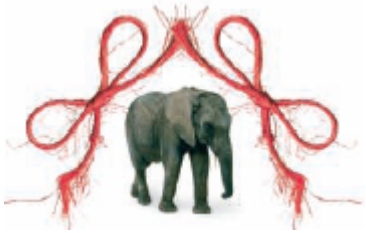
Memory



Study Guide Questions

- What is memory and the three processes of memory?
- What does the information processing model propose of how memory works?
- What terms are related to sensory memory?
- What terms are related to short-term memory?
- What terms are related to long-term memory?
- What are the different types of long-term memory?
- How do the following methods of retrieval differ: recall, recognition, relearning?
- What are primacy and recency effects, and how do they affect memory?

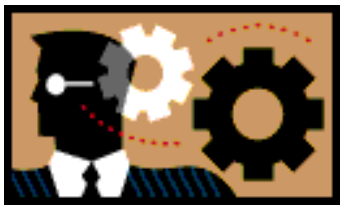
Study Guide Questions cont.

- How and where are memories formed in the brain?
- How does the arousal theory explain the development of flashbulb memories?
- What contributions to the study of memory were made by Daniel Schacter?
- What contributions to the study of memory were made by Hermann Ebbinghaus?
- What are different types and causes of forgetting?
- How does amnesia relate to memory development and forgetting?
- How are people with Alzheimer's disease affected and helped?
- What are some examples of memory-enhancing strategies?

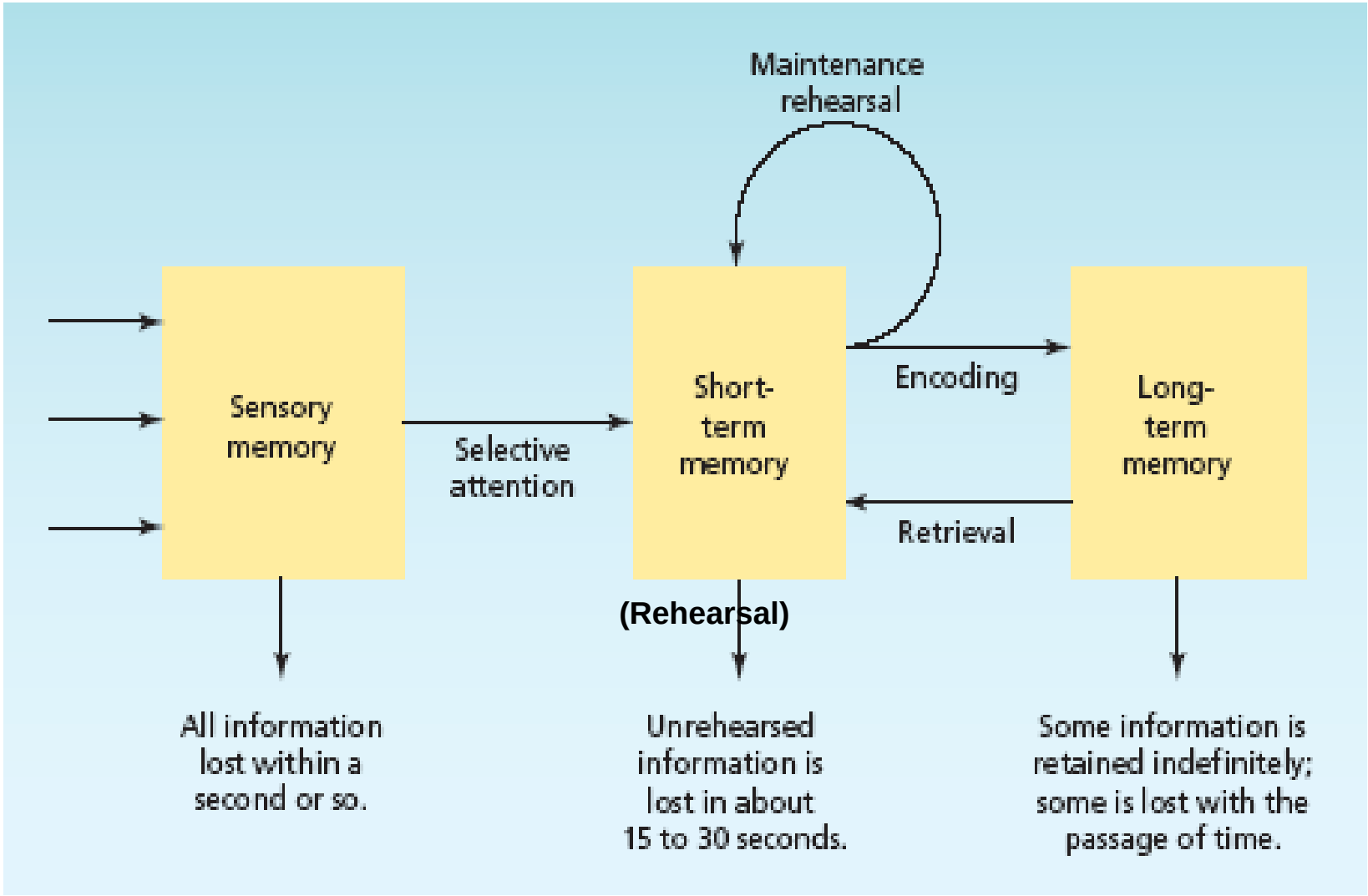
Memory and Its Processes

- **Memory** – an active system that *receives*, *organizes, alters, stores*, and *retrieves* information
- **Three Processes of Memory**:
  - **Encoding** – the set of mental operations that people perform on sensory information to convert that information into a form that is usable in the brain's storage systems—"*programming information*"
  - **Storage** – holding onto information for some period of time
  - **Retrieval** – getting information that is in storage into a form that can be used

Information Processing Model of Memory



- **Information-processing model** – model of memory that assumes the processing of information for memory storage is similar to the way a computer processes memory in a series of three stages—*sensory memory, short term memory*, and *long-term memory*.


Maintenance rehearsal
Sensory memory
Selective attention
Short-term memory
Encoding
Long-term memory
Retrieval
(Rehearsal)
All information lost within a second or so.
Unrehearsed information is lost in about 15 to 30 seconds.
Some information is retained indefinitely; some is lost with the passage of time.

Sensory Memory

- **Iconic memory** – visual sensory memory (visual encoding), lasting only a fraction of a second.
  - Capacity – everything that can be seen at one time.
  - Duration – information that has just entered iconic memory will be pushed out very quickly by new information, a process called masking.

Sensory Memory

- **Echoic memory** – the brief memory of something a person has just heard (acoustic encoding).
  - Capacity – limited to what can be heard at any one moment and is smaller than the capacity of iconic memory
  - Duration – lasts longer that iconic — about 2 to 4 seconds

Short-Term Memory

- **Short-term memory (STM) (working memory)** – the memory system in which information is held for brief periods of time while being used
  - **Selective attention** – the ability to focus on only one stimulus from among all sensory input

Short-Term Memory

- **Digit-span test** – memory test in which a series of numbers is read to subjects in the experiment who are then asked to recall the numbers in order (George Miller)
  - Conclusions are that the capacity of STM is about seven items or pieces of information, plus or minus two items, or from five to nine bits of information (7 plus or minus 2).
    - "magical number" = 7

Short-Term Memory and Rehearsal

- **(Maintenance) Rehearsal** – the conscious repetition of information to be remembered to maintain it in short-term memory (STMs tend to be encoded in auditory form)
- Duration of STM – lasts from about 15 to 30 seconds without rehearsal (20 seconds on average)

- STM is vulnerable to interference (e.g., if counting is interrupted, have to start over).

Long-Term Memory

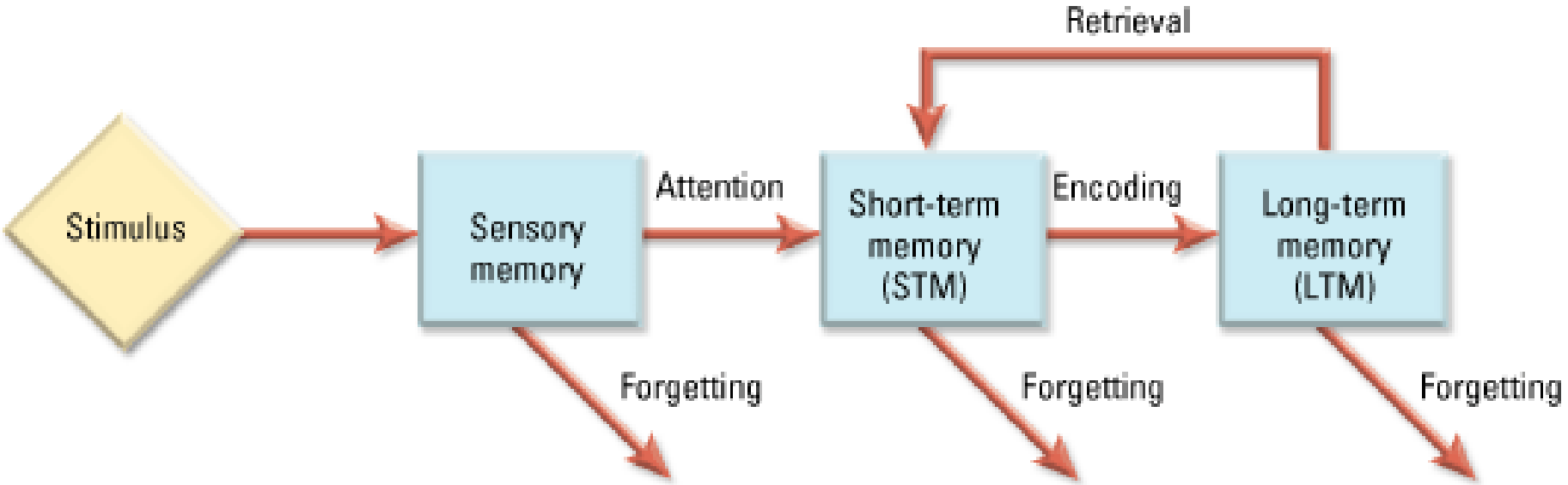
- **Long-term memory** – the continuous storage of information
  - **Memory consolidation** – the transferring of information from STM into LTM by making that information meaningful in some way (elaborative rehearsal)

Types of LTM

- **<u>Procedural/Implicit (nondeclarative) memory</u>** – type of long-term memory including memory for *skills, procedures, habits, and conditioned responses*. These memories are not conscious but are implied to exist because they affect conscious behavior.

Declarative LTM

- **Declarative memory** – type of long-term memory containing information that is conscious and known (memory for facts)--all the things that people know.
  - **Semantic memory** – type of declarative memory containing general knowledge, such as knowledge of language and information learned in formal education.
  - **Episodic memory** – type of declarative memory containing personal information not readily available to others, such as daily activities and events.
    - Semantic and episodic memories are forms of **explicit memory** – memory that is consciously known.


Retrieval
Stimulus
Sensory memory
Attention
Short-term memory (STM)
Encoding
Long-term memory (LTM)
Forgetting
Forgetting
Forgetting

Retrieving Information

- **Recall** – type of memory retrieval in which the information to be retrieved must be "pulled" from memory with very few external cues.

- *Examples: Essays, fill-in-the-blank, and short answer exams are based on recall.*

Retrieving Information (cont.)

- **Recognition** – the ability to match a piece of information or a stimulus to a stored image or fact
  - *Examples: Multiple choice, true/false, and matching exams are assessments based on recognition.*

Retrieving Information (cont.)

- **Relearning** – involves learning information that you previously learned
  - *Example: After not speaking Spanish for 13 years, Whitney was able to learn it rather quickly.*

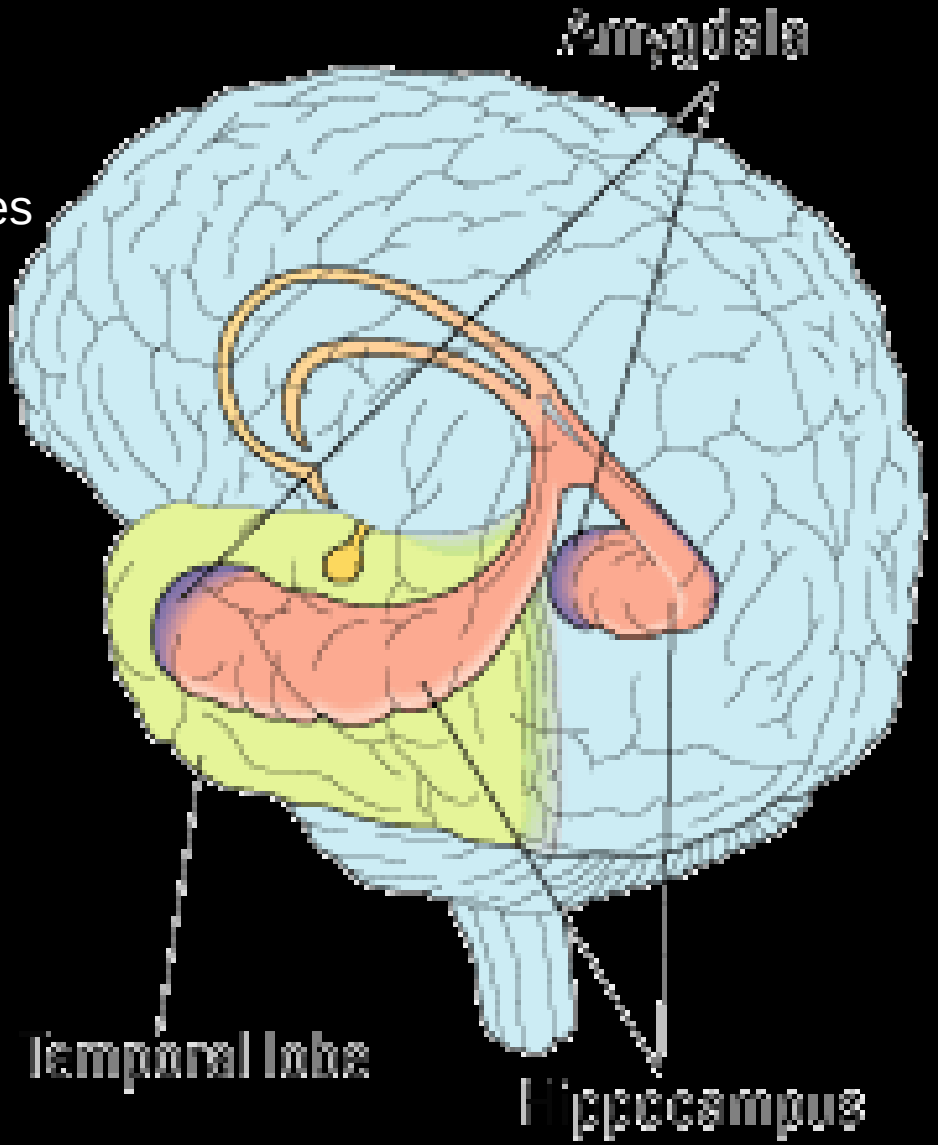
Remembering Information

- **Primacy effect** – tendency to remember information at the beginning of a body of information better than the information that follows
- **Recency effect** – tendency to remember information at the end of a body of information better than the information ahead of it

Memory and the Brain

- **Frontal Lobes**–area of the brain that processes information in short-term memory—rehearsal of information helps move info from short-term to long-term memory
- **Amygdala** – area of brain that facilitates the encoding of memories at a deeper level when the event is emotionally arousing
- **Hippocampus** – area of the brain responsible for the transferring of new information into long-term memories
- **Cerebellum** – area of the brain responsible for creating implicit memories (procedural memory, motor learning, and classical conditioning)

Frontal Lobes



Flashbulb Memories and Arousal Theory

- **Arousal theory** – the belief that strong emotions trigger the formation of strong memories, and weaker emotions form weaker memories
  - **Flashbulb memories** – type of automatic encoding that occurs because an unexpected event has strong emotional associations for the person remembering it–generally results in an exceptionally clear recollection

Forgetting–Types and Causes

- **Forgetting** – the loss of information from long-term memory
- **Encoding failure** – failure to process information into memory

Forgetting: Memory Trace Theory

- **Decay (Transcience)** – loss of memory due to the passage of time, during which the memory trace is not used
  - **Disuse** – another name for decay, assuming that memories that are *not used* will eventually decay and disappear

Forgetting: Memory Errors

- Psychologist Daniel Schacter (2001) offers seven ways our memories tend to fail us, something he refers to as the "seven sins of memory"):

Schacter's Seven Sins of Memory			
Sin	Type	Description	Example
Transcience	Forgetting	Accessibility of memory decreases over time	Forget events that occurred long ago
Absentmindedness	Forgetting	Forgetting caused by lapses in attention	Forget where your phone is
Blocking	Forgetting	Accessibility of information is temporarily blocked	Tip of the tongue phenomenon
Misattribution	Distortion	Source of memory is confused	Recalling a dream memory as a waking memory
Suggestibility	Distortion	False memories	Result from leading questions
Bias	Distortion	Memories distorted by current belief system	Align memories to current beliefs
Persistence	Intrusion	Inability to forget undesirable memories	Traumatic events

Forgetting: Ebbinghaus's Process of Memorization

- The scientific study of memory started with the work of German psychologist Hermann Ebbinghaus, who, in 1885, published the book *Memory: A Contribution to Experimental Psychology*.
- Ebbinghaus tested his own memory by memorizing over 2,000 ***nonsense syllables*** *:* letter combinations like "RIY" and "TPR" that were supposedly meaningless. He then measured how much he had learned (retained) as he attempted to relearn each syllable.
- Through his findings, Ebbinghaus introduced what is referred to as the "forgetting curve," which suggests that due to decay, an average person will lose about 50% of memorized information after 20 minutes and about 70-80% of the information after 24 hours.
- Ebbinghaus' work suggested that learning is more effective when it is spaced out over time rather than conducted during a single longer session. He also discovered that forgetting happens most rapidly right after learning occurs and slows down over time.

Forgetting: Interference Theory

- **Proactive interference** – memory retrieval problem that occurs when older information prevents or interferes with the retrieval of newer information
- **Retroactive interference** – memory retrieval problem that occurs when newer information prevents or interferes with the retrieval of older information

Proactive interference – problem driving in England after learning in US.

TABLE 6.1 TYPES OF FORGETTING

Type of Forgetting	Description
Encoding Failure	The information is not attended to and fails to be encoded.
Decay or Disuse	Information that is not accessed decays from the storage system over time.
Proactive Interference	Older information already in memory interferes with the retrieval of newer information.
Retroactive Interference	Newer information interferes with the retrieval of older information.

Amnesia

- **Retrograde amnesia** – loss of memory from the point of some injury or trauma backwards, or loss of memory for the past
- **Anterograde amnesia** – loss of memory from the point of injury or trauma forward, or the inability to form new long-term memories ("senile dementia")
- **Infantile amnesia** – the inability to retrieve memories from much before age 3 (natural occurrence)

Alzheimer's Disease

- The primary memory difficulty in Alzheimer's is anterograde amnesia, although retrograde amnesia can also occur as the disease progresses.
- There are various drugs in use or in development for use in slowing or stopping the progression of Alzheimer's disease.

Memory-Enhancing Strategies

- **Memory-enhancing strategies** – strategies that help to ensure information goes from short-term to long-term memory (e.g., rehearsal)
- Other memory enhancing strategies:
  - **Chunking** – bits of information are combined into meaningful units, or chunks, so that more information can be held in short-term memory
  - **Mnemonic devices** – memory aids that help organize information for encoding--E.g., learning the names of the great lakes by remembering the word "HOMES"
    - Huron
    - Ontario
    - Michigan
    - Erie
    - Superior