

NAPS Unit list of standard primers.

All primers written from 5' to 3'.

RAPD Primer Set #1 (10 micrograms/tube)

1. CCT GGG CTT C	26. TTT GGG CCC A	51. CTA CCC GTG C	76. GAG CAC CAG T
2. CCT GGG CTT G	27. TTT GGG GGG A	52. TTC CCG GAG C	77. GAG CAC CAG G
3. CCT GGG CTT A	28. CCG GCC TTA A	53. CTC CCT GAG C	78. GAG CAC TAG C
4. CCT GGG CTG G	29. CCG GCC TTA C	54. GTC CCA GAG C	79. GAG CTC GTG T
5. CCT GGG TTC C	30. CCG GCC TTA G	55. TCC CTC GTG C	80. GTG CTC TAG A
6. CCT GGG CCT A	31. CCG GCC TTC C	56. TGC CCC GAG C	81. GAG CAC GGG G
7. CCT GGG GGT T	32. GGG GCC TTA A	57. TTC CCC GAG G	82. GGG CCC GAG G
8. CCT GGC GGT A	33. CCG GCT GGA A	58. TTC CCG GAG C	83. GGG CTC GTG G
9. CCT GCG CTT A	34. CCG GCC CCA A	59. TTC CGG GTG C	84. GGG CGC GAG T
10. GGG GGG ATT A	35. CCG GGG TTA A	60. TTG GCC GAG C	85. GTG CTC GTG C
11. CCC CCC TTT A	36. CCC CCC TTA G	61. TTC CCC GAC C	86. GGG GGG AAG G
12. CCT GGG TCC A	37. CCG GGG TTT T	62. TTC CCC GTC G	87. GGG GGG AAG C
13. CCT GGG TGG A	38. CCG GGG AAA A	63. TTC CCC GCC C	88. CGG GGG ATG G
14. CCT GGG TTT C	39. TTA ACC GGG C	64. GAG GGC GGG A	89. GGG GGC TTG G
15. CCT GGG TTT G	40. TTA CCT GGG C	65. AGG GGC GGG A	90. GGG GGG TAG G
16. GGT GGC GGG A	41. TTA ACC GGG G	66. GAG GGC GTG A	91. GGG TGG TTG C
17. CCT GGG CCT C	42. TTA ACC CGG C	67. GAG GGC GAG C	92. CCT GGG CTT T
18. GGG CCG TTT A	43. AAA ACC GGG C	68. GAG CTC GCG A	93. GGG GGG AAA G
19. GCC CGG TTT A	44. TTA CCC CGG C	69. GAG GGC AAG A	94. GGG GGG AAC C
20. TCC GGG TTT G	45. TTA ACC CCG G	70. GGG CAC GCG A	95. GGG GGG TTG G
21. ACC GGG TTT C	46. TTA AGG GGG C	71. GAG GGC GAG G	96. GGC GGC ATG G
22. CCC TTG GGG G	47. TTC CCC AAG C	72. GAG CAC GGG A	97. ATC TGC GAG C
23. CCC GCC TTC C	48. TTA ACG GGG A	73. GGG CAC GCG A	98. ATC CTG CCA G
24. ACA GGG GTG A	49. TTC CCC GAG C	74. GAG CAC CTG A	99. ATC CCC TGG G
25. ACA GGG CTC A	50. TTC CCC GCG C	75. GAG GTC CAG A	100. ATC GGG TCC G

RAPD Primer Set #2 (10micrograms/tube)

101. GCG GCT GGA G	126. CTT TCG TGC T	151. GCT GTA GTG T	176. CAA GGG AGG T
102. GGT GGG GAC T	127. ATC TGG CAG C	152. CGC ACC GCA C	177. TCA GGC AGT C
103. GTG ACG CCG C	128. GCA TAT TCC G	153. GAG TCA CGA G	178. CCG TCA TTG G
104. GGG CAA TGA T	129. GCG GTA TAG T	154. TCC ATG CCG T	179. TCA CTG TAC G
105. CTC GGG TGG G	130. GGT TAT CCT C	155. CTG GCG GCT G	180. GGG CCA CGC T
106. CGT CTG CCC G	131. GAA ACA GCG T	156. GCC TGG TTG C	181. ATG ACG ACG G
107. CTG TCC CTT T	132. AGG GAT CTC C	157. CGT GGG CAG G	182. GTT CTC GTG T
108. GTA TTG CCC T	133. GGA AAC CTC T	158. TAG CCG TGG C	183. CGT GAT TGC T
109. TGT ACG TGA C	134. AAC ACA CGA G	159. GAG CCC GTA G	184. CAA ACG GCA C
110. TAG CCC GCT T	135. AAG CTG CGA G	160. CGA TTC AGA G	185. GTG TCT TCA C
111. AGT AGA CGG G	136. TAC GTC TTG C	161. CGT TAT CTC G	186. GTG CGT CGC T
112. GCT TGT GAA C	137. GGT CTC TCC C	162. AAC TTA CCG C	187. AAC GGG GGA G
113. ATC CCA AGA G	138. GCT TCC CCT T	163. CCC CCC AGA T	188. GCT GGA CAT C
114. TGA CCG AGA C	139. CCC AAT CTT C	164. CCA AGA TGC T	189. TGC TAG CCT C
115. TTC CGC GGG C	140. GTC GCA TTT C	165. GAA GGC ACT G	190. AGA ATC CGC C
116. TAC GAT GAC G	141. ATC CTG TTC G	166. ACT GCT ACA G	191. CGA TGG CTT T
117. TTA GCG GTC T	142. ATC TGT TCG G	167. CCA ATT CAC G	192. GCA AGT CAC T
118. CCC GTT TTG T	143. TCG CAG AAC G	168. CTA GAT GTG C	193. TGC TGG CTT T
119. ATT GGG CGA T	144. AGA GGG TTC T	169. ACG ACG TAG G	194. AGG ACG TGC C
120. GAA TTT CCC C	145. TGT CGG TTG C	170. ATC TCT CCT G	195. GAT CTC AGC G
121. ATA CAG GGA G	146. ATG TGT TGC G	171. TGA CCC CTC C	196. CTC CTC CCC C
122. GTA GAC GAG C	147. GTG CGT CCT C	172. ACC GTC GTA G	197. TCC CCG TTC C
123. GTC TTT CAG G	148. TGT CCA CCA G	173. CAG GCG GCG T	198. GCA GGA CTG C
124. ACT CGA AGT C	149. AGC AGC GTG G	174. AAC GGG CAG C	199. GCT CCC CCA C
125. GCG GTT GAG G	150. GAA GGC TCT G	175. TGG TGC TGA T	200. TCG GGA TAT G

NAPS Unit Standard Primers
5'-3'

RAPD Primer Set #3 (10 micrograms/tube)

201. CTG GGG ATT T	226. GGG CCT CTA T	251. CTT GAC GGG G	276. AGG ATC AAG C
202. GAG CAC TTA C	227. CTA GAG GTC C	252. CTG GTG ATG T	277. AGG AAG GTG C
203. CAC GGC GAG T	228. GCT GGG CCG A	253. CCG TGC AGT A	278. GGT TCC AGC T
204. TTC GGG CCG T	229. CCA CCC AGA G	254. CGC CCC CAT T	279. AGA CAT TAG A
205. CGG TTT GGA A	230. CGT CGC CCA T	255. TTC CTC CGG A	280. CTG GGA GTG G
206. GAG GAC GTC C	231. AGG GAG TTC C	256. TGC AGT CGA A	281. GAG AGT GGA A
207. CAT ATC AGG G	232. CGG TGA CAT C	257. CGT CAC CGT T	282. GGG AAA GCA G
208. ACG GCC GAC C	233. CTA TGC GCG C	258. CAG GAT ACC A	283. CGG CCA CCG T
209. TGC ACT GGA G	234. TCC ACG GAC G	259. GGT ACG TAC T	284. CAG GCG CAC A
210. GCA CCG AGA G	235. CTG AGG CAA A	260. TCT CAG CTA C	285. GGG CGC CTA G
211. GAA GCG CGA T	236. ATC GTA CGT G	261. CTG GCG TGA C	286. CGG AGC CGG C
212. GCT GCG TGA C	237. CGA CCA GAG C	262. CGC CCC CAG T	287. CGA ACG GCG G
213. CAG CGA ACT A	238. CTG TCC AGC A	263. TTA GAG ACG G	288. CCT CCT TGA C
214. CAT GTG CTT G	239. CTG AAG CGG A	264. TCC ACC GAG C	289. ATC AAG CTG C
215. TCA CAC GTG C	240. ATG TTC CAG G	265. CAG CTG TTC A	290. CCG GAG GCA C
216. CAT AGA CTC C	241. GCC CGA CGC G	266. CCA CTC ACC G	291. AGC TGA AGA G
217. ACA GGT AGA C	242. CAC TCT TTG C	267. CCA TCT TGT G	292. AAA CAG CCC G
218. CTC AGC CCA G	243. GGG TGA ACC G	268. AGG CCG CTT A	293. TCG TGT TGC T
219. GTG ACC TCA G	244. CAG CCA ACC G	269. CCA GTT CGC C	294. TGA TTG GCC A
220. GTC GAT GTC G	245. CGC GTG CCA G	270. TGC GCG CGG G	295. CGC GTT CCT G
221. CCC GTC AAT A	246. TAT GGT CCG G	271. GCC ATC AAG A	296. CCG CTG GGA G
222. AAG CCT CCC C	247. TAC CGA CGG A	272. AGC GGG CCA A	297. GCG CAT TAG A
223. GAT CCA TTG C	248. GAG TAA GCG G	273. AAT GTC GCC A	298. CCG TAC GGA C
224. TCT CCG GTA T	249. GCA TCT ACC G	274. GTT CCC GAG T	299. TGT CAG CGG T
225. CGA CTC ACA G	250. CGA CAG TCC C	275. CCG GGC AAG C	300. GGC TAG GGC G

RAPD Primer Set #4 (10 micrograms/tube)

301. CGG TGG CGA A	326. CGG ATC TCT A	351. CTC CCG GTG G	376. CAG GAC ATC G
302. CGG CCC ACG T	327. ATA CGG CGT C	352. CAC AAC GGG T	377. GAC GGA AGA G
303. GCG GGA GAC C	328. ATG GCC TTA C	353. TGG GCT CGC T	378. GAC AAC AGG A
304. AGT CCT CGC C	329. GCG AAC CTC C	354. CTA GAG GCC G	379. GGG CTA GGG T
305. GCT GGT ACC C	330. GGT GGT TTC C	355. GTA TGG GGC T	380. AGG AGT GAG A
306. GTC CTC GTA G	331. GCC TAG TCA C	356. GCG GCC CTC T	381. ATG AGT CCT G
307. CGC ATT TGC A	332. AAC GCG TAG A	357. AGG CCA AAT G	382. ATA CAC CAG C
308. AGC GGC TAG G	333. GAA TGC GAC G	358. GGT CAG GCC C	383. GAG GCG CTG C
309. ACA TCC TGC G	334. ATG GCA AAG C	359. AGG CAG ACC T	384. TGC GCC GCT A
310. GAG CCA GAA G	335. TGG ACC ACC C	360. CTC TCC AGG C	385. ACC GGG AAC G
311. GGT AAC CGT A	336. GCC ACG GAG A	361. GCG AGG TGC T	386. TGT AAG CTC G
312. ACG GCG TCA C	337. TCC CGA ACC G	362. CCG CCT TAC A	387. CGC TGT CGC C
313. ACG GCA GTG G	338. CTG TGG CGG T	363. ATG ACG TTG A	388. CGG TCG CGT C
314. ACT TCC TCC A	339. CTC ACT TGG G	364. GGC TCT CGC G	389. CGC CCG CAG T
315. GGT CTC CTA G	340. GAG AGG CAC C	365. TAG ACA GAG G	390. TCA CTC AGA G
316. CCT CAC CTG T	341. CTG GGG CCG T	366. CCT GAT TGC C	391. GCG AAC CTC G
317. CTA GGG GCT G	342. GAG ATC CCT C	367. ACC TTT GGC T	392. CCT GGT GGT T
318. CGG AGA GCG A	343. TGT TAG GCT C	368. ACT TGT GCG G	393. TTC CAT GCC T
319. GTG GCC GCG C	344. TGT TAG GCA C	369. GCG CAT AGC A	394. TCA CGC AGT T
320. CCG GCA TAG A	345. GCG TGA CCC G	370. TCA GCC AGC G	395. TCA CTT GAG G
321. ATC TAG GGA C	346. TAG GCG AAC G	371. TCT CGA TTG C	396. GAA TGC GAG G
322. GCC GCT ACT A	347. TTG CTT GGC G	372. CCC ACT GAC G	397. GGG CTG TGC C
323. GAC ATC TCG C	348. CAC GGC TGC G	373. CTG AGG AGT G	398. CAG TGC TCT T
324. ACA GGG AAC G	349. GGA GCC CCC T	374. GGT CAA CCC T	399. TTG CTG GGC G
325. TCT AAG CTC G	350. TGA CGC GCT C	375. CCG GAC ACG A	400. GCC CTG ATA T

NAPS Unit Standard Primers
5'-3'

RAPD Primer Set #5 (10 micrograms/tube)

401. TAG GAC AGT C	426. TCT CCC GGT G	451. CTA ATC TCG C	476. TTG AGG CCC T
402. CCC GCC GTT G	427. GTA ATC GAC G	452. CTA ATC ACG G	477. TGT TGT GCC C
403. GGA AGG CTG T	428. GGC TGC GGT A	453. AGT ACA AGG G	478. CGA GCT GGT C
404. TCT CTA CGA C	429. AAA CCT GGA C	454. GCT TAC GGC A	479. CTC ATA CGC G
405. CTC TCG TGC G	430. AGT CGG CAC C	455. AGC AAG CCG G	480. GGA GGG GGG A
406. GCC ACC TCC T	431. CTG CGG GTC A	456. GCG GAG GTC C	481. GTA ATT GCG C
407. TGG TCC TGG C	432. AGC GTC GAC T	457. CGA CGC CCT G	482. CTA TAG GCC G
408. CCG TCT CTT T	433. TCA CGT GCC T	458. CTC ACA TGC C	483. GCA CTA AGA C
409. TAG GCG GCG G	434. TCG CTA GTC C	459. GCG TCG AGG G	484. CTG GCA AGG A
410. CGT CAC AGA G	435. CTA GTA GGG G	460. ACT GAC CGG C	485. AGA ATA GGG G
411. GAG GCC CGT T	436. GAG GGG GCC A	461. CCC GTA TGT C	486. CCA GCA TCA G
412. TGC GCC GGT G	437. AGT CCG CTG C	462. CAT AGC GGC A	487. GTG GCT AGG T
413. GAG GCG GCG A	438. AGA CGG CCG G	463. AGG CGG AAG C	488. TTC GCT TCT C
414. AAG GCA CCA G	439. GCC CCT TGA C	464. CAC AAG CCT G	489. CGC ACG CAC A
415. GTT CCA GCA G	440. CTG TCG AAC C	465. GGT CAG GGC T	490. AGT GCA CCT T
416. GTG TTT CCG G	441. CTG CGT TCT T	466. TTC TTA GCG G	491. TCC TGT CAA G
417. GAC AGG CCA A	442. CTA CTC GGT T	467. AGC ACG GGC A	492. GTG ACT GCT C
418. GAG GAA GCT T	443. TGA TTG CTC G	468. ACG GAA GCG C	493. CCG AAT CAC T
419. TAC GTG CCC G	444. GCA GCC CCA T	469. CTC CAG CAA A	494. TGA TGC TGT C
420. GCA GGG TTC G	445. TAG CAG CTT G	470. AGG AGC TGG G	495. CTT TCC TTC C
421. ACG GCC CAC C	446. GCC AGC GTT C	471. CCG ACC GGA A	496. CCT TTC AAG G
422. CAC CTG CGG G	447. CAG GCT CTA G	472. AGG CGT GCA A	497. GCA TAG TGC G
423. GGG TCT CGA A	448. GTT GTG CCT G	473. ATC CCC AAG A	498. GAC AGT CCT G
424. ACG GAG GTT C	449. GAG GTT CAA C	474. AGG CGG GAA C	499. GGC CGA TGA T
425. CGT CGG GCC T	450. CGG AGA GCC C	475. CCA GCG TAT T	500. TTG CGT CAT G

RAPD Primer Set #6 (10 micrograms/tube)

501. CGG ATA TAC C	526. AAC GGG CAC C	551. GGA AGT CCA C	576. CAC CTA ATG G
502. GCA TGG TAG C	527. CTT CAA CGT G	552. CTA AAT GGC G	577. GTC TGA TGT G
503. ATC GTC CAA C	528. GGA TCT ATG C	553. TCC GAG ATC G	578. GGT GTC CAC T
504. ACC GTG CGT C	529. CAC TCC TAC A	554. TCA TCC AGG G	579. TGG AAT CGT G
505. CCC TTT ACA C	530. AAT AAC CGC C	555. GTG AAC AGC A	580. GCG ATA GTC C
506. CCT TTC CCG A	531. GCT CAC TGT T	556. ATG GAT GAC G	581. CCC GTT AAG G
507. AGA CGT ACT C	532. TTG AGA CAG G	557. GTG TAG AGC C	582. GGT ATA GAC G
508. CGG GGC GGA A	533. GCA TCT ACG C	558. CGA TAT CCG G	583. GTA TTT GCG C
509. ACA GAG ACT G	534. CAC CCC CTG C	559. GAG AAC TGG C	584. GCG GGC AGG A
510. CGC ATC TCT T	535. CCA CCA ACA G	560. CAC TGC TGT C	585. CCC GCG AGT C
511. GAA TGG TGA G	536. GCC CCT CGT C	561. CAT AAC GAC C	586. CCG GTT CCA G
512. GGG TGG ACA T	537. CGA AAG GAC T	562. CAA AGT AGC C	587. GCT ACT AAC C
513. TAT ACG ACC C	538. TGA CCT CTC C	563. CGC CGC TCC T	588. CAG AGG TTG G
514. CGG TTA GAC G	539. CTT ACG TCA C	564. CGG CGT TAC G	589. GAC GGA GGT C
515. GGG GGC CTC A	540. CGG ACC GCG T	565. GGT CGA TTT C	590. CCG GCA TGT T
516. AGC GCC GAC G	541. GCC CCT TTA C	566. CCA CAT GCG A	591. TCC CTC GTG G
517. GGT CGC AGC T	542. CCC ATG GCC C	567. AGA CAC CTG A	592. GGG CGA GTG C
518. TGC TGG TCC A	543. CGC TTC GGG T	568. ACC TGT TCT C	593. CGA GCT TTG A
519. ACC GGA CAC T	544. TAG AGA CTC C	569. CGA ATT GCT G	594. AGG AGC TGG C
520. TGC GCA GCC C	545. ACG TTG AGA C	570. GGC CGC TAA T	595. GTC ACC GCG C
521. CCG CCC CAC T	546. CCC GCA GAG T	571. GCG CGG CAC T	596. CCC CTC GAA T
522. TCG TCT AGC A	547. TAT GAC CTG G	572. TTC GAC CAT C	597. TGG TTC CCG A
523. ACA GGC AGA C	548. GTA CAT GGG C	573. CCC TAA TCA G	598. ACG GGC GCT C
524. CGG TTA CTA G	549. CCG GCT TAT G	574. GCC AGA CAA G	599. CAA GAA CCG C
525. GCT GGT TGG A	550. GTC GCC TGA G	575. GGA GAT GTA C	600. GAA GAA CCG C

NAPS Unit Standard Primers
5'-3'

RAPD Primer Set #7 (10 micrograms/tube)

601. CCG CCC ACT G	626. CCA AGC CCG G	651. TCA TTT CGC C	676. GCT AAC GTC C
602. GCG AAG ACT A	627. GGA TTC ACA G	652. CCC AAC ACA C	677. TCT CAG GAC A
603. ACC CAC CGC G	628. GTC TGG TTA G	653. CAT GCA AGA C	678. AGC GGA GCT G
604. GGC CCA TTG C	629. GCA AGT ATG C	654. CCC TGG TCT G	679. GAT GGG GTG G
605. CCG ATC ATT C	630. CAC TCT CTG G	655. GCA TTT CCC G	680. AAT GAG AGC C
606. CGG TCG GCC A	631. GGC TTA ACC G	656. CGT AAC CTT G	681. CCC CCG GAC T
607. AGT GTC GTC G	632. GAG TTT ACC C	657. GTC CTT TAG C	682. CTG CGA CGG T
608. GAG CCC GAA A	633. CGT TGT ATC C	658. CCT ATG TAC C	683. TAT TAC CGC C
609. ACA GCA CCA T	634. CCG TAC ACG C	659. CGG TTT CGT A	684. CCA CAC GTA G
610. TTT GCC GCC C	635. CTC AGC TCA G	660. AGA CGC CGA C	685. GAT CGC AGG C
611. CCA TCG TAC C	636. GGG ATA TCG C	661. CCT GCT TAC G	686. CGT GAC AGG A
612. CCG TGA GTA T	637. CCC TAA AGC G	662. GGC TAC GTC T	687. ATA CAA GGG G
613. TGC ACC CAC G	638. GCG GTG ACT A	663. CGT ATA GCC G	688. GCA GGA GCG T
614. GTA GTC TCG C	639. ATC GAG CAC C	664. GCC TGA AAA C	689. TGT CCG GAA G
615. CGT CGA CGG G	640. CGT GGG GCC T	665. GAC GCT TTT C	690. TAA TCC GGT C
616. CGG AAG AAA C	641. TGG AAC CAT G	666. CTT AAC ACG C	691. AAA CCA GGC G
617. CGG ACT ATG T	642. GTG GTC TCG A	667. CGC AGA AAT C	692. ACA TTG GGG G
618. CGG ACT ATG T	643. ATA AGC GGT G	668. CCC GAT TGA G	693. GAC GAG ACG G
619. TTC CCT AGC G	644. TCG TAT TGG G	669. GTT ACA CCA C	694. GGT TTG GAG G
620. TTG CGC CCG G	645. TAC AGC GTT G	670. CCC TTG AGA C	695. GCT AAT CAG C
621. GTC TGC GCT A	646. GTC CAC TTC C	671. CAT TAA GGC G	696. CGG ACA TGG C
622. ACA GGT GGT T	647. CCT GTG GGG G	672. TAC CGT GGC G	697. CGC AGG TCA C
623. TGC GGG ACT G	648. GCA CGC GAG A	673. TTC ATA CGC G	698. CTA GAC GTT G
624. GTG ATA AGC C	649. AAT GCT GGA C	674. ATC GAT CCG G	699. GTT ACT GCC C
625. CCG CTG GAG C	650. AGT ATG CAG C	675. ACC GGT GGA G	700. GGA CTA AGG T

RAPD Primer Set #8 (10 micrograms/tube)

701. CCC ACA ACC C	726. GGT GTG GGT G	751. CCC ACC ACA C	776. CTT CCC TCC T
702. GGG AGA AGG G	727. GGG TGT GGT G	752. CCC TCC TCT C	777. GGA GAG GAG A
703. CCA ACC ACC C	728. GTG GGT GGT G	753. GGG AGG AGG A	778. CCA CAC CAC A
704. GGA AGG AGG G	729. CCC AAC CCA C	754. GGG TGG TGG T	779. CCT TTC TCC C
705. GGA GGA AGG G	730. CCA CAC CCA C	755. CCC ACC ACC A	780. CCT CTT CCT C
706. GGT GGT TGG G	731. CCC ACA CCA C	756. CCC TCC TCC T	781. GGG AAG AAG G
707. CCC AAC ACC C	732. CAC CCA CCA C	757. GGA AGG GAG G	782. GGG AAG AGA G
708. GGG TTG TGG G	733. GGG AAG GGA G	758. GGT TGG GTG G	783. GGT GGG TTG T
709. CCT CCT CCC T	734. GGA GAG GGA G	759. CCA ACC CAC C	784. GTG GGT GTT G
710. GGT GGT GGG T	735. GGG AGA GGA G	760. CCT TCC CTC C	785. CAC CCA ACC A
711. CCC TCT CCC T	736. GAG GGA GGA G	761. GAG AGG AGG G	786. TCC CTT CCT C
712. GGG TGT GGG T	737. GGT GGG TGT G	762. GTG TGG TGG G	787. CCC TTC TTC C
713. CCC TCC CTC T	738. GGT GGG TGG T	763. CAC ACC ACC C	788. CCT TCC CTC T
714. GGG TGG GTG T	739. GGA GGG AGA G	764. CTC TCC TCC C	789. GGA AGG GAG A
715. CCA CCA CCC A	740. GGA GGG AGG A	765. AGG GAG GAG G	790. GGG TGT GGT T
716. GGA GGA GGG A	741. CCT CCC TCT C	766. TGG GTG GTG G	791. GTG GGT TGT G
717. CCC ACA CCC A	742. CCT CCC TCC T	767. ACC CAC CAC C	792. CAA CCC ACA C
718. GGG AGA GGG A	743. CCA CCC ACA C	768. TCC CTC CTC C	793. CTC CTC TCT C
719. CCC ACC CAC A	744. CCA CCC ACC A	769. GGG TGG TGG G	794. GAG GGG AAA G
720. GGG AGG GAG A	745. GGG AAG AGG G	770. GGG AGG AGG G	795. TGG TGT GGG T
721. CCC TTC CCT C	746. GGG TGT TGG G	771. CCC TCC TCC C	796. AGA GGG AGG A
722. CCT CTC CCT C	747. CCA CCA ACC C	772. CCC ACC ACC C	797. CCA CCA ACA C
723. CCC TCT CCT C	748. CCC TTC TCC C	773. GGG TTG TTG G	798. GAG AGG AAG G
724. CTC CCT CCT C	749. GGG AGG AGA G	774. GGT GTG TGG T	799. TGT GGT GGT G
725. GGG TTG GGT G	750. GGG TGG TGT G	775. GGT TTG GTG G	800. TCT CCC TCC T

UBC Primer Set #9 (Microsatellite)

A number of users of the UBC RAPD primer sets have expressed an interest in using a set of SSR-targeted primers for genomic analysis, if one were made available. We have therefore assembled set #9 for this purpose. The sequences are shown below, together with a reminder of the abbreviations for mixed-base positions. As with previous sets, the oligos were purified by elution with Tris/EDTA buffer through NAP-5 drip columns. Aliquots (10-20 microlitres each) calculated to be 3 nanomoles (see below) were made near the bottom of the tubes and air-dried in a running sterile flow-hood. The primers were quantitated by u.v. spectrophotometry and two assumptions were made in converting the A260 figures to concentrations: first, that at mixed base positions, equal quantities of the mixed bases are incorporated, and second, that no secondary structure is present, i.e. that no hypochromicity is occurring. Nucleic acid chemists will appreciate that these are necessarily approximations, and the second, particularly, is likely to be inaccurate for some sequences. However, in these cases the error is likely to be in favour of the recipient, with the actual quantity of primer probably being between 3 and 4 nmoles.

Many of the sequences are 2-base repeats reported in the literature as having been used for genomic mapping, with the repeat sequence interrupted at the 3'- or 5'- end by bases which in type or identity are "out-of-phase" with the repeat and can thus act as anchors (for use of primers of this type, see Zietkiewicz, Rafalski and Labuda, *Genomics*, 20,176-183 (1994)). A number of 3-, 4-, and 5- base repeats, without putative anchors, have also been included: all have been reported as SSRs for various species. A number of oligonucleotides described as general genomic amplification primers have also been included in the set. References to these are as follows:

- #892 Hadano et al., *Genomics*, 11, 364-373 (1991)
- #893 Zhang et al., *Proc. Natl. Acad. Sci. USA*, 89, 5847-5851 (1992)
- #894, 895 Bohlander et al., *Genomics*, 13, 1322-1324 (1992)
- #896,897 Telenius et al., *Genomics*, 13, 718-725 (1992)
- #898 Breneman et al., *Chromosoma*, 102, 591-598 (1993)

I thank those who have taken the time and trouble to provide suggestions for sequences to be included in this set.

UBC Primer Set #9 (Microsatellite)
3 nanomoles/tube

801	ATA TAT ATA TAT ATA TT	851	GTG TGT GTG TGT GTG TYG
802	ATA TAT ATA TAT ATA TG	852	TCT CTC TCT CTC TCT CRA
803	ATA TAT ATA TAT ATA TC	853	TCT CTC TCT CTC TCT CRT
804	TAT ATA TAT ATA TAT AA	854	TCT CTC TCT CTC TCT CRG
805	TAT ATA TAT ATA TAT AC	855	ACA CAC ACA CAC ACA CYT
806	TAT ATA TAT ATA TAT AG	856	ACA CAC ACA CAC ACA CYA
807	AGA GAG AGA GAG AGA GT	857	ACA CAC ACA CAC ACA CYG
808	AGA GAG AGA GAG AGA GC	858	TGT GTG TGT GTG TGT GRT
809	AGA GAG AGA GAG AGA GG	859	TGT GTG TGT GTG TGT GRC
810	GAG AGA GAG AGA GAG AT	860	TGT GTG TGT GTG TGT GRA
811	GAG AGA GAG AGA GAG AC	861	ACC ACC ACC ACC ACC ACC
812	GAG AGA GAG AGA GAG AA	862	AGC AGC AGC AGC AGC AGC
813	CTC TCT CTC TCT CTC TT	863	AGT AGT AGT AGT AGT AGT
814	CTC TCT CTC TCT CTC TA	864	ATG ATG ATG ATG ATG ATG
815	CTC TCT CTC TCT CTC TG	865	CCG CCG CCG CCG CCG CCG
816	CAC ACA CAC ACA CAC AT	866	CTC CTC CTC CTC CTC CTC
817	CAC ACA CAC ACA CAC AA	867	GGC GGC GGC GGC GGC GGC
818	CAC ACA CAC ACA CAC AG	868	GAA GAA GAA GAA GAA GAA
819	GTG TGT GTG TGT GTG TA	869	GTT GTT GTT GTT GTT GTT
820	GTG TGT GTG TGT GTG TC	870	TGC TGC TGC TGC TGC TGC
821	GTG TGT GTG TGT GTG TT	871	TAT TAT TAT TAT TAT TAT
822	TCT CTC TCT CTC TCT CA	872	GAT AGA TAG ATA GAT A
823	TCT CTC TCT CTC TCT CC	873	GAC AGA CAG ACA GAC A
824	TCT CTC TCT CTC TCT CG	874	CCC TCC CTC CCT CCC T
825	ACA CAC ACA CAC ACA CT	875	CTA GCT AGC TAG CTA G
826	ACA CAC ACA CAC ACA CC	876	GAT AGA TAG ACA GAC A
827	ACA CAC ACA CAC ACA CG	877	TGC ATG CAT GCA TGC A
828	TGT GTG TGT GTG TGT GA	878	GGA TGG ATG GAT GGA T
829	TGT GTG TGT GTG TGT GC	879	CTT CAC TTC ACT TCA
830	TGT GTG TGT GTG TGT GG	880	GGA GAG GAG AGG AGA
831	ATA TAT ATA TAT ATA TYA	881	GGG TGG GGT GGG GTG
832	ATA TAT ATA TAT ATA TYC	882	VBV ATA TAT ATA TAT AT
833	ATA TAT ATA TAT ATA TYG	883	BVB TAT ATA TAT ATA TA
834	AGA GAG AGA GAG AGA GYT	884	HBH AGA GAG AGA GAG AG
835	AGA GAG AGA GAG AGA GYC	885	BHB GAG AGA GAG AGA GA
836	AGA GAG AGA GAG AGA GYA	886	VDV CTC TCT CTC TCT CT
837	TAT ATA TAT ATA TAT ART	887	DVD TCT CTC TCT CTC TC
838	TAT ATA TAT ATA TAT ARC	888	BDB CAC ACA CAC ACA CA
839	TAT ATA TAT ATA TAT ARG	889	DBD ACA CAC ACA CAC AC
840	GAG AGA GAG AGA GAG AYT	890	VHV GTG TGT GTG TGT GT
841	GAG AGA GAG AGA GAG AYC	891	HVH TGT GTG TGT GTG TG
842	GAG AGA GAG AGA GAG AYG	892	TAG ATC TGA TAT CTG AAT TCC C
843	CTC TCT CTC TCT CTC TRA	893	NNN NNN NNN NNN NNN
844	CTC TCT CTC TCT CTC TRC	894	TGG TAG CTC TTG ATC ANN NNN
845	CTC TCT CTC TCT CTC TRG	895	AGA GTT GGT AGC TCT TGA TC
846	CAC ACA CAC ACA CAC ART	896	AGG TCG CGG CCG CNN NNN NAT G
847	CAC ACA CAC ACA CAC ARC	897	CCG ACT CGA GNN NNN NAT GTG G
848	CAC ACA CAC ACA CAC ARG	898	GAT CAA GCT TNN NNN NAT GTG G
849	GTG TGT GTG TGT GTG TYA	899	CAT GGT GTT GGT CAT TGT TCC A
850	GTG TGT GTG TGT GTG TYC	900	ACT TCC CCA CAG GTT AAC ACA

SINGLE LETTER ABBREVIATIONS FOR MIXED BASE POSITIONS

N = (A,G,C,T)
R = (A,G)
Y = (C,T)
B = (C,G,T) (i.e. not A)
D = (A,G,T) (i.e. not C)
H = (A,C,T) (i.e. not G)
V = (A,C,G) (i.e. not T)
K = (G,T) (Keto in large groove)
M = (A,C) (aMino in large groove)
S = (G,C) (Strong [3 H-bonds])
W = (A,T) (Weak [2 H-bonds])

Conifer Kit Primers

(Subset of RAPD Primer Sets #1 - #7 + Conifer Operons. 100 primers in total))

10 micrograms/tube

Subset of RAPD Primer Sets #1 - #7

116. TAC GAT GAC G	256. TGC AGT CGA A	370. TCA GCC AGC G	533. GCA TCT ACG C
119. ATT GGG CGA T	258. CAG GAT ACC A	372. CCC ACT GAC G	536. GCC CCT CGT C
123. GTC TTT CAG G	266. CCA CTC ACC G	381. ATG AGT CCT G	550. GTC GCC TGA G
146. ATG TGT TGC G	268. AGG CCG CTT A	402. CCC GCC GTT G	554. TCA TCC AGG G
153. GAG TCA CGA G	269. CCA GTT CGC C	408. CCG TCT CTT T	561. CAT AAC GAC C
159. GAG CCC GTA G	270. TGC GCG CGG G	424. ACG GAG GTT C	564. CGG CGT TAC G
167. CCA ATT CAC G	295. CGC GTT CCT G	427. GTA ATC GAC G	570. GGC CGC TAA T
168. CTA GAT GTG C	297. GCG CAT TAG A	429. AAA CCT GGA C	579. TGG AAT CGT G
169. ACG ACG TAG G	299. TGT CAG CGG T	460. ACT GAC CGG C	580. GCG ATA GTC C
181. ATG ACG ACG G	320. CCG GCA TAG A	479. CTC ATA CGG C	586. CCG GTT CCA G
184. CAA ACG GCA C	322. GCC GCT ACT A	485. AGA ATA GGG C	587. GCT ACT AAC C
186. GTG CGT CGC T	324. ACA GGG AAC G	493. CCG AAT CAC T	589. GAC GGA GGT C
190. AGA ATC CGC C	327. ATA CGG CGT C	499. GGC CGA TGA T	590. CCG GCA TGT T
193. TGC TGG CTT T	330. GGT GGT TTC C	504. ACC GTG CGT C	600. GAA GAA CCG C
195. GAT CTC AGC G	333. GAA TGC GAC G	507. AGA CGT ACT C	631. GGC TTA ACC G
203. CAC GGC GAG T	336. GCC ACG GAG A	509. ACA GAG ACT G	667. CGC AGA AAT C
213. CAG CGA ACT A	337. TCC CGA ACC G	517. GGT CGC AGC T	677. TCT CAG GAC A
225. CGA CTC ACA G	348. CAC GGC TGC G	519. ACC GGA CAC T	
248. GAG TAA GCG G	352. CAC AAC GGG T	530. AAT AAC CGC C	
254. CGC CCC CAT T	362. CCG CCT TAC A	531. GCT CAC TGT T	

Conifer Operons

A-06 GGT CCC TGA C	B-08 GTC CAC ACG G	E-12 TTA TCG CCC C	J-01 CCC GGC ATA A
A-08 GTG ACG TAG G	B-13 TTC CCC CGC T	E-17 CTA CTG CCG T	J-08 CAT ACC GTG G
A-09 GGG TAA CGC C	C-04 CCG CAT CTA C	F-07 CCG ATA TCC C	X-04 CCG CTA CCG A
A-11 CAA TCG CCG T	D-12 CAC CGT ATC C	G-09 CTG ACG TCA C	Y-09 AGC AGC GCA C
A-16 AGC CAG CGA A	E-08 TCA CCA CGG T	G-10 AGG GCC GTC T	Y-17 GAC GTG GTG A
B-05 TGC GCC CTT C	E-09 CTT CAC CCG A	G-12 CAG CTC ACG A	

DDRT-PCR (Differential Display Reverse Transcription PCR) Primer Set
(12 x TnXX Primers (30 nanomoles/tube) + mRNA 1 - mRNA 26 (3 nanomoles/tube))

TnXX Primers

TnAA d[(T11)AA]
TnAG d[(T11)AG]
TnAC d[(T11)AC]
TnAT d[(T11)AT]
TnGA d[(T11)GA]
TnGG d[(T11)GG]
TnGC d[(T11)GC]
TnGT d[(T11)GT]
TnCA d[(T11)CA]
TnCG d[(T11)CG]
TnCC d[(T11)CC]
TnCT d[(T11)CT]

mRNA Primers

mRNA 1 TAC AAC GAG G
mRNA 2 TGG ATT GGT C
mRNA 3 CTT TCT ACC C
mRNA 4 TTT TGG CTC C
mRNA 5 GGA ACC AAT C
mRNA 6 AAA CTC CGT C
mRNA 7 TCG ATA CAG G
mRNA 8 TGG TAA AGG G
mRNA 9 TCG GTC ATA G
mRNA 10 GGT ACT AAG G
mRNA 11 TAC CTA AGC G
mRNA 12 CTG CTT GAT G
mRNA 13 GTT TTC GCA G
mRNA 14 GAT CAA GTC C
mRNA 15 GAT CCA GTA C
mRNA 16 GAT CAC GTA C
mRNA 17 GAT CTG ACA C
mRNA 18 GAT CTC AGA C
mRNA 19 GAT CAT AGC C
mRNA 20 GAT CAA TCG C
mRNA 21 GAT CTA ACC G
mRNA 22 GAT CGC ATT G
mRNA 23 GAT CTG ACT G
mRNA 24 GAT CAT GGT C
mRNA 25 GAT CAT AGC G
mRNA 26 GAT CTA AGG C

in-DNA (Insect nuclear DNA) Set

10 nanomoles/tube

This primer set was compiled by B. Crespi, with contributions and assistance from M. Berbee, A. Brower, D. Carmean, R. DeSalle, B. Farrell, T. Friedlander, B. Normark, S. Palumbi, J. Regier, H. Robertson, G. Roderick, and C. Simon. Dr. Crespi would especially like to thank

Andy Brower and Ben Normark for making available the sequences for unpublished primers that they have designed and tested.

The purpose of the compilation is to make easily available a set of primers for nuclear genes for insect systematics and population biology. These primers were chosen because they are known, expected, or hoped to work with more than one order of insects. The contributors should be considered in no way responsible for multiple copies, recombination, huge introns, lineage sorting, lack of amplification in your favourite insects, or amplification of your pet iguana by mistake. Remember: working with nuclear DNA sequence is considerably more complex than working with mtDNA sequence. Please see the references associated with (most of) the primers for details concerning primer design and usefulness. All primers are listed 5' to 3'.

NUCLEAR PRIMER SET

(1) Protein-coding genes:

ELONGATION FACTOR-1ALPHA

Cho, Mitchell, Regier, Mitter, Poole, Friedlander and Zhao, 1995. A highly conserved nuclear gene for low-level phylogenetics: Elongation factor - 1alpha recovers morphology - based tree for heliothine moths. Mol. Biol. Evol. 12:650-656, 1995.

M3 CACAT(CT)AACATTGTCGT(CG)AT(CT)GG [2103]
rcM44.9 CTTGATGAAATC(CT)CTGTGTCC [2342]
M44-1 GCTGAGCG(CT)GA(GA)CGTGGTATCAC [2277]
rcM51-1 CAT(GA)TTGTC(GT)CCGTGCCA(GT)CC [2645]
M46-1 GAGGAAAT(CT)AA(GA)AAGGAAG [2582]
rcM52.6 GC(CT)TCGTGGTGCAT(CT)TC(GC)AC [2936]
M51.9 CA(GA)GACGTATACAAAATCGG [2832]
rcM53-2 GCAATGTG(GA)GCIGTGTGGCA [3149]
M52.7 C GTCAAGGA(GA)(CT)TGCCTCGTGG [3030]
rcM4 ACAGC(CGA)AC(GT)GT(TC)TG(CT)CTCAT(AG)TC [3344]

Degenerate positions are identified by placing the appropriate nucleotides within parentheses. "rc" stands for "reverse complement" and indicates that the primer binds to the sense strand of the DNA. Numbers in brackets at the 3' end of each primer refer to nucleotide position relative to the *Drosophila melanogaster* sequence. I, inosine.

These primers work in some Lepidoptera, and possibly in many other insects and arthropods.

Primers designed and submitted by Dr. Ben Normark, Department of Ecology and Evolution, University of Arizona, Tucson:

EFS599 Elongation factor 1-alpha

(23-mer) ATCTCCGGATGGCACGGYGACAA

Fly (F1 copy) ..T.....C....
Fly (F2 copy)C....
BeeC....
Moth (Bombyx) ..T..T.....A....
Brine shrimp ..T..T.....T..T....

EFA923 Elongation factor 1-alpha

(22-mer) ACGTTCTTCACGTTGAARCCAA

Fly (F1 copy)G.....G....
Fly (F2 copy)G....
Bee ..T.....G....
Moth (Bombyx)T.....A..T.
Brine shrimpT..G..A.....A....

Designed by B. Normark on the basis of fly, bee, and brine shrimp. Successfully amplifies beetle (weevil genus *Aramigus*) elongation factor 1a. Attempts to amplify aphid genes failed. In conjunction with EFS599, amplifies a fragment containing an intron whose position is conserved between bee and fly F2. This fragment also contains an intron (in a slightly different position) in weevils.

PHOSPHOENOLPYRUVATE CARBOXYKINASE

(Friedlander, Regier, Mitter and Wagner. 1995. A nuclear gene for higher level phylogenetics: Phosphoenolpyruvate carboxykinase tracks Mesozoic-age divergences within Lepidoptera (Insecta). *Mol Biol Evol* 13:594-604.

284dF	GAG GGC TGG CTR GCM GAR CAY ATG (901)
18.5dF	TGT GGN AAR ACC AAY YTG GCC ATG (991)
19.5dF	GGN GAY GAY ATI GCB TGG ATG (1051)
20.5dF	GGI GTI TGG TGG GAR GGI ATG G (1226)
21dNrc	CAI AAY CTI GAR TTI GGR TGN GC (1305)
511drc	GGM CGC ATT GCR AAY GGR TCR TGC AT (1532)
22.5drc	GAA CCA RTT RAC RTG RAA GAT C (1630)

Primer name abbreviations: d = degenerate, F = forward, N = new version, rc = reverse complement. Non-standard nucleotide abbreviations: B = C/G/T, M = A/C, N = A/C/G/T, R = A/G, Y = C/T, I = inosine. Numbers in parentheses following the primer sequences correspond to the 3' end of the primer as localized in the *Drosophila melanogaster* sequence (GenBank accession no. Y00402).

According to Friedlander et al. 1996, these primers, or a subset thereof, work in some Lepidoptera, Trichoptera, Diptera, Siphonaptera, and

NAPS Unit Standard Primers
5'-3'

Mecoptera. Since they were designed from *Drosophila*, chicken and rat, they should work in other insects as well.

GLUCOSE 6 PHOSPHATE DEHYDROGENASE

Soto-Adames, F., H. M. Robertson and S. H. Berlocher. 1994. Phylogenetic utility of partial DNA sequences of G6pdh at different taxonomic levels in Hexapoda with emphasis on Diptera. *Ann. Entomol. Soc. Amer.* 87:723-736

G6PDH 56F: AAR AAR AAR ATH TAY CCN AC
G6PDH 209R: TTY TGN ACC ATY TCY TTN CC

N= AGCT
H= ACT
R= AG
Y= TC

Designed from human and *Drosophila*. Works in flies, lepidopterans, thysanurans, collembolans only when cDNA is used as the PCR template, though genomic DNA sometimes amplifies in some flies and collembolans.

Primers designed and submitted by Dr. Andy Brower, American Museum of Natural History, New York (brower@amnh.org), with modification by Dana Campbell, Harvard University.

Wingless:

LEPWG1: GAR TGY AAR TGY CAY GGY ATG TCT GG
ModLEPWG2: ACT ICG CAR CAC CAR TGG AAT GTR CA

Works for Lepidoptera and Diptera, success reported with crickets. Amplified bit 400 (in leps) to 700 bp (in flies) long. There are 2 large data sets (70+ taxa), for nymphalid (Brower, AMNH) and lycaenid (N. Pierce et al., Harvard U.) butterflies, that have been generated using these primers. The sequences are informative at the intergeneric to subfamily level in these groups.

Decapentaplegic:

LepDecaA: CGI IGA CTT CGC IGA CGT IGG CTG
LepDecaB: CCA CAI CCI ACI ACI ATC ATG TCC TGG TA

Designed from three Lepidoptera. Not yet tested thoroughly on other insects. This marker is not recommended as highly as wingless by Brower.

Sodium Pump

The primers cover a 1-2kb fragment and were designed by Brian Farrell from sequences on GenBank for *Drosophila*, leps and *Artemia* and fleas. The

NAPS Unit Standard Primers
5'-3'

numbers refer to positions on *Drosophila melanogaster*. Sequences were first published by Lebovitz, R. M., K Takeyasu and D. M. Fambrough. 1989. EMBO J. 8:193-202. These sometimes produce multiple bands in beetles, but work well for other taxa mentioned above. We have been able to produce excellent sequences using these primers for *Drosophila* and *Artemia*, but not yet for beetles.

This gene is highly conserved, and likely useful for higher insect phylogeny (e.g., for flies as reported in Emery et al 1995). There are introns between these primers for some lepis.

S389(SDPA): 5' CTG TGG AT(C/T) GG(T/A) G(C/A)(T/G) ATT CT 3'

A526(SDPC): 5' ACC ATG TT(G/A) TTG AA(C/G) GAT TCC ATG ATC TT 3'

A1669: 5' AG(C/T) TCC ATG TAG GCA TTG TTG A 3'

S1124: 5' AG CGT ATG GC(C/A) TC(A/G) AAG AAC TG 3'

A1103: 5' CA GTT CTT (C/T)GA (G/T)GC CAT ACG CT 3'

(2) EPIC (exon-primed intron crossing) primers

Palumbi, S. 1996. Nucleic Acids II: The Polymerase Chain Reaction. Chapter 7 of Molecular Systematics II, Sinauer Press, pp. 241-246. See this chapter for important details concerning these primers. For these primers, Y=C,T ; R=A,G ; Z=C,G ; S=C,A ; Q=A,T ; M=A,T,C ; D = G,T ; K = G,T (note that both D and K equal G, T); N = all four bases ; X=amino link.

Creatine kinase introns:

CK6-5': GAC CAC CTC CGA GTC ATC TCZ ATG
CK7-3': CAG GTG CTC GTT CCA CAT GAA
ARK7-3': GT GCC AAG GTT GGT DGG GCA

CK6 with CK7 works in tephritid flies, and CK6 with ARK7 was designed to work in arthropods.

Actin introns:

ACT I5': GCT GTT TTC CCG TCC ATT GT
ACT II3': GTC CTT CTG CCC CAT ACC SAC CAG

Works in some insects and spiders.

Cytochrome c introns:

cytC-C-5': AAG TGT GCY CAR TGC CAC AC
cytC-B-3': CAT CTT GGT GCC GGG GAT GTA TTT CTT

Works in some Diptera and Lepidoptera, should work in other arthropods.

EF1alpha introns:

EF0-5': TCC GGA TGG CAY GGC GAG AAY ATG
EF1-5': GAC AAC GTT GGC TTC AAC GTG AAG AAC G
EF2-3': AT GTG AGC AGT GTG GCA ATC CAA

These primers were designed in collaboration with George Roderick.
They work in insects, spiders, crustaceans, and gastropods.
Pairing of EFO with EF2 generally provides the best results.

Beta-tubulin introns:

Tub1-5': CAG GCT GGT CAA TGT GGY AAY CA
Tub2-3': CC RTG YTC ATC ACT (TG)AT YAC CTC CCA
Tub3-5': GAT TTG GAG CCN GGN ACC ATG GA
Tub4-3': AT ACG GTC TGG GTA CTC YTC NCG

Tub1 and Tub2 do not work well together. Tub1 with Tub4, and
Tub3 with Tub4, work in flies, molluscs and sea urchins.

Calmodulin introns:

Cal-1 GCC GAG CTG CAR GAY ATG ATC AA

drosG ..C
human ..AG ..T
Aplysia ..T ..A T.. ..A ..C

Cal-2 GT GTC CTT CAT TTT NCK TGC CAT CAT

drosG.G
humanC.. T.T G.. ..
AplysiaT.. ..C.T

These primers, communicated to BC by Steve Palumbi, were designed by
Tom Duda, University of Hawaii, and are similar to those developed
independently by Peter Holland. Cal-2 is the reverse complement of the
coding sequence and anneals at amino acid position 80. Cal-1 anneals
at amino acid position 47, and the amplified product without an intron
is ca. 90. Introns occur at amino acid position 60 in snails and urchins
and insects and mammals.

(3) Ribosomal genes and ITS

18S primers

Vawter, L. 1991. Evolution of blattoid insects and of the small subunit ribosomal gene. PhD diss, University of Michigan, Ann Arbor.

18S-S22: TAA TGA TCC TTC CGC AGG TTC A
18S-A1984: TCC CTG GTT GAT CCT GCC AGT A

These primers amplify the 18S gene in virtually all insects tested.

ITS primers

ITS4: TCC TCC GCT TAT TGA TAT GC
ITS5 GGA AGT AAA AGT CGT AAC AAG G

These primers amplify a fragment often about 600 bp long and should work in virtually all of life. These primers are from: White, T. J., T. Bruns, S. Lee and J. Taylor. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. Pp. 315-322 in M. A. Innis, D. H. Gelfand, J. J. Sninsky and T. J. White, eds. PCR Protocols, A Guide to Methods and Applications. Academic Press Inc., San Diego, California and their sequence was provided to BC by Mary Berbee and Dave Carmean.

Each set contains 10 nmoles
each (which is enough for 1 ml of 10uM solution of each primer) of 50 oligos marked inD-1 to inD-50. The complete sequence list for the set, showing concordance between tube marking, conventional designation, and sequence is enclosed with each set.

The oligonucleotides were purified by elution with Tris/EDTA buffer through NAP-5 drip columns. Aliquots of 10 nmoles (10-20 microlitres) each were made near the bottom of the tubes and air dried. All manipulations were conducted in a sterile laminar flow hood. We suggest dissolving your oligos in water or buffer as required, dividing them into portions of adequate size for each intended set of experiments, and storing these as stock solutions at -20 C, thawing portions only when needed. Oligonucleotides subjected to repeated freeze-thaw cycles will become degraded.

in-DNA (Insect nuclear DNA) Set

Key

Tube label
Standard designation
Sequence

inDNA 1

M3
CAC AT(CT) AAC ATT GTC GT(CG) AT(CT) GG

inDNA 2

rcM44.9
CTT GAT GAA ATC (CT)CT GTG TCC

inDNA 3

M44-1
GCT GAG CG(CT) GA(GA) CGT GGT ATC AC

inDNA 4

rcM51-1
CAT (GA)TT GTC (GT)CC GTG CCA (GT)CC

inDNA 5

M46-1
GAG GAA AT(CT) AA(GA) AAG GAA G

inDNA 6

rcM52.6
GC(CT) TCG TGG TGC AT(CT) TC(GC) AC

inDNA 7

M51.9
CA(GA) GAC GTA TAC AAA ATC GG

inDNA 8

rcM53-2
GCA ATG TG(GA) GCI GTG TGG CA

inDNA 9

M52.7
CGT CAA GGA (GA)(CT)T GCG TCG TGG

inDNA 10

rcM4
ACA GC(CGA) AC(GT) GT(TC) TG(CT) CTC AT(AG) TC

inDNA 11

EFS599
ATC TCC GGA TGG CAC GG(CT) GAC AA

inDNA 12

EFA923

ACG TTC TTC ACG TTG AA(AG) CCA A

inDNA 13

284dF

GAG GGC TGG CT(AG) GC(AC) GA(AG) CA(CT) ATG

inDNA 14

18.5dF

TGT GG(AGCT) AA(AG) ACC AA(CT) (CT)TG GCC ATG

inDNA 15

19.5dF

GG(AGCT) GA(CT) GA(CT) ATI GC(CGT) TGG ATG

inDNA 16

20.5dF

GGI GTI TGG TGG GA(AG) GGI ATG G

inDNA 17

21dNrc

CAI AA(CT) CTI GA(AG) TTI GG(AG) TG(AGCT) GC

inDNA 18

511drc

GG(AC) CGC ATT GC(AG) AA(CT) GG(AG) TC(AG) TGC AT

inDNA 19

22.5drc

GAA CCA (AG)TT (AG)AC (AG)TG (AG)AA GAT C

inDNA 20

G6PDH 56F

AA(AG) AA(AG) AA(AG) AT(ACT) TA(CT) CC(AGCT) AC

inDNA 21

G6PDH 209R

TT(CT) TG(AGCT) ACC AT(CT) TC(CT) TT(AGCT) CC

inDNA 22

LEPWG1

GA(AG) TG(CT) AA(AG) TG(CT) CA(CT) GG(CT) ATG TCT GG

inDNA 23

ModLEPWG2

ACT ICG CA(AG) CAC CA(AG) TGG AAT GT(AG) CA

inDNA 24

LepDecaA

CGI IGA CTT CGC IGA CGT IGG CTG

inDNA 25

LepDecaB

CCA CAI CCI ACI ACI ATC ATG TCC TGG TA

inDNA 26

CK6-5'
GAC CAC CTC CGA GTC ATC TC(CG) ATG

inDNA 27

CK7-3'
CAG GTG CTC GTT CCA CAT GAA

inDNA 28

ARK7-3'
GTG CCA AGG TTG GT(GT) GGG CA

inDNA 29

ACT I5'
GCT GTT TTC CCG TCC ATT GT

inDNA 30

ACT II3'
GTC CTT CTG CCC CAT ACC (CA)AC CAG

inDNA 31

cytC-C-5'
AAG TGT GC(CT) CA(AG) TGC CAC AC

inDNA 32

cytC-B-3'
CAT CTT GGT GCC GGG GAT GTA TTT CTT

inDNA 33

EF0-5'
TCC GGA TGG CA(CT) GGC GAG AA(CT) ATG

inDNA 34

EF1-5'
GAC AAC GTT GGC TTC AAC GTG AAG AAC G

inDNA 35

EF2-3'
ATG TGA GCA GTG TGG CAA TCC AA

inDNA 36

Tub1-5'
CAG GCT GGT CAA TGT GG(CT) AA(CT) CA

inDNA 37

Tub2i-3'
CC(AG) TG(CT) TCA TCT TA(TG) AT(CT) ACC TCC CA

inDNA 38

Tub3-5'
GAT TTG GAG CC(AGCT) GG(AGCT) ACC ATG GA

inDNA 39

Tub4-3'
ATA CGG TCT GGG TAC TC(CT) TC(AGCT) CG

inDNA 40

Cal-1

GCC GAG CTG CA(AG) GA(CT) ATG ATC AA

inDNA 41

Cal-2

GTG TCC TTC ATT TT(AGCT) C(GT)T GCC ATC AT

inDNA 42

18S-S22

TAA TGA TCC TTC CGC AGG TTC A

inDNA 43

18S-A1984

TCC CTG GTT GAT CCT GCC AGT A

inDNA 44

ITS4

TCC TCC GCT TAT TGA TAT GC

inDNA 45

ITS5

GGA AGT AAA AGT CGT AAC AAG G

mt-DNA (mitochondrial DNA) Primer Set

10 nanomoles/tube

Key

Tube

Designation

Alias

Sequence

mtD-1

TI-N-24

t-Iso

ATT TAC CCT ATC AAG GTA A

mtD-2

TM-J-206

Frank

GCT AAA TAA GCT AAC AGG TTC AT

mtD-3

TM-N-193

met-20

TGG GGT ATG AAC CCA GTA GC

mtD-4

TY-J-1460

TAC AAT TTA TCG CCT AAA CTT CAG CC

mtD-5

C1-N-1560

TGT TCC TAC TAT TCC GGC TCA

mtD-6

C1-J-1718

GGA GGA TTT GGA AAT TGA TTA GTT CC

mtD-7

C1-J-1751

Ron

GGA TCA CCT GAT ATA GCA TTC CC

mtD-8

C1-J-2183

Jerry

CAA CAT TTA TTT TGA TTT TTT GG

mtD-9

C1-N-2191

Nancy

CCC GGT AAA ATT AAA ATA TAA ACT TC

mtD-10

C1-J-2195

COI-RLR

TTG ATT TTT TGG TCA TCC AGA AGT

mtD-11

C1-N-2329

K525

ACT GTA AAT ATA TGA TGA GCT CA

mtD-12

L2-N-3014

Pat

TCC AAT GCA CTA ATC TGC CAT ATT A

mtD-13

TL2-J-3034

AAT ATG GCA GAT TAG TGC A

mtD-14

C2-J-3279

A-171

GGT CAA ACA ATT GAG TCT ATT TGA AC

mtD-15

C2-N-3389

Marilyn

TCA TAA GTT CAR TAT CAT TG

mtD-16

C2-J-3400

A-298

ATT GGA CAT CAA TGA TAT TGA

mtD-17

C2-N-3494

B-434

GGT AAA ACT ACT CGA TTA TCA AC

mtD-18

C2-N-3661

Barbara

CCA CAA ATT TCT GAA CAT TGA CCA

mtD-19

C2-J-3696

A-611

GAA ATT TGT GGA GCA AAT CAT AG

mtD-20

TK-N-3785

B-tLYS

GTT TAA GAG ACC AGT ACT TG

mtD-21

C3-J-5014

CO3a

TTA TTT ATT GCA TCA GAA GT

mtD-22

C3-N-5460

CO3b

TCA ACA AAG TGT CAG TAT CA

mtD-23

N4-N-8924

ND4rev

AAA GCT CAT GTT GAA GCT CC

mtD-24

N4-J-8944

ND4

GGA GCT TCA ACA TGA GCT TT

mtD-25

CB-J-10612

CB1L

CCA TCC AAC ATC TCA GCA TGA TGA AA

mtD-26

CB-J-10933

CB1

TAT GTA CTA CCA TGA GGA CAA ATA TC

mtD-27

CB-N-10920

CB2-H

CCC TCA GAA TGA TAT TTG TCC TCA

mtD-28

CB-N-11367

CB2

ATT ACA CCT CCT AAT TTA TTA GGA AT

mtD-29

N1-J-12585

ND1A-Colorado

GGT CCC TTA CGA ATT TGA ATA TAT CCT

mtD-30

N1-N-12595

ND1

GTA GCA TTT TTA ACT TTA TTA GAA CG

mtD-31

LR-N-12866

16Sb

ACA TGA TCT GAG TTC AAA CCG G

mtD-32

LR-J-12887

16Sbr

CCG GTC TGA ACT CAG ATC ACG T

mtD-33

LR-J-13417

16Sa

ATG TTT TTG TTA AAC AGG CG

mtD-34

LR-N-13398

16Sar

CGC CTG TTT AAC AAA AAC AT

mtD-35

SR-J-14233

12Sbi

AAG AGC GAC GGG CGA TGT GT

mtD-36

SR-N-14588

12Sai

AAA CTA GGA TTA GAT ACC CTA TTA T

mtD-37

SR-N-14925

TTA AAG TTT TAT TTT GGC