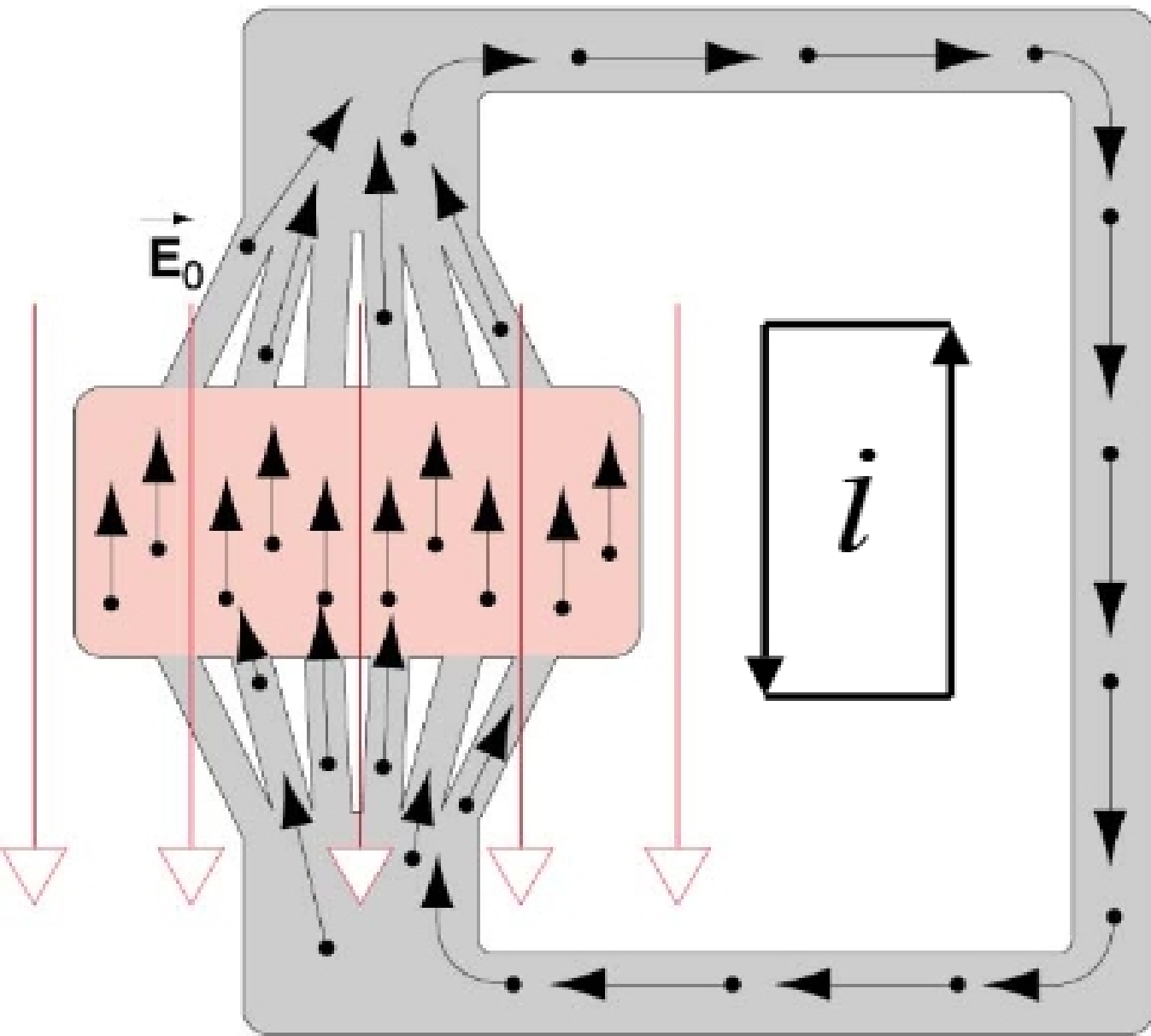


Conductors in E-fields: dynamic conditions



- *If the E-field is maintained, then the dynamics persist, i.e. charge continues to flow indefinitely.*
- *This is no longer strictly the domain of electrostatics.*
- *Note the direction of flow of the charge carriers (electrons).*

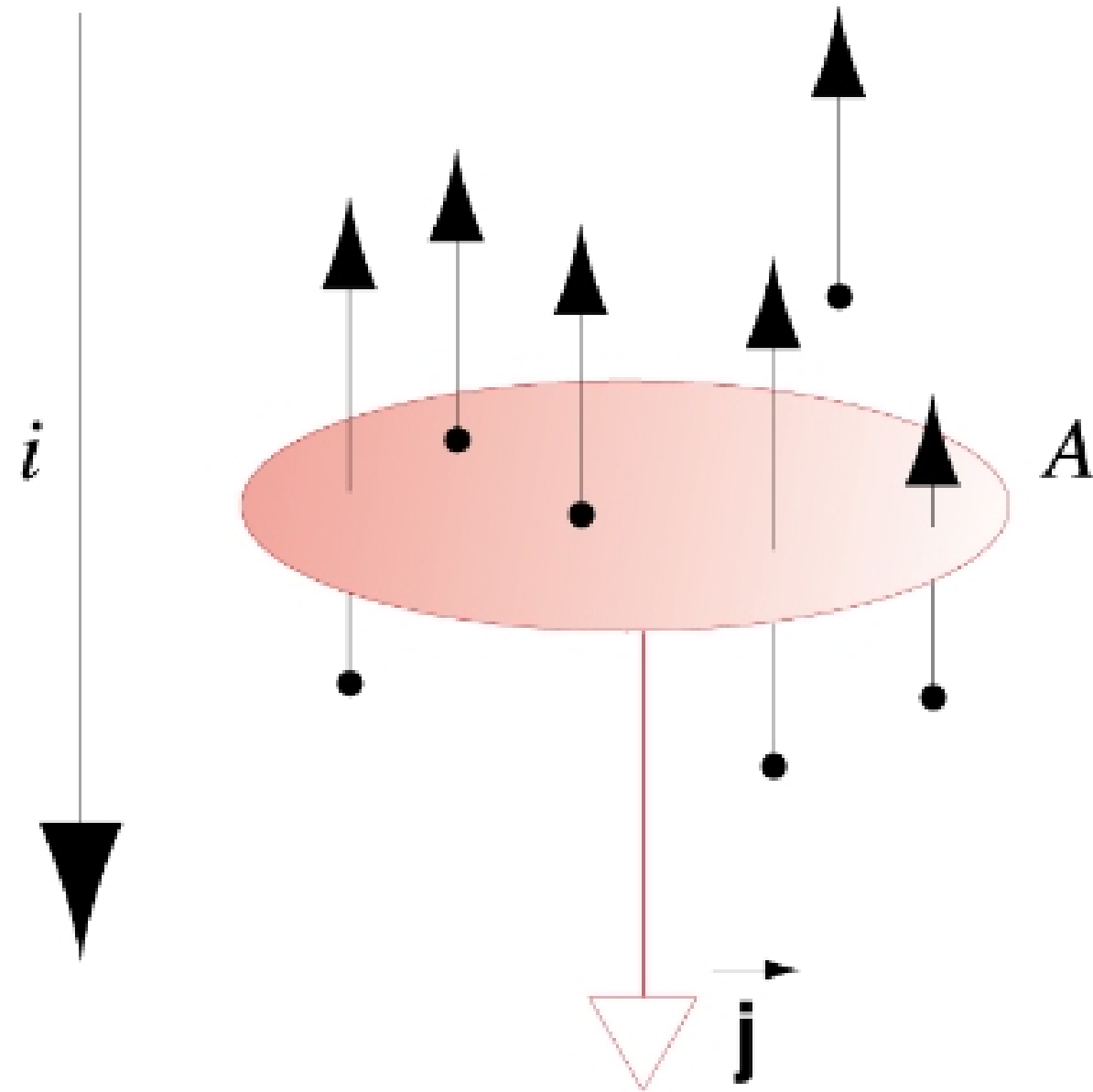
Electrical current:

$$i = \frac{dq}{dt}$$

SI unit:

1 ampere (A) = 1 coulomb per second (C/s)

Conductors in E-fields: dynamic conditions



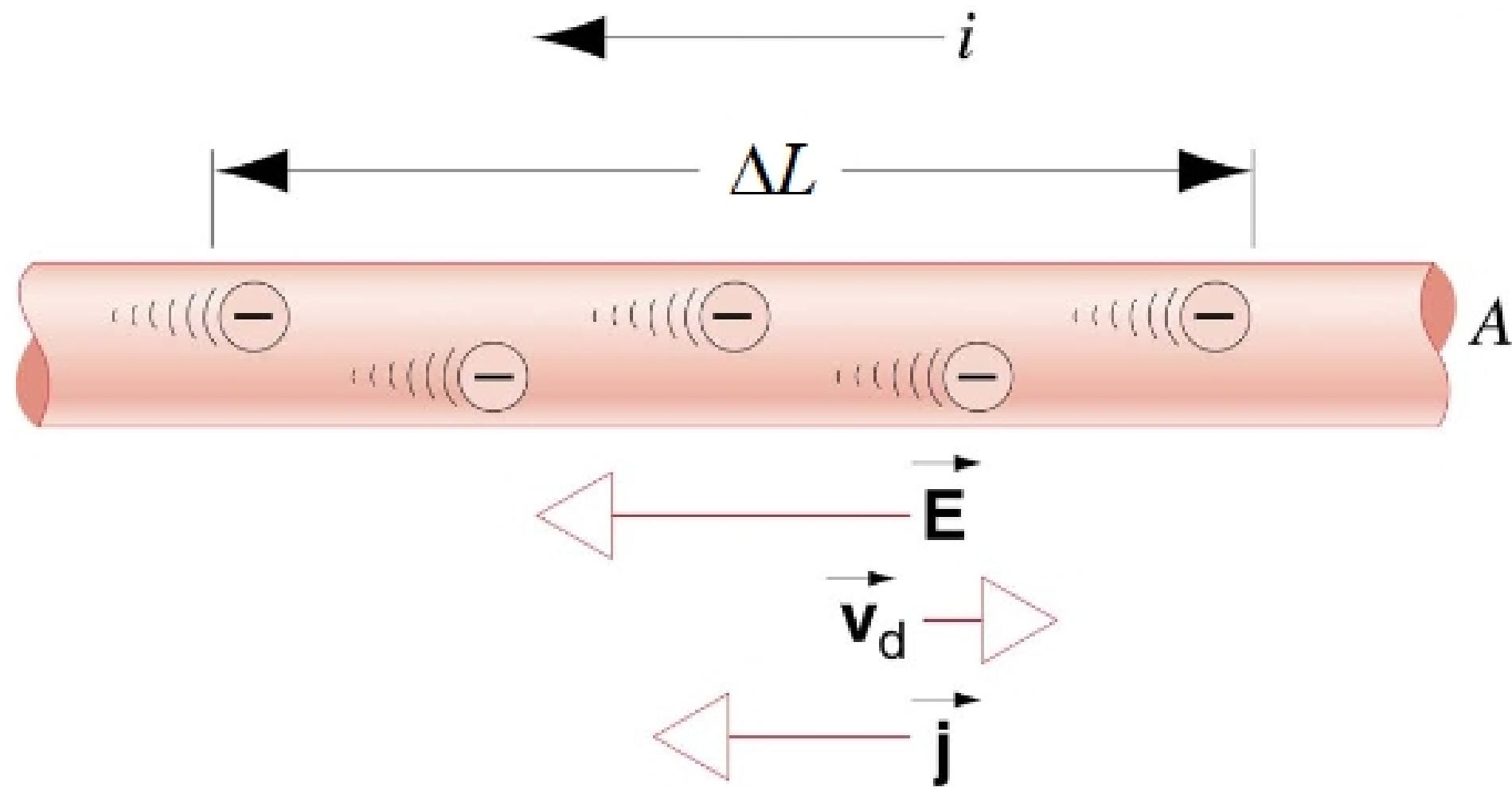
- *If the E-field is maintained, then the dynamics persist, i.e. charge continues to flow indefinitely.*
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Current density:

$$j = \frac{i}{A} \quad \text{or} \quad \frac{di}{dA}$$

$$i = \int \vec{j} \cdot d\vec{A}$$

Current density and drift speed



$$j = \frac{i}{A} = \frac{1}{A} \frac{\Delta q}{\Delta t} = \frac{1}{A} \frac{(enA\Delta L)}{(\Delta L/v_d)} = env_d$$

$n = \#$ electrons per unit volume

$$\vec{j} = -ne\vec{v}_d$$

Starting point
for Ohm's Law