CNS/sinus.
4. **Histology/BAL/biopsy** for EORTC “proven” disease.

7. Antifungal susceptibility & resistance

- **Azole-R A. fumigatus** increasing in Europe (environmental TR34/L98H, TR46/Y121F/T289A).

- **Intrinsic AmB-R:** *A. terreus*, *A. nidulans*.
- Always request MICs on invasive isolates.

8. Management cheat-sheet

Condition	First-line	Key alternatives / notes
Invasive aspergillosis	Voriconazole	Liposomal AmB; isavuconazole (non-inferior; shortens QT c)
ABPA	Oral steroids ± itraconazole/posaconazole	
CPA	Long-term oral triazole; monitor levels	
Onychomycosis / Otomycosis	Topical clotrimazole ± oral azole	
Surgical	Resection of solitary aspergilloma; debridement of sinus/CNS masses	

Supportive: remove colonised lines, taper immunosuppression, give G-CSF if neutropenic.

9. Prognosis & prevention

- IA mortality: 50-60 % (SOT) → 70-85 % (other immunosuppressed). Early targeted therapy improves survival .
- **Primary prophylaxis** (e.g. posaconazole in AML/allo-HSCT) cuts incidence but monitor for resistance.
- **Environmental control:** HEPA filtration, positive-pressure rooms, meticulous dust containment during building/refurbishment .

10. High-yield exam pearls

1. Columnar uniseriate head + **growth to 65 °C** = ***A. fumigatus***.
2. **Accessory conidia** → think *A. terreus* (and AmB-R).
3. Galactomannan **false-positive** with piperacillin-tazobactam or *Penicillium*.
4. **Sterigmatocystin** ↔ ***A. versicolor***; **ochratoxin** ↔ ***A. terreus***; **aflatoxin** ↔ ***A. flavus***.
5. Report isolates as “*A. fumigatus* complex” unless molecular ID performed (≥ 40 cryptic species) .
6. **Isavuconazole** shortens QTc (contrast other azoles).
7. Memorise **EORTC/MSG 2008** possible/probable/proven definitions—frequent SAQ.
8. **Environmental reservoirs** (damp concrete, carpets, HVAC) explain hospital outbreak questions.

9. Room-temperature growth (~25 °C) onychomycosis isolate? Think *A. versicolor*.