PSY.BIO9 Evaluating Biopsychology: Reductionism, Determinism and Methodology

Total Marks

AQA 7182 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A researcher reports a correlational study linking a specific allele to increased aggression in a sample of 28 male prison inmates. Identify one limitation of using a small, male-only sample when generalising biopsychological findings to the wider population.

(Total for Question 1 is 2 marks)

2 A lab study isolates rats to study circadian rhythm changes after dim light exposure, and attributes behavioural changes purely to altered melatonin secretion. Give one evaluative criticism based on biological reductionism.

(Total for Question 2 is 3 marks)

3 A study of stroke patients links damage in one brain region to loss of language function, and the authors claim this proves a single localisation for language. Outline one methodological critique based on evidence from biopsychology.

(Total for Question 3 is 3 marks)

4 Taylor et al.'s tend-and-befriend critique suggests fight-or-flight research based on male samples may be gender biased. In a novel biopsy study of cortisol response using only male students, state a practical change to reduce gender bias.

(Total for Question 4 is 2 marks)

5 Sperry's split-brain research used unique clinical cases to argue for lateralisation. A student claims this proves that language is always lateralised to the left hemisphere. Give two evaluative points that challenge that deterministic claim.

(Total for Question 5 is 4 marks)

6 A PET scanning study with 12 participants reports a correlation between amygdala activation and reported fear intensity during a film. Outline one limitation of small-sample neuroimaging studies for making causal claims about emotion.

(Total for Question 6 is 3 marks)

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7 Maguire's taxi-driver study used a non-experimental, correlational design and a relatively small sample of London taxi drivers. Explain one strength and one limitation of using such real-world MRI studies to investigate brain-behaviour relationships.

(Total for Question 7 is 4 marks)

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8 A researcher uses animal models to test effects of a neurotoxin on circadian rhythms and concludes the results directly apply to humans. State one evaluative point about the validity of generalising from animal biopsychology to humans.

(Total for Question 8 is 3 marks)

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9 A published biopsychology study reports significant group differences with $p = 0.04$. Explain one implication of relying solely on p values when interpreting results of biopsychological research, particularly for complex traits.

(Total for Question 9 is 4 marks)

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10 Researchers argue that because brain processes involve neurons, hormones and genes interacting, simple biological explanations are incomplete. Identify and explain one methodological approach that could help address biological reductionism in biopsychological research.

(Total for Question 10 is 4 marks)

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11 A student reads a biopsychology paper that uses only correlational methods to link early stress to adult HPA axis differences. Identify two ethical or methodological reasons why the authors might prefer correlational designs in this area, and explain one limitation that results for causal inference.

(Total for Question 11 is 6 marks)

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12 Write a balanced 16-mark essay discussing how reductionism, determinism and methodological choices affect biopsychological research. Refer to specific examples from biopsychology where appropriate, and evaluate the consequences for scientific understanding and practical application.

Discuss issues of reductionism, determinism and methodology in biopsychological research. In your answer, apply these issues to examples from biopsychology and consider implications for interpretation and application of findings.

(Total for Question 12 is 16 marks)

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Mark scheme · PSY.BIO9 Evaluating Biopsychology: Reductionism, Determinism and Methodology

Question 1

- **B1** identifies reduced generalisability because a small, male-only sample may not represent females or the general population oe
- **B1** explains that sex differences or sampling bias could mean the genetic-aggression link is not the same in other groups oe
- **Answer: The small, male-only sample limits generalisability; the finding may not apply to females or to non-prison populations because of sex differences and sampling bias.**

Question 2

- **M1** identifies reductionism: explaining complex behaviour solely in terms of hormones (melatonin) oe
- **A1** explains a limitation, e.g. ignores psychological, social or environmental factors that also influence behaviour oe
- **A1** explains why this matters, e.g. oversimplified explanations reduce ecological validity and limit intervention approaches oe
- **Answer: This is biologically reductionist: it reduces behaviour to melatonin changes and ignores psychological and environmental influences, so the explanation may be incomplete and less useful for wider contexts.**

Question 3

- **M1** identifies methodological limitation: brain-damage studies are often correlational and lack experimental control oe
- **A1** explains that other damaged areas or individual differences might contribute, so the link is not necessarily causal oe
- **A1** notes that plasticity and network interactions can mean language functions are supported by distributed systems, challenging strict localisation oe
- **Answer: Brain-damage studies are correlational and may not show causation; damage elsewhere or individual brain differences and plasticity mean language may be distributed rather than located in a single region.**

Question 4

- **B1** states a practical change, e.g. include female participants or use a mixed-sex sample oe
- **B1** explains briefly why, e.g. allows testing of sex differences and avoids assuming male responses generalise to females oe
- **Answer: Include female participants or use a balanced mixed-sex sample so potential sex differences in cortisol response and alternative stress responses can be examined rather than assumed.**

Question 5

- **M1** points out individual variability: lateralisation varies between people, e.g. some left-handers show different patterns oe
- **A1** explains this matters because generalising from unusual clinical cases to the entire population is unreliable oe
- **M1** identifies developmental and plasticity evidence: language can shift hemispheric representation after early damage oe
- **A1** explains that plasticity shows deterministic claims are too rigid because the brain can reorganise and compensate oe
- **Answer: Individual variability and handedness show lateralisation is not identical for all people, so split-brain cases cannot prove universal left-lateralisation. Brain plasticity and developmental evidence show language representation can shift after early damage, undermining a strictly deterministic claim.**

Question 6

- **M1** identifies limitation: small sample size reduces statistical power and increases chance findings oe
- **A1** explains that low power and individual variability mean the correlation may not replicate or indicate causation oe
- **A1** notes scanning studies are correlational: activation may be associated with, but not cause, reported fear oe
- **Answer: Small neuroimaging samples have low statistical power and high individual variability, so correlations between activation and fear may be unreliable and do not prove a causal role for the amygdala.**

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Question 7

- **M1** identifies strength: high ecological validity, studying real-world, long-term navigation expertise rather than artificial tasks oe
- **A1** explains why this matters: findings about structural changes are more meaningful for real-life functions and applications oe
- **M1** identifies limitation: correlational design cannot establish causation, e.g. pre-existing differences may have influenced who became a taxi driver oe
- **A1** explains that without longitudinal or experimental control it is unclear whether experience caused the brain differences or vice versa oe
- **Answer: Strength: such MRI studies have ecological validity because they investigate real-world expertise, making findings about brain structure more applicable. Limitation: the correlational design cannot prove causation, so pre-existing differences could explain who becomes a taxi driver rather than experience causing structural change.**

Question 8

- **M1** states a limitation: physiological and behavioural differences between species may limit direct generalisation oe
- **A1** explains a consequence, e.g. mechanisms in rodents may not operate identically in humans, so translational validity is uncertain oe
- **A1** suggests that ethical, lifespan and environmental differences further reduce direct applicability oe
- **Answer: Animal models may not fully represent human physiology and behaviour, so effects of a neurotoxin on rodent circadian rhythms may not translate directly to humans due to species differences and different living conditions.**

Question 9

- **M1** identifies limitation: p values indicate probability of the observed data under the null, not the size or practical importance of an effect oe
- **A1** explains that a significant p value with a small sample or small effect size may be misleading about practical relevance oe
- **M1** identifies need for effect sizes and confidence intervals, and replication, in biopsychology oe
- **A1** explains that for complex traits many small effects may exist and p values alone do not show reproducibility or biological importance oe
- **Answer: P values do not convey effect size or reproducibility; a p = 0.04 may reflect a tiny or sample-specific effect. Biopsychology needs effect sizes, confidence intervals and replication to judge biological importance, especially for complex traits.**

Question 10

- **M1** identifies a methodological approach, e.g. multi-level, integrative research such as combining neuroimaging, behavioural measures and psychosocial assessment oe
- **A1** explains how combining levels addresses reductionism by capturing interactions between biological and psychological factors oe
- **M1** identifies another feature, e.g. longitudinal or intervention studies to test causal pathways oe
- **A1** explains that longitudinal or experimental designs can help show direction of causation and contextual influences, reducing simplistic biological explanations oe
- **Answer: Use multi-level integrative methods, combining neuroimaging, behavioural and psychosocial measures, and employ longitudinal or intervention designs. This captures interactions and helps test causal pathways, reducing simple biological reductionism.**

Question 11

- **M1** identifies ethical reason: cannot randomly assign participants to early-life stress for ethical reasons oe
- **A1** explains why this forces researchers to observe natural variation rather than use experimental manipulation oe
- **M1** identifies practical/methodological reason: long timeframes and cost make experimental longitudinal manipulation impractical oe
- **A1** explains that following cohorts over years is more feasible as observational research than experimental control oe
- **M1** identifies limitation for causal inference: correlations do not establish direction of causation or rule out third variables oe
- **A1** explains consequence, e.g. findings may reflect confounding factors like socioeconomic status rather than a direct effect

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Question 12

- **Level 4** (13-16): Knowledge of reductionism, determinism and methodological issues in biopsychology is accurate and detailed. Discussion is thorough and balanced, using relevant, specific examples from biopsychology to support points. Evaluation considers implications for interpretation, causality and application, and alternatives or methodological improvements are discussed. The argument is coherent and uses appropriate terminology consistently.
- **Level 3** (9-12): Knowledge is clear with some detail. Discussion evaluates issues and refers to examples from biopsychology, though some points may be less developed. There is a reasonable balance between description and evaluation, and some implications for interpretation and application are considered. The answer is mostly organised and uses specialist terms appropriately.
- **Level 2** (5-8): Knowledge is present but limited or partial. Discussion contains some evaluative points but is largely descriptive or unbalanced. Examples are general or only partly linked to evaluation. Implications for interpretation and application are stated but not developed. Organisation and specialist terminology may be inconsistent.
- **Level 1** (1-4): Knowledge is minimal and answers may be simplistic. Discussion is largely absent or superficial, with few or no relevant examples. Little consideration is given to implications for interpretation or application. Answer lacks structure and specialist terminology is missing or used incorrectly.
- **Level 0** (0): No creditable content.
- **Indicative content:**
  - AO1: Define biological reductionism: explaining complex behaviour solely in terms of neurons, neurotransmitters, hormones or genes, with examples such as explanations of aggression in terms of testosterone or of depression in terms of serotonin.
  - AO1: Define biological determinism: the idea that biological mechanisms fix behaviour in a rigid way, with examples such as claims that localisation of function implies fixed, determinate brain loci for cognitive abilities.
  - AO1: Methodological features of biopsychology include correlational designs, neuroimaging, lesion studies, animal models, small samples and ethical constraints preventing some experimental manipulations.
  - AO3: Evaluate reductionism by noting its scientific strengths: testable biological mechanisms, precision and potential for pharmacological interventions. Give examples where reductionist accounts led to effective treatments, but also explain limitations: ignoring psychological and social influences reduces explanatory scope and may mislead interventions.
  - AO3: Evaluate determinism by noting that some biological constraints exist, for example genetic predispositions and reflexive physiological responses, yet plasticity and individual variability limit deterministic claims. Use examples such as recovery of function after brain injury and handedness/lateralisation variability to challenge strict determinism.
  - AO3: Methodological evaluation: brain-damage and lesion studies provide valuable causal evidence but are often opportunistic and limited by individual differences. Neuroimaging shows correlational activation patterns and can suffer from small samples, reverse inference and statistical issues. Animal studies offer control but limited generalisability. Longitudinal and intervention studies help with causality but have ethical and practical limits.
  - AO3: Consider gender bias and sample bias: many classic biopsychology findings were obtained from male-only samples or specific clinical groups, so generalising to women or the general population can be unwarranted. Mention tend-and-befriend critique and examples.
  - AO3: Discuss p values, effect sizes and replication: biopsychology must interpret statistical significance alongside effect sizes, confidence intervals and reproducibility. Small effects across many genes or neural circuits require cautious interpretation.
  - AO3: Consider ethical and practical implications: deterministic biological claims can affect stigma and responsibility attributions; reductionist accounts can prioritise biomedical interventions and underplay psychosocial treatments. Discuss how multidisciplinary approaches and methodological triangulation can produce more nuanced explanations.
  - AO3: Conclude with balanced judgement: biological explanations are essential and powerful but must be integrated with psychological and social levels; methodological improvements such as larger samples, multi-level designs and longitudinal studies can reduce overclaiming and improve applicability.

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